HERBERT MYRICK J. B. KILLEBREW

TOBACCO LEAF

Its Culture and Cure, Marketing and Manufacture

A practical handbook on the most approved methods in growing, harvesting, curing, packing and selling tobacco, also of tobacco manufacture

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—BY—

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—AND—

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Assisted by successful tobacco growers, dealers in the leaf, manufacturers of tobacco, and by specialists in the sciences.

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PREFACE

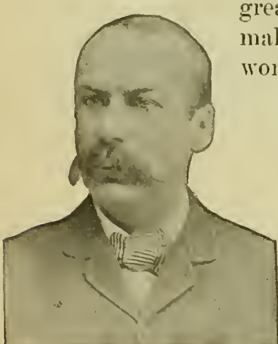
The object of the authors of this work is to give a comprehensive account of the tobacco industry in the United States, and its relations to other countries. Great efforts have been put forth to make exact and complete the directions for the culture, curing and marketing of the different kinds of leaf. The aim has been to make every chapter in the first three parts of the work essentially complete, though it has not been possible, in our limited space, to undertake a technical description of all the intricate and manifold processes of manufacturing tobacco. The chapter on manures and fertilizers has been prepared with extraordinary care and fullness, owing to prevailing misconceptions upon this subject among both growers and the trade.

LEWIS R. CLARK. M. H. CLARK.

The senior author has devoted years to the collection of facts and methods pertaining to the Heavy Shipping, Bright, Burley and Perique tobaccos, and has carefully verified disputed points by experimenting on his own plantation. The junior author has compiled and verified the experience of the most successful growers of cigar-leaf tobacco in all parts of America.

The authors have travelled more than ten thousand miles in pursuit of trustworthy information for this book, while thousands of circulars have been used for securing original data and practical experience, and hundreds of letters written to insure accuracy, to the end that the work might stand for years as an authoritative manual. No pains have been too severe, no distance has been too far, no expense has been too great, to make the work one that will commend itself to all classes of persons who grow, sell, buy, manufacture, retail, export, import, or consume, tobacco.

F. B. MOODIE, FLORIDA.



S. P. CARR, VIRGINIA.

Co-authors with us in the preparation of this work, have been the closest investigators into the complex scientific problems involved in the tobacco industry; many of them the most observant growers of the leaf, and expert planters of long and successful experience in the field and curing barn; while in preparing the very important portions relating to the marketing of the leaf and the manufacture of tobacco, we have enjoyed the invaluable assistance of the most experienced experts. Without the generous aid of these gentlemen, a work of this character could not have been published. Their services are entitled to the fullest recognition, which is most gladly accorded.

F. R. DIFFENDERFER, PENNSYLVANIA.

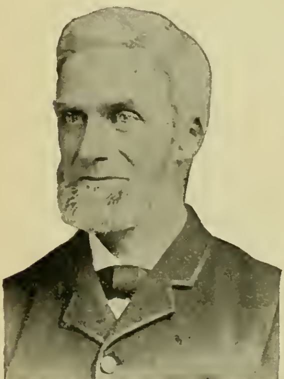
Among the scientists who have aided in the preparation of this book, special credit is due Prof. William Frear, in charge of tobacco work at the Pennsylvania experiment station, who is the author of the admirable treatise on the bacteriology of tobacco; Dr. E. H. Jenkins, vice director of the Connecticut experiment station, under whose management the famous Poquonock experiments have been conducted; Prof. H. Garman, entomologist to the Kentucky experiment station, whose assistance has been invaluable in the preparation of the chapter on insect pests; Prof. M. A. Scovell, director of the Kentucky experiment station; Prof. W. C. Stubbs and J. G. Lee, director and vice director of the North Louisiana experiment station; President Le Roy Broun of the Alabama agricultural college; Dr. C. A. Goessman of the Massachusetts experiment station and Prof. R. J. Davidson, chemist to the Virginia experiment station. Full use has also

PROF. H. GARMAN, KENTUCKY.

been made of the excellent work done by Prof. E. S. Goff, at the Wisconsin experiment station, by F. G. Carpenter, at the North Carolina experiment station, and by Dr. S. W. Johnson of Connecticut, and by Nessler, Schlöesing, and others in Germany.

GEORGE L. WIMBERLY, N. C.

Among the practical men who have contributed valuable aid, we would mention, in Virginia, in Richmond, Hon. S. P. Carr of the Davenport warehouse, James M. Gentry, Cameron & Cameron, J. Wright Co. and William M. Dibrell; John Sims of Maxwelton, Halifax county, himself a successful planter, who has descended through a long line of successful tobacco growers reaching back nearly 200 years. Mr. Carr has never failed to respond promptly and cheerfully for any information, and when the facts were not at his command, he has spared neither time nor expense in securing data for us, and his substantial and ready assistance fully entitles him to share with us in the authorship of the work.



WALLACE TAPPAN, NEW YORK.

In Tennessee, our obligations are due to F. W. Taylor and George C. Carthrons of Morristown, to C. Austin of Greeneville, Jack Crouch of Clarksville, Hon. James G. Aydelotte of Tullahoma, Walter Fort and Mr. Harned of Robertson county, Otto Giers of

Nashville. A. B. and J. P. Killebrew, of Montgomery county, large and successful tobacco planters, have supplied many valuable facts regarding the more recent methods in the heavy-shipping districts of fertilization, cultivation and harvesting; also Mr. J. C. Kendrick, president of the Clarksville tobacco board of trade, and M. H. Clark, the Nestor among tobacco dealers of Tennessee. Mr. Clark's high intelligence and extensive and varied knowledge of tobacco among all civilized nations, and his intimate acquaintance with the special types suitable for consumption by the various peoples of the earth, make his contribution to this work of special and authoritative value. The rich endowments of his mind are only equaled by the excellence of his address, his high courtesy as a gentleman, and his gracefulness and perspicuity as a writer. His brother, Lewis R. Clark, a full associate in the tobacco trade, is also a gentleman of rare culture and of varied attainments. He has never hesitated to comply with any request made of him for information pertaining to tobacco. Charles Dowell, of Robertson county, is entitled to our best thanks for the admirable designs furnished by him for building curing houses.

THOMAS MASON, OHIO.

JOHN SIMS, VIRGINIA.

Kentucky's interest in this work, besides that already mentioned, is represented by contributions from Alexander Harthill, of Louisville, whose name is familiar to the tobacco dealers of two continents; W. C. Thompson, of Georgetown, a large and most intelligent grower of White Burley tobacco, furnished minute details respecting the culture and management of that variety of tobacco; Thomas E. Browder, of Logan county, who for several years was associated with a large tobacco commission house, and subsequently became a successful grower of tobacco,

H. S. FRYE, CONNECTICUT.

supplied valuable information respecting the types used in foreign countries. Single facts have been obtained from a large number of the most intelligent planters and dealers throughout the State.

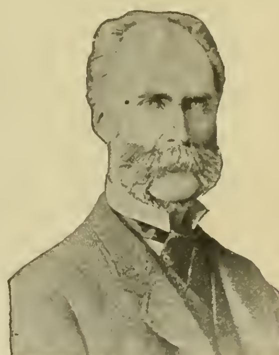
WALTER A. FORT, TENN.

In North Carolina, valuable aid was received from G. L. Wimberly, an intelligent grower of Edgecombe county; Col. Isaac Sugg of Greenville, Hon. H. G. Connor and James I. Thomason of Wilson, and the Hon. Julian S. Carr of Durham. The name of the latter is known and appreciated wherever pipe-smoking tobacco is used. In South Carolina, we are indebted to E. M. Pace of Marion, Sydnor & Treadway and Bright Williamson of Darlington.

Thomas Mason of Cincinnati, the accomplished editor of the *Western Tobacco Journal*, has never failed to answer inquiries relating to tobacco, and this work is enriched by many useful facts supplied by him. Mr. Lockwood Myrick's deep studies, laboratory work, and practical experience in the manufacture, sale and use of fertilizers, is largely responsible for the completeness of Chapter VI. A. W. Fulton assisted in working up the valuable chapter on the marketing of the various kinds of tobacco.

W. F. ANDROSS, CONN.

In the cigar leaf portions of the work, we are particularly indebted to W. W. Sanderson, one of the most careful and practical experts in the culture of Havana seed in Massachusetts; Pres. H. S. Frye, of the New England tobacco growers' association; W. F. Andross, of the East Hartford section; John E. DuBon, field manager for the Connecticut Tobacco Experiment Company; Hon. Wallace Tappan, of Onondaga county, New York; Pres. W. C. Morse, of the Chemung valley (N. Y.) growers' association; Mr. F. R. Diffenderfer of Lancaster county, and other Pennsylvania growers; Mr. Jacob Zimmer, of the Miami valley, Ohio, and several Wisconsin planters. The chapter on cigar-leaf culture in the South and West is largely based



ALEX HARTHILL, KY.

on the successful practical experience of Col. F. B. Moodie, president of the Florida tobacco growers' association; A. Alonzo Cordery, vice president of the Cuban tobacco growers' company in Southern Florida, and to Dr. Jenkins' careful studies of the extensive operations with tobacco in Florida.

It is also to the gentlemen enumerated that we are mainly indebted for the large number of original photographs from which the engravings for this work have been produced. Pardonable pride is felt in the completeness of our illustrations. We especially commend the reader's attention to the plates illustrating the most perfect plants of the leading varieties of tobacco. These plants were grown specially for this purpose by experts, from the finest strains of seed true to the perfected varieties, and are believed to faithfully present, for the first time in print, truly lifelike portraitures of variety-standards. Even the cursory reader will observe that, after nearly four hundred years of tobacco growing, there is yet much to be learned. The increasing competition in raising this crop in various parts of the world makes it necessary that American tobacco planters employ to the utmost the teachings of practical experience and applied science. This, combined with good management and the closest economy throughout the business, will enable the United States to hold its lead for another century in the world's tobacco markets, besides supplying its own consumption, with the cigar leaf heretofore imported.

W. W. SANDERSON, MASS.

PART I.

Essentials in Tobacco Culture.

ESSENTIALS IN TOBACCO CULTURE.

CHAPTER I.

ORIGIN AND SPREAD OF TOBACCO CULTURE.

The truth of the assertion made by the Chinese that they cultivated and knew the use of tobacco long anterior to the discovery of America by Columbus, is not sustained by any records entitled to credit by civilized nations. When or where it was first cultivated or used is one of the mysteries which rest in the unrelieved darkness of unlettered history. Pipes from prehistoric mounds in the United States, Mexico and Peru prove the extreme antiquity of tobacco, and pipes are found only in American ruins or mounds. Columbus, during his first voyage, saw the natives smoking it, and in subsequent voyages the fact was noted that it was used by the aborigines in smoking, chewing and snuffing. It is supposed to have taken the name tobacco, by which the Spaniards called it, from the *tobaco,* which was the inhaling apparatus of the Caribbees. Benzoni, who traveled in America in 1542-1556, says the Mexicans called the plant "tobacco." On the continent of America it was usually called "petum"; by the West India islanders, "yoli."

In 1558, Francisco Fernandes, a physician who had been sent to Mexico by Philip II to investigate and report on the natural productions of that country, brought back with him the tobacco plant. The next year Hernando de Toledo carried some tobacco from San Domingo to Europe.

During the same year Jean Nicot, the French embassador to Portugal, sent some seeds to his sovereign-mistress, Queen Catherine de Medici, and from this circumstance it was called *herba regina*. To commemorate the services rendered by Nicot, in spreading a knowledge of the plant, the generic name *Nicotiana* was given to it.

FIG. 1. TOBACCO SMOKED THROUGH A TUBE, AS FIRST SEEN BY COLUMBUS. From Lobel's "History of Plants," 1576.

Sir John Hawkins carried it from Florida to England. Harriot, who was in the expedition under the command of Sir Richard Grenville, sent out by Sir Walter Raleigh, which discovered Virginia and North Carolina, mentions the fact that the Spaniards called the plant tobacco. In 1586, tobacco was first carried into England from Virginia by the agents of Sir Walter Raleigh, and its use soon became fashionable among the courtiers and the persons of quality.

John Rolfe, in 1612, became the first civilized tobacco grower. He was the husband of Pocahontas, and grew tobacco for export to the mother country. Shortly afterwards Sir George Yeardley, the deputy governor, encouraged the colonists to grow it for profit. In 1617, the streets, market places and all the open lots of Jamestown were planted in tobacco. But for tobacco, the settlement of Virginia at that period would have proved a failure, for it became the currency of the country, the measure of all values and the sole product of Virginia that would command articles of value in exchange.

In June, 1619, twenty thousand pounds were shipped to England. James I, a pedant in learning and a fool in statecraft, made a furious attack upon the use of tobacco in a paper which he called "A Counterblaste to Tobacco." His kingly influence caused a duty of sixpence a pound to be levied on all importations of tobacco to the United Kingdom. So far, however, from the "Counterblaste" proving an injury to the planter and a check to the consumption of tobacco, it actually increased the one and benefited the other. Prices went up and the area of its cultivation was rapidly enlarged. From this period on, the colony of Virginia grew and expanded, and the narcotic which aroused the kingly ire of James became the foundation stone upon which was erected one of the most populous and prosperous commonwealths in the New World. And so it came about that the beginning of law, the expansion of justice, the increase of commerce, civilization, culture, refinement and progressive thought, rested upon the plant, the fumes of which were compared by King James to the "fumes of hell."

FIG. 2. INDIAN SMOKING, A FRESH SUPPLY OF LEAVES BEING BROUGHT IN BY A FEMALE.
From Be Bry's "Historia Brasiliana," 1590.

Young women were brought into the colony after this, to become the wives of the growers of tobacco. In 1620, and just before the Pilgrim Fathers landed on Plymouth Rock, ninety young women were brought to Virginia, chargeable with the cost of transportation, which was at first one hundred and twenty pounds, and afterwards one hundred and fifty pounds, of tobacco. This expense was cheerfully borne by those who took them for wives. And thus tobacco first riveted the bonds of matrimony in the New World, and made contented citizens of the little white band of adventurous spirits that first peopled Virginia. But for the profits of tobacco, the colony would, doubtless, have perished, and British civilization would have lost its foothold in the southern boundaries of North America.

The profits from tobacco proved so great that the cultivation of the food crops was neglected. This condition demanded strenuous regulations by the Virginia company. In 1621, the colonists were restricted to the planting of one hundred plants per head, and the number of leaves to each plant was limited to nine. Afterwards, the number of leaves was extended to twenty-five or thirty, and reduced, in 1629, to twelve. In 1629, 3000 plants per poll and 1000 plants each for women and children were allowed. The crop of 1621 was 60,000 pounds, 55,000 pounds of which were exported to Holland. The price in England for the same year, with the duty added, ranged from seventy-five cents to one dollar per pound. In 1676, the mother country collected from the duty on tobacco 120,000 pounds sterling. The whole amount collected from the custom duties in 1590, during the reign of Elizabeth, was only 50,000 pounds. This increase is largely to be attributed to the trade in tobacco. In 1731, the exports of tobacco from the Provinces of Maryland and Virginia conjointly reached 60,000 hogsheads of 600 pounds each, which yielded 375,000 pounds sterling, or $1,875,000. The imposts on this were 180,000 pounds sterling, or $900,000.

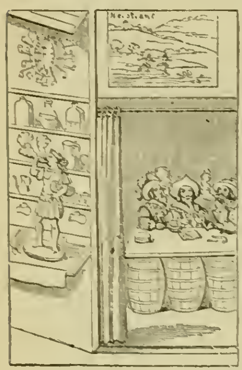


FIG. 3. TOBACCONIST'S SHOP, LONDON, 1600. From Brathwait's "Smoking Age."

Warehouses for the inspection of tobacco were first established in Virginia in 1730, the object of which was to prevent the exportation of trash, bad, unsound and unmerchantable tobacco. The minimum weight for a hogshead was 800 pounds. So rapidly did this industry grow, that in 1754 the exports from Virginia alone were 50,000 hogsheads. During this period, tobacco was worth, in London, 11d to 12½d per pound. Only 24,500 hogsheads were made in Virginia in 1758, and the price rose as high as fifty shillings per hundred pounds in that province. The annual average exports of tobacco from Virginia from 1745 to 1755 inclusive, were 44,000 hogsheads. The annual exportation from the American colonies from 1763 to 1770, was 66,780 hogsheads of 1000 pounds each. For the four years just before the Revolutionary war, 100,000,000 pounds were sent abroad annually. The average exports during the war of the Revolution were 12,000,000 pounds.

FIG. 4. A TOBACCO "DRINKER" INHALING SMOKE AND EXPELLING IT BY THE NOSE, AS PRACTICED BY THE DUTCH ABOUT 1600. Copied from a rare book on tobacco published at Rotterdam, 1623.

Kentucky, now producing nearly one-half of all the tobacco grown in the United States, was settled mainly by Virginians, and the culture of tobacco was coeval with its first settlement. As early as 1785, Gen Wilkinson, of Kentucky, entered into a contract with the Spanish authorities in New Orleans to supply them with several boat loads of tobacco. It is believed that most of this was grown in Kentucky. In the southern and central parts of Kentucky, and in Tennessee, tobacco was grown as a commodity as early as 1810. Prior to 1833, by far the largest quantity of tobacco grown in Kentucky and Tennessee was sent to the market in New Orleans, where it was taken for foreign consumption. After that time, local dealers established factories in Clarksville and at a few interior points, and began to buy loose tobacco and stem it (i. e., take out the midrib of the leaf) for the English market. A few years after this, Henderson, Ky., grew to be a great strip market, a position which it still holds. From this time on, the Western markets for tobacco sprang up in many places. Inspection warehouses were established in Louisville as early as 1839, and in Clarksville in 1845. At these markets, casks are stripped from the tobacco, and samples drawn by sworn inspectors. These two places, Louisville and Clarksville, are the pioneer inspection markets of the Mississippi valley, and they opened the first inspection warehouses in the West. From the establishment of these local markets in Kentucky and Tennessee, the tobacco trade of the Mississippi valley went on increasing, until now it stands second only to cotton as a farm commodity for exportation.

PIPE OF WAR. PIPE OF PEACE.
FIG. . PIPES OF AMERICAN INDIANS.

The New England colonists grew some tobacco in the decade embraced between 1640 and 1650, but the cultivation of it was, for the most part, abandoned during the 18th and the first three decades of the 19th century, when, by experiments first made by B. P. Barber of East Windsor, Conn., it was ascertained that a quality of tobacco could be grown, deficient, indeed, in sweetness and in nicotine, and in those qualities desired in chewing tobacco, but in fineness and delicacy of texture, in strength of tissue, and in glossiness and smoothness of surface, far superior to anything that had ever been grown in the South. It proved to be highly valuable in the manufacture of cigars. Its culture brought great wealth to the planters of the Connecticut valley, especially in the years succeeding the Civil war, which culminated in an era of speculation and extravagance that was closed disastrously by the panic of 1873. Meanwhile, eastern Pennsylvania and central New York State, attracted by the profit in cigar leaf tobacco, embarked in it upon a constantly increasing scale, followed by the Miami valley in Ohio, and by southern Wisconsin, until now more than 100,000,000 pounds of tobacco are grown in these states annually, not all of which may be classed as cigar leaf.

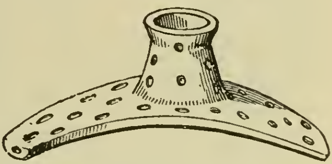


FIG. 6. PREHISTORIC PIPE USED BY THE MOUND BUILDERS IN THE MISSISSIPPI VALLEY CENTURIES AGO. From Smithsonian Report, 1848.

The industry gradually revived from 1878 to 1885, when the increasing importation of wrapper leaf from Sumatra curtailed the market for domestic wrappers. Serious decline followed, with virtual bankruptcy for many planters, until the tariff of 1890 imposed a duty of two dollars per pound on imported wrappers. The domestic cigar leaf industry promptly rallied, quantity and quality of crop improved, prices advanced, and prosperity seemed to dawn again upon the wrapper-producing sections. Florida's capabilities as a wrapper leaf State were demonstrated, although some excellent tobacco had been grown there prior to the Civil war. Prices declined after the national election in November, 1892, foreshadowing a change in policy; but with a return to the former method, it is believed that the home market for domestic-grown cigar wrappers will once more make this branch of the tobacco industry as prosperous as the culture of the leaf in other States for other purposes.

The rise and progress of the yellow tobacco interest in the Piedmont regions of Virginia and North Carolina, and especially in the latter State, show one of the most abnormal developments in agriculture that the world has ever known. This leaf is mainly used for wrappers, chewing plugs, and also for making "fine cut" tobacco and cigarettes. About the year 1852, two brothers, Eli and Elisha Slade, owned farms which, in part, occupied poor ridge lying between two tributaries of the Dan river, in Caswell county, North Carolina. Upon this ridge, during the year mentioned, they planted tobacco, and cured it with fires made of charcoal, regulated in a definite manner. They succeeded, by this means, in giving to it a beautiful lemon-yellow color.

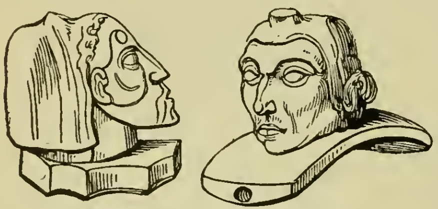


FIG. 7. MOUND BUILDERS' PIPES FOUND IN ROSS COUNTY, OHIO, U. S. A. From Smithsonian Report, 1848.

Their neighbors caught the infection, and soon the tobacco from Caswell county began to arrest the attention of the tobacco dealers by reason of its superior beauty and sweetness. High prices were paid for it. During the Civil war very little of this high-grade tobacco was produced, but between 1870 and 1880 its production was revived, and it is not an exaggeration to say that it did more to build up the prosperity of North Carolina than all other agencies combined. Old fields, that had been abandoned because of their sterility, became the most profitable farming lands in the State. Poverty in the soil, for once, became the first principle of agriculture.

The lands which grew the finest tobacco had light cream-colored soils, 93 per cent of which was siliceous matter. This porous, spongy, sandy earth, destitute of humus, and incapable of growing any crop without the most abundant application of manures, became the corner stone of a new agriculture. Tobacco was planted upon it, with the addition of a very small quantity of manure, from which the plant could derive sustenance until it approached maturity. When the manure became exhausted, the plant began to lose its vitality and take on every day a deeper yellowish tinge. Just before they were harvested, the plants turned to a beautiful color, like hickory leaves in autumn, and fields of tobacco at a distance looked more like those of small grain ready for the harvest than tobacco fields.

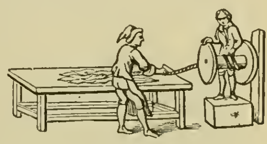


FIG. 8. MAKING SPUN ROLL TOBACCO, 1700. From an old poster.

The sterilized spots, worn out and abandoned, grown up in bamboo briers, chinquapin bushes and sickly, scrubby pines, that in 1860 could with difficulty be sold for fifty cents per acre, were soon in demand at thirty to fifty dollars per acre. Old towns that had been well-nigh deserted because of the decay of agriculture in their vicinity, suddenly took on new life. New streets were laid out, great blocks of buildings were erected, railroads were constructed, and the constant going and coming of hustling business men made a transformation as great and almost as quick, and certainly as profitable, as would the discovery of gold mines. Indeed, the yellow-tobacco interests of North Carolina proved far more beneficial to the whole population than the finding of gold mines would have been. Gradually the planting extended, first westward from the Piedmont region to the steep ridges lying at the foot of the lofty mountains in Buncombe and other counties in western North Carolina. Many thriving towns were built up, hundreds of prosperous manufacturing establishments of cotton and tobacco followed in the wake of this new tobacco trade. In a few years the soils of the Champaign regions were tested for their capacity to grow this yellow tobacco, and the success with such soils opened a new district for its expansion and cultivation.

Then the culture extended still further westward over the mountains, to the sunny slopes of Unicoi, Greene and Washington counties in Tennessee, where its growth rescued many villages from decay and planted a prosperity in that region which it had never before enjoyed. Nor is its progress yet ended. North Georgia, western South Carolina, the white lands of the Highland Rim in middle Tennessee and Alabama, the white, sandy and clayey soils of West Tennessee, and of the hill regions of Mississippi, Louisiana and Arkansas, and the sides of the Ozark mountains in Missouri, may all be transformed from regions of comparative poverty to regions of wealth, through the successful culture of yellow tobacco. Every year, new territory is being tested for the growth of this tobacco. The thin, sterile, white soils around Tullahoma, Tennessee, produced as fine yellow tobacco in 1896 as was produced in North Carolina, and this experiment opens a new field for its growth, embracing 500,000 acres in the center of Tennessee.

FIG. 9. MAKING SNUFF, 1700.
From Fairholt's "Tobacco."

Scarcely less interesting is the history of the culture of the White Burley tobacco. This variety originated in Brown county, Ohio, upon the farm of George Webb, living near Higginsport. In the spring of 1864, Mr. Webb sowed the Red Burley seed. The plants came up and grew with the usual appearance of healthy plants, except in one particular spot, where they had a whitish, sickly look, so much so that they were left in the bed for a time. In setting out his crop, however, Mr. Webb found that he lacked plants enough of a healthy character to finish his planting, so he drew the whitish looking ones and set them out. For two or three weeks the whitish plants grew but little, but after they became well rooted they advanced with great rapidity, retaining their creamy richness of color, and ripening two weeks earlier than any other plants in the field.

When cured by atmospheric influences, the same process used in curing the Red Burley, the underside of the cured leaves was of a whitish tinge, while the upper side was of a beautiful golden hue. Some of these plants, when cured, measured six feet in length, and were so handsome in appearance, and the tissue of the leaves was so fine, that Mr. Webb placed them on exhibition in the Bodeman warehouse in Cincinnati. Intelligent buyers gave encouragement for its further cultivation, and the next year Mr. Webb, fortunately having saved some seed, planted ten acres of it, which yielded 11,000 pounds of tobacco, very handsome and silky, with all the characteristic coloring which the sample of the previous year displayed. When offered in the market it brought from twenty-five to forty-five cents per pound, and a premium of three hundred dollars, in addition, was awarded to the grower. From this "sport," which originated so unaccountably, there has been developed an impetus in tobacco culture in southern

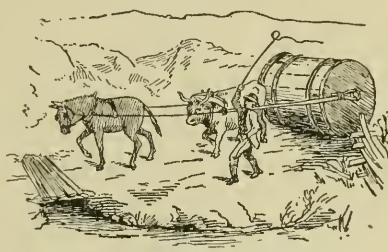


FIG. 10. TRANSPORTING TOBACCO IN THE OLDEN TIMES.

Ohio and northern Kentucky as great as in the yellow-tobacco regions of North Carolina and Virginia. This class or type of tobacco was found to be more suited for manufacturing purposes and to the tastes of the American tobacco chewers than any other. It is very mild, with a small content of nicotine, and its absorbent capacity is greater than that of any tobacco hitherto grown. For many years the demand for it far exceeded the supply. The prices paid for the most trashy leaves exceeded the prices paid for the best crops of heavy shipping tobacco. It soon invaded the famous blue grass regions of Kentucky. Stock farms were converted into tobacco farms. Blue grass pastures that had been the ornaments of the farms and the pride and glory of many generations of stock breeders, were plowed up and planted in White Burley tobacco. Experiments were made in its culture in every part of the tobacco-growing area of the United States, but it was soon found, as it was with the growth of yellow tobacco, that it may be produced in its perfection only upon the soils adapted to it. The blue limestone regions of Kentucky and the drift soils of southern Ohio have almost a monopoly of its culture, as the light, sandy regions and whitish, clayey districts have the monopoly of the growth of the yellow tobacco.

Within three hundred and seventy years the cultivation of tobacco has extended from the streets of Jamestown to every quarter of the globe. Population has moved westward, tobacco eastward. Of all the stimulants and narcotics used by man, it is probably the least injurious in its effects upon the human system. Yet it may be injurious, and often is, so much so that its culture and use has ever been bitterly contested. In spite of all this, tobacco grows on every land and is used by every people. From New England to Louisiana, from Virginia to the prairies of the West, from the

Indias of the West to the Indias of the East, from the continental islands of the Indian ocean to the southern continent of Australia, tobacco is grown and consumed. Like its next of kin, the Irish potato, it has made the conquest of the earth.

It is the greatest of all revenue-producers. It is taxed by every government. It bears a heavier burden, in proportion to its cost of production, than any other commodity. The governments of France, Spain, Italy and Austria make a monopoly of its manufacture and sale. England puts a tax upon it, averaging 1200 per cent of its prime cost. It is the stay of nations, the poor man's luxury and the rich man's solace.

CHAPTER II.

STATUS OF THE TOBACCO INDUSTRY—ON THE USE OF THE WEED.

The demand for prime quality tobacco is constantly increasing, because of the increased rate of consumption.

In the United States, while population in 1896 is only two and one-half times greater than in 1860, consumption of manufactured tobacco is fivefold greater, and of cigars tenfold, to say nothing of five hundred cigarettes per capita consumed annually, which were unknown before the war. In the twelve years ended with 1892, domestic consumption of cigar leaf tobacco increased forty per cent, while the quantity of manufactured tobacco consumed (smoking, chewing and snuff) just about doubled. Exports have doubled within two decades, and now average one-third larger than ten years ago.

The per capita consumption in France has trebled in little more than half a century, while a somewhat similar rate of increase is apparent in England and other European countries. In other parts of the world, for which statistics are lacking, it is believed that the per capita consumption is increasing even more rapidly. Add to this the growth of population, and it is evident that the market for tobacco is certain to be an expanding one. This is in marked contrast to the staple necessities of life, such as wheat, rye and potatoes, the consumption of which for each unit of population appears to be comparatively stationary.

An advance in the value of tobacco has been coincident with this increased demand. If 100 is taken to represent the average wholesale market price of American tobacco in leaf during the year 1860, its value for 1891 averaged 140 in the United States, in England 163, and at Hamburg, Germany, 85 (see table in Appendix). The advance noted in America and Great Britain is partly due to the improvement in quality, only the better grades being included in the quotations averaged, while the decline observed at Hamburg may be ascribed to the bulk of low-grade leaf imported, including, of late years, increasing quantities from new centers of production south of the equator.

The advance of 40 per cent in market value of the better grades of American leaf is all the more remarkable because of an average decline of 12 per cent in the value of wheat during the period under review, a decline in wool of 25 per cent, and of cotton 20 per cent. The general average for all farm products shows a decline of three per cent (see table in Appendix). In other words, tobacco alone, of all the great staples, maintained an advance in value in the three decades since the war. Nearly all values have declined since the exhaustive study of prices was made, in 1891-3, by the finance committee of the United States Senate, but the general average for tobacco shows a less falling off than most other crops, except in the more speculative cigar wrapper leaf. The tables of quotations in the Appendix, upon the standard grades of leaf in the principal home and foreign markets, confirm the foregoing.

Increased production in the United States, of leaf and of cigars, cigarettes and manufactured tobacco, has fully kept pace with increased consumption and export. The United States now devotes over 700,000 acres to this crop annually, about one-third more than forty years ago, with a crop twice as large as then, for it exceeds 500,000,000 pounds in a year of average production. Nearly 300,000,000 pounds are manufactured for chewing, smoking and snuffing, a tremendous increase—ten times as much as was returned for internal revenue taxation three decades ago. The cigar output is also ten times larger and bids fair to soon reach five billion a year, while eight billion cigarettes have been made in a single twelve months.

The development of the cigar making and tobacco manufacturing industry in the United States has likewise been rapid. It employs about 150,000 people in about 12,000 establishments, against only 25,000 employees and 2000 factories in 1860. The wages now paid are ten times as much as then, materials used cost five times as much, while the annual product of these factories represents seven times the value of 1860. Indeed, these tobacco products in 1890 exceeded in value the total of the printing and publishing trades. The people pay more for tobacco than for newspapers, books, or other literature—almost as much as for foot wear, and about twice as much as they pay for sugar. With a tobacco factory product valued at $200,000,000, the last census affords this comparison with the values of the product in other manufactures: Boots and shoes, $220-000,000; carpentry, $281,000,000; carriages and wagons, $114,000,000; cotton goods, $268,000,000; woolen and worsted, $225,000,000; liquors, $300,000,000; flour and mill products, $514,000,000; slaughtering and meat packing, $433,000,000; sugar refining, $123,000,000.

Government revenues from the tobacco industry have kept pace with this marvellous growth, although the rate of taxation has been downward. Almost $50,-000,000 of revenue was obtained by the federal government from tobacco in the fiscal year 1891. Two-thirds of this vast sum was derived from the direct or internal revenue taxes on domestic leaf, and the balance from duties on imports (Appendix). Until internal revenue taxes were reduced by the law of 1883, tobacco yielded

PLATE I. CONNECTICUT (East Hartford) BROADLEAF (topped plant).

This beautiful engraving is of a plant grown in a field of several acres raised by W. F. Andross, an experienced planter in the famous East Hartford district. The seed has been carefully selected and inbred for years, this specimen representing average perfection of the variety. This plant is topped and is nearly ready for harvesting. When photographed, August 10th, it was 5½ feet high; length of stalk, 3 feet 1 inch; top leaf, 28½ inches long and 13 inches wide; largest leaf, 34x19½ inches; number of perfect or merchantable leaves on plant, 14, only one being a thick top leaf, three good leaf binders, and ten fine wrappers. Many plants are larger, some having top leaves 36 inches long, with largest leaves 43x23 inches—a truly royal plant.

one-third of the total receipts from internal revenue taxation, and it now yields about one-fifth. Tobacco also yields ten per cent of the total customs receipts, against four per cent under the tariff of 1883. Altogether, tobacco now furnishes fifteen per cent, or nearly one-sixth, of government's total net ordinary receipts.

The present status of the tobacco industry thus represents immense financial interests. Many millions are invested in tobacco lands, barns, fertilizers, culture, implements, labor and warehouses. About $100,000,000 are engaged in making cigars, cigarettes and snuff, and in manufacturing tobacco. The growers get, say, from $40,000,000 to $50,000,000 for the crop in its raw state. Aside from vast sums paid for help in the domestic trade, our tobacco factories alone pay in wages over $60,000,000, and their annual product exceeds $200,000,000 in value. Tobacco is exported, in its raw state, to the average value of $30,000,000, while imports represent about half that sum. Add to this something like $50,000,000 of revenue paid to government, and it appears that the annual stake in the United States tobacco crop and industry represents the stupendous sum of more than $400,000,000. The duplication in this total is much more than offset by items that manifestly are not included, such as the permanent investment in farms, warehouses, factories and the like.

Certainly the investment in this tobacco crop and trade, and its annual product, are sufficiently large to raise it to the dignity of one of the most important of American industries. As such, it is well worthy of the most profound attention on the part of planters and agricultural scientists, of dealers and manufacturers, and of statesmen.

All evidence and experience demonstrates what every intelligent tobacco planter knows—that only the best quality, except in rare instances, pays a real profit.

And with the increasing competition of foreign leaf in the markets of the world, it is evident that the supremacy of American tobaccos will depend, in great measure, upon their quality. Present profits and future prosperity will be governed by the quality of the leaf produced. This fact cannot be too often reiterated. To this end, our scientists must coöperate most earnestly with planters, while much is yet to be learned about preservation and improvement of quality in the processes of packing, handling and manufacturing.

Our statesmen must also be educated to pursue a policy that shall develop, instead of discourage, this great industry. This country's policy of removing every possible obstruction in the way of domestic tobacco culture, trading and manufacture, is the only right method. The product can stand a reasonable amount of direct taxation, when imposed and collected by the comparatively simple and effective system now in vogue. It imposes on growers no restrictions of any moment, while taxes on the finished product and on licenses are moderate, and are collected with little friction.

While we should jealously guard our interests in the foreign market for the surplus of American leaf, the certain increase in production and quality in other parts of the world must be reckoned upon. The idiotic restrictions on tobacco culture in other countries (it is prohibited in Great Britain and Spain, and seriously hampered in other European States), are likely to be succeeded by the American system, which is equally successful as a revenue producer, without depriving farmers of the benefits of growing this profitable crop. The longer those restrictions are maintained abroad, the better the opportunity for American leaf in foreign markets. But it is inevitable that these older nations will gradually encourage tobacco culture, while newer lands possess vast areas of soil, now virgin to this crop, where it is destined to be grown on a commercial scale.

Thus the present status of the tobacco industry throughout the world emphasizes the wisdom of guaranteeing the home market to the American producer. How important this is, appears from the fact that within less than two decades our imports of tobacco have jumped from a nominal figure to equal half the value of our tobacco exports—the latter a fruit of four hundred years of effort! To buy foreign leaf at an average of sixty cents a pound, and pay for it with domestic tobacco at eight cents per pound, is a policy that cannot be justified by any economic theory, when the truth is that leaf of the same quality as the imported can be grown in the United States.

IS TOBACCO INJURIOUS TO THE HEALTH OF THE BODY, THE MORALS, OR THE INTELLECTUAL FACULTIES?

The enormous increase in the consumption of tobacco, previously outlined, has been accomplished in the face of what was formerly the bitterest opposition. During the past twenty years this feeling against the tobacco habit has somewhat waned, until the campaign against the weed is now mainly directed against its being indulged in by the young, or to excess by the old. Snuff taking is on the decrease, it is a question whether chewing is not also on the decline, and the vast increase is in the various ways of consuming tobacco by smoking.

Tobacco has, on the one hand, been denounced as the fruitful parent of all that is physically injurious or morally depraved, and on the other hand, its use is regarded as innocent, wholesome, pleasing and comforting, adding to the happiness, while subtracting nothing from the health of the body, or from the elevation of the morals or the clearness of the intellectual faculties. The

PLATE II. CONNECTICUT BROADLEAF (in flower).

Complete or perfect plant of the variety shown in Plate I. This plant was slightly wilted when photographed a few minutes after being lifted from the soil.

truth seems to lie between these extremes. With persons of weak bodies or nervous temperaments, the use of tobacco is unquestionably injurious, while persons of full habit and sluggish minds frequently derive great benefit from its use.

Norman Kerr, M. D., F. L. S., of London, England, who is probably the highest authority among the English-speaking peoples in all matters pertaining to the effects of narcotics and stimulants upon the human system, says: "With persons of a certain temperament the use of tobacco produces concentration of thought, mental satisfaction, protection against infection, and domestic happiness." "There are persons," he says, "so constituted that the intellectual powers require to be arrested and concentrated before any definite intellectual effort can be even entered upon. To such persons tobacco smoking has proved invaluable, the advantages far outweighing the disadvantages. No other substance, narcotic or anæsthetic, is yet known which would serve this purpose and do so little damage." "Were tobacco not known," he continues, "the idiosyncrasies of such individuals would interfere with the achievement and excellence of their work. All those with whom tobacco does not disagree realize fully the pleasure and mental satisfaction afforded by its use."

"No language," says Dr. Kerr, "can accurately describe the comfort enjoyed from a pipe, when exposed to severe weather in trenches, or the power it has to stay the stomach-crave when no food is to be had, and this action of tobacco, under such circumstances, cannot be harmful."

Tobacco, as a powerful and efficient disinfectant, has long been known, and within recent years this has been fully demonstrated by an ingenious series of experiments performed by Tazzinari, of Rome, which are reported in the Annual of Universal Medical Science for

1892. Tobacco smoke was passed from ten to thirty minutes through the interior of hollow bells lined with gelatin containing disease germs, and it was found that the bacilli of Asiatic cholera and of pneumonia were destroyed.

Dr. Kerr says that, though not having used tobacco for many years, he would not think of going through a yellow-fever ward, unless after a full meal, without a lighted pipe or cigar or cigarette. "There are many persons," he continues, "cultured and uncultured, but especially the former, who, after an exhausting day's work with head or hands, are so worn out and irritable that everything appears wrong, from the cooking of the food to the playfulness of the children, but who, when they have had a smoke, are pleased with themselves and all the world besides."

Dr. Kerr, after long and patient investigation, carried on through years under the most favorable conditions for arriving at the truth, declares that tobacco never impairs or destroys moral capacity or leads to offences against morality or to acts of criminal violence. "The poison of tobacco," he says, "has effected physical injuries, but appears to leave untouched the conscience and the moral sense." Nor does he believe the habit of using tobacco increases the desire to use other stimulants or narcotics. Indeed, it would seem, from the concurrent testimony of all nations, that among those in which tobacco is most generally used there appears to be the least liability among the inhabitants to contract the habit of using morphine, opium, cocaine, hasheesh and other obnoxious and more injurious drugs. So it may, with truth, be said that if tobacco has no other merit, it at least diminishes the desire among those habituated to its use of wishing to substitute more deleterious substances in its place.

An almost complete answer to the assertion that tobacco is highly injurious to the health of those who use it, is found in the fact that probably seventy-five per cent of the male population in Europe and America uses tobacco in one or some of the many ways it is prepared for consumption, while not over one-tenth of the female population uses it in any form whatever. Yet statistics show that men are as healthy as women in every country.

In view of all these facts, there is every reason to believe that the consumption of tobacco will continue to increase in far greater ratio than population. It therefore appears to be one of the safest, surest and most profitable crops for the planter, and equally established as a success for the manufacturer and retailer.

CHAPTER III.

VARIETIES OF THE TOBACCO PLANT.

Tobacco belongs to the nightshade (*Solanaceæ*) family, which embraces in its genera a number of well-known plants and vegetables. Among them are red pepper, Jamestown or jimson weed, petunia, Irish potato, tomato, egg plant and tobacco. The genus *Nicotiana* is of American origin, and embraces fifty or more species, one of which, *Tabacum*, supplies nearly all the tobacco of commerce. The tobacco plant (*Nicotiana Tabacum*) grows from two to nine feet high, with wide-spreading leaves, ovate, oblong or lanceolate in form. The leaves are alternately attached to the stalk spirally, so that the ninth leaf overhangs the first, and the tenth leaf the second. The distance between the leaves, on the stalk, is about two inches, in ordinary varieties. The flowers are in large clusters, with corollas of rose color, or white tinged with pink, and about two inches long, funnel-shaped, with inflated throats. Tobacco is a rank, acrid narcotic, viscidly pubescent, leaves and stalk covered with soft, downy hair. The seed pods have two valves.

In Mexico and tropical countries the tobacco plant becomes perennial. The writer has seen it growing in the deep, narrow valleys, or *barrancas*, of the Sierra Madre mountains in Mexico, without cultivation. The same stalk sends forth new sprouts from year to year, the leaves from which are gathered by the natives just before the seed matures, cured in the sun to a dull, greenish color, and when crumbled, are used by the peons and

PLATE III. HAVANA SEEDLEAF (topped plant).

Photographed from same field and at same time as Plate IV. Hight of plant, 4½ feet; number of merchantable leaves on average topped plant, 15 to 18. Top leaves are from 22 to 27 inches long, and from 14 to 16 inches wide; middle leaves 28 to 34 inches long, 16 to 19 inches wide; bottom leaves 20 to 25 inches long, and 11 to 15 inches wide.

Indians for cigarette smoking. The inner, or softer portions, of the corn shucks, or husks, are employed for wrappers for the cigarettes. The species found in Mexico growing wild is very much branched, and is supposed to be the *Nicotiana rustica,* which was extensively cultivated by the ancient Mexicans, and gradually spread northward. It is stated that a plant of this species, even now, is occasionally found growing wild in New York, and is looked upon as a relic of the cultivation of tobacco by the Indians. It is more hardy than the common species, and it has ovate leaves attached to the stalk by long, naked stems, similar to those of the fern. It has dull greenish-yellow flowers. Some of this species is cultivated in Germany, Sweden and Russia, by the peasantry. The Turkish, Hungarian and Latakia tobacco is probably of this species.

Another species is cultivated in Shiraz, Persia, known as *Nicotiana Persica.* It has white flowers, and, unlike the last mentioned, the leaves, at the point of junction, almost enwrap the stalk. This tobacco, when cured, has a yellowish color, is mild in flavor, and is almost exclusively used for pipe smoking.

A variety known as Yara is cultivated in Cuba. It is probably the species known as *Nicotiana repanda.* It has a totally different flavor from the Havana. It is mostly grown for home consumption. One or two other species have been cultivated, to some extent, but they hardly deserve mention.

No plant is so easily modified by climate, soil, and different methods of cultivation, as tobacco. Climate imparts flavor; soil determines texture. The nearly inodorous product of the seedleaf districts of our Northern States (north of the 40th degree of latitude), if planted South, acquires, in a few generations, the sweetness of the Southern tobacco. In amplitude of leaf it decreases, but increases in thickness, sweetness, and in the time required for ripening. On the other hand, if the sweet Havana or Virginia tobacco is grown in Connecticut or Pennsylvania, it becomes, year by year, more delicate in texture, and more leafy and less sweet. The fibers grow small, but the thickness of the leaf decreases, and in time it makes a fine wrapper, but a poor filler. It also grows quicker and ripens earlier than it did further South. Attempts have often been made, in the South, to grow the seedleaf tobacco, but always with failure. The writer once sowed seed of the best Pennsylvania seedleaf variety, and planted a crop upon soils in Tennessee, resembling, in all particulars, the soils upon which it is grown in Pennsylvania. The very first year, the leaves narrowed and became too thick for cigar wrappers; the color, from a dark brown, became a cinnamon red; the aroma changed from that of the dampish cigar odor to that of sweet chewing tobacco. The comparatively gumless leaf of the parent became a rich, waxy leaf with the offspring. And this was the result of an experiment lasting for one year only. The modification was so pronounced that no one would have taken it for a seedleaf variety. The Florida seedleaf, so called, resembles the tobacco of Cuba more than it does the tobacco of the seedleaf districts of the North. It is thick, heavy, less expensive, and not so delicate of fiber, but often very fragrant, with an odor not unlike that of the Cuba tobacco, but not so strong.

The long period of growth, in the Southern States, gives tobacco ample time for the elaboration in its vesicular system of the oils and waxes and gums that contribute to its sweetness and fragrance. Even saccharine juices have been found stored up, in large quantity, in some of the yellow tobacco of North Carolina and Virginia. We infer, therefore, that two causes are constantly in operation to increase the number, or modify the character, of existing varieties. These are soil and climate.

Another cause, still greater, perhaps, and one that has a more powerful effect in determining the shape of the leaves and the peculiarities of the plant, is the cross-fertilization of different varieties. From two varieties, the one with a narrow leaf, and the other with a broad leaf, by cross-fertilization may be produced one partaking of the character of both. Planted on the same farm, and even in the same field, they will produce some modification of variety in the succeeding crop, although the utmost pains may be taken to prevent this, by turning out the seed heads of the two varieties as far apart as possible. Any one who has grown a few hundred plants of Cuba tobacco, for domestic use, on a farm where the heavy export tobacco is produced from the Big Orinoco, the Medley Pryor, or the Beat-All, knows that in the crop of the succeeding year many growing plants will be found with the sweetish odor of the Cuba tobacco, growing side by side with the heavy varieties.

It is exceedingly important, therefore, in consequence of the readiness with which the varieties mix, that in order to keep a desirable variety from deterioration, no two varieties shall be planted upon the same farm. Hundreds of modifications of varieties have thus been made. Darwin made some exceedingly interesting experiments in the cross-fertilization and self-fertilization of the tobacco plant, from which he drew the conclusion that cross-fertilization from plants grown from the same seed produces deterioration of variety, both in size and weight.

On the other hand, when a plant is cross-fertilized with a totally different variety, grown under different conditions of climate and culture, and on different soils, the improvement was manifest, both in size and weight. This improvement was shown in several ways, "by earlier germination of the crossed seeds, by the more rapid growth of the seedlings while quite young,

PLATE IV. HAVANA SEEDLEAF (complete plant in flower).

Grown in Connecticut valley, Massachusetts. Hight 6 feet 7 inches. Top leaves 20 to 25 inches long, 12 to 15 inches wide; middle leaves 15 to 17 by 28 to 33 inches; bottom leaves 11 to 15 by 20 to 25 inches.

by the earlier flowering of the crossed plants, as well as by the greater hight which they ultimately attain. The superiority of the crossed plants was shown still more plainly when the two lots were weighed, the weight of the crossed plants to that of the self-fertilized being as 100 to 37. Better evidence," he concludes, "could hardly be desired, of the immense advantage derived from a cross with a fresh stock." But Darwin neglected the most important point, and that is, the relative value of the cured products. Strong vitality in the tobacco plant does not ensure a high quality of products.

While this tendency of the varieties to mix is accompanied with trouble in preserving the purity of the seeds of desirable varieties, it also offers opportunities for improving old, or of creating new, varieties. The plant may be bred for qualities desired for specific purposes. In the districts growing wrappers, width and fineness of the leaf may be increased by cross-fertilization. Where the product is thick and heavy, but not large, the cross-fertilization with a plant of larger leaf may result in a decided improvement. This should be one of the duties of those having charge of agricultural experiment stations.

In the investigation of the culture and curing of tobacco, by the census of 1880, more than one hundred names of varieties were mentioned in the schedules returned. Probably half of these were synonyms. In the list below are given the names, uses, places where grown, and peculiarities of growth of such varieties as commended themselves to growers. A few new varieties have been introduced since 1880, of which the names, uses and qualities are given at the close of the chapter.

New "varieties" are frequently brought to notice, but in most cases prove, upon investigation, to be merely variations of established kinds. Indeed, it is difficult to mark the line between distinct and indistinct varie-

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ties. We by no means contend that absolute perfection has yet been attained in any of our varieties of tobacco, and feel confident that the great development of tobacco culture which is coming in America, will be characterized by marked improvements in the desirable features of the different classes of leaf.

PRINCIPAL VARIETIES OF TOBACCO GROWN IN THE UNITED STATES.

Adcock.—Wide space between leaves; ripens uniformly from top to bottom; used for yellow wrappers and fillers for plug; excellent fine smokers; grown in North Carolina.

Baden.—Short leaves, light, inclined to be chaffy; cures a fine yellow, but liable to green spots; used for plug wrappers and fillers, smokers; grown in Maryland.

Baltimore Cuba.—Long leaf, good body, fine, silky texture, tough; yields well; sweats a uniform color; disseminated by the United States agricultural department; used for cigar wrappers and fillers; grown in Ohio (Miami valley).

Bay.—Large, heavy leaf, red spangled and yellow when cured; used for manufacturing and shipping; grown in Maryland.

Beat-All (same as Williams).—Large, spreading leaf, fine fiber, dark, rich and gummy; export to Great Britain and Germany; well cured, makes fine Swiss wrappers. Tennessee, Virginia.

Belknap. — Sub-variety of Connecticut seedleaf; same as Connecticut seedleaf. Connecticut, Massachusetts, New York.

Bullface.—Sub-variety of the Pryor; large, heavy leaf, oval shaped, tough, small stems and fibers; a luxuriant grower; heavy shipping, makes good wrappers for cheap plug. Virginia, North Carolina, Tennessee.

Bullock.—Broad, smooth leaf, with no ruffle on stem; yellow wrappers and plug fillers. North Carolina.

Burley, White.—Long, broad leaf, white in appearance while growing; grows flat, with points of leaves hanging down, and often touches the ground; fancy wrappers, plug fillers, and for cutting purposes. Ohio, Kentucky, Virginia, Maryland, Missouri, Indiana. Plates VII, VIII. There is another variety of the White Burley with narrow leaf, twisted bud, not so tender, and the ends of the leaves do not touch the ground. Plate IX.

Clardy.—Large, smooth, heavy leaf, extremely broad; stalks long; common plug, exported for Swiss wrappers and consumption in the Regie countries. Kentucky, Tennessee.

Connecticut Seedleaf.—Broad leaf, strong, thin, elastic, silky, small fibers, sweetish taste, light in color; cigar wrappers, lower grades for binders and fillers. Massachusetts, Connecticut, New Hampshire, New York, Pennsylvania, Ohio, Wisconsin, Minnesota, also in Indiana, Illinois and Florida.

Connecticut Broadleaf (East Hartford Broadleaf).—Modification of above; leaves broader in proportion to length; fibers more at right angles to midrib; same as above. Connecticut, New York, Wisconsin. Plates I, II.

Cuba.—Small leaf, grown from imported seed; retains much of the aroma of Cuba-grown tobacco; cigar wrappers, fillers and binders. Pennsylvania, New York, Wisconsin, Florida and Louisiana.

Cunningham.—Short, broad leaf, thick and stalky growth; fillers and smokers. North Carolina.

Duck Island.—Broad leaf, fine appearance, full grower; originated from Havana seed; cigar work. New York, Pennsylvania.

PLATE V. Plant Topped. PLATE VI. Plant in Flower.

SUMATRA SEEDLEAF.

From a photograph taken in August, 1896, of a field in Columbia county, northern Florida. Hight of plant, 6 to 8 feet when topped, or 8 to 10 feet when in flower. Length of longest leaf, when cured, 18 to 20 inches; length of shortest leaf, 7 to 8 inches; average length, 14 inches. Width of longest leaf, 10 to 12 inches in the middle; width of shortest leaf, 5 to 6 inches; average width, 8 inches. Greatest number of leaves on best plant, 40; lowest, 20; average, 30.

FLANAGAN. — Similar to Little Orinoco, but broader leaf, finer fiber, silky and tough; fancy wrappers, plug fillers. Virginia.

FLORIDA.—Fine texture, silky, thick and elastic; becomes spotted when grown upon certain soils, with white specks when ripening; cigar wrappers, binders and fillers.

FREDERICK.—Akin to White Stem; rough leaf, heavy and rich, stands up well; mainly for export to Europe. Virginia and Tennessee.

GLESSNER.—Large, handsome leaf, fine texture, soft and elastic; cigar wrappers and fillers, smokers. Pennsylvania, New York, Wisconsin.

GOOCH.—Broad, round leaf; leaves thick on stalk; yellows on hill when ripe; cures easily; fancy, bright export, and domestic wrappers and smokers. Virginia, North Carolina. A favorite variety in North and South Carolina.

GOURD LEAF.—Broad, short, fine and silky leaf, yellows on hill; plug wrappers and fillers, smokers. Virginia.

GOVERNOR JONES.—Long, narrow leaf, of good body; plug wrappers and fillers, and for common smoking. Kentucky.

HAVANA SEED.—Very thin, fine leaf, fine texture, delicate flavor; cigar wrappers. Connecticut, Massachusetts, Pennsylvania, Wisconsin, Ohio. Plates III, IV.

HESTER.—Broad-shouldered, heart-shaped leaf, fine fiber, silky, cures very bright; plug wrappers, fillers and smokers. A great favorite in North and South Carolina for yellow tobacco.

HICKORY LEAF.—Fine fiber and texture, cures up very bright; plug work, smokers and shipping. West Virginia.

JOHNSON GREEN.—Said to be a cross of Orinoco and White Stem; large, heavy leaf, strong flavor; strips and shipping leaf. Virginia.

KITE-FOOT.—Rather short, wide leaf, thin, apt to cure a greenish color unless fully ripe; for very common cigars; culture decreasing. Indiana.

LACKS.—Heavy weight on strong soils; used for making yellow tobacco in Virginia, and heavy tobacco in Kentucky; well colored, broad leaf, fine fiber; a strong grower. Kentucky, Virginia. Plate XIV.

LITTLE DUTCH.—Very narrow leaf, small, thick and short, in flavor resembling Yara tobacco; for binders and fillers for cigars; once very popular in the Miami valley of Ohio, but now discarded, along with seedleaf, and Zimmer's Spanish is mainly grown.

LONG GREEN.—Coarse and heavy, vigorous grower; heavy shipping leaf. Virginia.

LANCASTER BROADLEAF.—Upright grower, delicate, silky fiber; cigar wrappers, binders and fillers, smokers. Pennsylvania, Wisconsin.

LOVELADY.—Long, dark, narrow leaf, very heavy; export, grown for African shippers. Virginia, Tennessee, Indiana.

MANN.—Leaf of good body, heavy and gummy; plug wrappers and fillers, export. North Carolina.

ORINOCO, SHORT.—Broad leaf, upright growth and open habit, light colored, much ruffled; plug wrappers and fillers, for strips and for export leaves. Virginia, Missouri.

ORINOCO, BIG.—Short, broad leaf, doubtless originally same as last named; sweet plug wrappers and fillers, export. Virginia, Missouri, North Carolina, Tennessee, West Virginia.

ORINOCO, YELLOW.—Long, narrow, tapering leaf, fine texture, stands up well; principally for plug work and smokers; sweetest variety grown. Virginia, Maryland, North Carolina, Tennessee, West Virginia, Missouri.

Pennsylvania Seedleaf. — Coarser and darker than Connecticut seedleaf; used for some purposes and grown in same States.

Perique.—Medium-sized leaf, fine fiber, small stem, tough, gummy and glossy; smoking, chewing, cigars and cigarettes, for mixing with other kinds. Louisiana.

Pittsylvania, Yellow. — Medium size, leaves elongated, good distance apart, fine texture, small, tough stems; fine wrappers and fillers, good export variety. West Virginia.

Pryor, Blue.—Large, fine leaf, long, and well proportioned, good color, slightly ruffled; cigar and plug fillers; stemmers for export. Virginia, North Carolina, Kentucky, Tennessee, Missouri, Indiana.

Pryor, Silky.—Long, sharp-pointed leaf, grows thin on the stalk, with a leaf very tough and pliant when cured; plug wrappers and fillers. North Carolina and Virginia. See Plates XII and XIII.

Pryor, Yellow.—Heavy, wide leaf, fine texture, fine, bright color, tough, weighs well; cigar and plug wrappers and fillers; stemmers for export. Same as last.

Pryor, White (or Medley Pryor).—Very broad leaf, soft and silky texture and tough fiber; a beautiful grower; plug wrappers and fillers. Virginia.

Shoestring.—Heavy leaf, rather narrow, long and large stem; dark navy plug; good shipping leaf. Tennessee, Kentucky, Missouri, Virginia.

Sleek Stem.—Large, long leaf, heavy weigher, no ruffles; heavy, dark fillers, shipping leaf. Tennessee.

Spanish Seed.—Uniform, dark color, medium size leaf, ripens ten days earlier than other varieties;

PLATE VII. WHITE BURLEY TOBACCO (topped plant).

Ready for cutting, slightly wilted. Hight, 4 feet 4 inches. Fifteen leaves on plant; top leaves, 28 inches long; center leaves, 38 inches long; bottom leaves, 36 inches. Grown in Greene county, east Tennessee.

highly prized for dark cigar wrappers. New York, Illinois, Wisconsin.

SUMATRA SEED.—Newest of all varieties of cigar leaf. Grown in Florida, from seed imported from Sumatra. Leaf light in weight and color; not long, compared to other seedleaf, and much narrower, with fine ribs. Promises to be very popular with cigar manufacturers. See article on Tobacco in Florida, also Plates V and VI.

THICKSET.—Leaf long, pointed, narrow, coarse fiber; very short stalk, coarse and heavy; common plug work and shipping. Kentucky, Missouri, Maryland, West Virginia, Tennessee, eastern Ohio.

TWIST BUD.—Heavy, large leaf, screw-shaped, terminal stem; export mainly, also plug fillers. Kentucky, Missouri, Maryland.

VALLANDIGHAM. — Large, pointed, smooth leaf; cigar wrappers and fillers, smokers. Wisconsin.

WAND.—Another name for Lacks, which see.

WHITE STEM ORINOCO.—Leaf long, slender, drooping, tough and fibrous, largest leaf grown; yellow plug wrappers, strips and shipping leaf. Virginia and North Carolina.

WILLIAMS.—Same as Beat-All. Grown in Tennessee for twenty-five years as Williams; British and German export. Tennessee.

WILSON'S HYBRID.—Said to be an improved Havana. Erect habit, easy of cultivation; cigar wrappers, binders and fillers. Grown very generally in New York. "Little Spanish," and "Corn-Cross Havana," are varieties of this type that have a local popularity.

YELLOW MAMMOTH.—Very large leaf; rapid grower, yields largely; stemmed for export, and used for Swiss wrappers. Tennessee. Plates X and XI.

Zimmer's Spanish.—Much like Wilson's Hybrid Havana. Generally grown in the Miami valley, in Ohio, and also in Wisconsin.

NEW VARIETIES.

Since 1880, the following new varieties for the growing of yellow and mahogany manufacturing leaf have been originated by cross-fertilization.

Ragland's Conqueror.—Grown in Virginia, North Carolina, South Carolina, Georgia and Tennessee. This is now a standard variety.

Bonanza.—A White Burley cross on the Yellow Orinoco, said to possess the qualities of both parents; beautifully blended, and very popular with manufacturers, being tougher than the White Burley, and more porous than the Orinoco; very hardy.

Safrano.—A cross of the Hyco on White Burley. The color resembles the saffron rose, it being a rich saffron color; it has a soft, silky texture, and delightful flavor.

Gold Finder.—Another cross of the Yellow Orinoco and the White Burley. It is almost as white as the White Burley, and has the shape and habits of growth of the Orinoco.

Bullion.—A White Burley cross on the Hester; a broad leafed, stately plant, well formed and fine fibered. It resembles the Hester in habit, but the leaves are larger and grow farther apart on the stalk. It has a fine texture and great absorptive capacity.

Climax.—A cross of the White Burley on the Sterling. This has not been much tried, but it is thought to be an acquisition to the bright list.

Ragland's Improved Yellow Orinoco has been more extensively planted in recent years for the yellow type than any other variety. In its habit of growth it does not differ very much from the Yellow Orinoco.

HONDURAS.—Used in the yellow-tobacco districts for growing the bright mahogany. It is a vigorous grower and very healthy.

Several old varieties, as the Yellow Pryor, the Hester, the Gooch, and the original White Burley, are said to have been improved by careful culture and cross-fertilization, by the late R. L. Ragland, of Virginia, for a long time the best known and one of the most successful tobacco growers in the yellow belt.

Among the new varieties of merit for dark, rich export tobacco recently originated, may be mentioned the Kentucky Yellow, one of the largest varieties known, combining weight with fine texture.

Every one of the varieties mentioned in this list has its excellences and its advocates. Two farmers, living side by side, upon the same soils, will often differ in their preferences, and will grow continuously for many years different varieties from each other. Each variety has some good points, and is deficient in others, and from this cause the great difference in opinion as to merits arises.

In the South, the favorite selections among a majority of planters, for the purposes indicated, are the following: For *yellow tobacco:* Gooch, Broadleaf Orinoco, or White Stem Orinoco, as it is sometimes called, Yellow Orinoco, Hester, Bradley, Tilly, Sterling, Yellow Pryor, Lacks, Primus, Tuckahoe. For *manufacturing purposes*, flue, sun and air cured: Bonanza, Flanagan, Little Orinoco, Sterling, Hyco, Hester, Sweet Orinoco and Bradley on siliceous loams, and White Burley on strong limestone soils. For *mild chewing tobacco and smokers:* Sweet Orinoco on siliceous soils, and White Burley on limestone lands. For *heavy shipping leaf:* Blue Pryor, Medley Pryor, Beat-All, Yellow Mammoth, and Kentucky Yellow; the Shoestring is largely grown for shipping abroad, though very

PLATE VIII. WHITE BURLEY TOBACCO (complete or seed plant).

From same farm as Plate VII. Hight, 6 feet. Top leaves, 22 inches long; center leaves, 30 inches long.

narrow. For *heavy stemming:* Lacks, Yellow Mammoth, Beat-All, Orinoco Broadleaf, Blue Pryor, Morrow and Kentucky Yellow. For *mahogany wrappers*, cutters, fillers and bright smokers, the same varieties are grown as for yellow tobacco, though some growers believe that a greater proportion of good wrappers is made from some of the new varieties bred by Mr. Ragland. Among those most heartily commended are: Conqueror, Ragland's Improved Yellow Orinoco, Bullion and the Long Leaf Gooch. It should always be remembered that varieties grown, even for specific purposes, will do better on some soils than on others. And every planter ought to test several varieties on his farm, in order to ascertain just which will give the best results, quality, quantity and demand considered.

CHAPTER IV.

CLASSIFICATION OF THE TOBACCO GROWN IN THE UNITED STATES, AND THE MARKETS FOR IT.

The cured product only of the tobacco plant is of marketable value. Each distinct soil formation, aided by climatic conditions, gives peculiar qualities to the cured leaf, as to texture, flavor, color and special fitness for varied uses and for different markets. The ability to cultivate the plant, or to cure the product, so as to give it such qualities as to make it desirable, is of the utmost importance to the grower, and upon his skill in this depend his profits.

In its green state there are many varieties of tobacco in which peculiarities of growth, size, or time of maturing, are the distinguishing features. Commercial circles recognize in the cured product classes, types and grades. The basis of a *class* is its adaptation for a certain use; the basis of a *type* is the combination of certain qualities, or properties, in the leaf, as color, strength, elasticity, body, flavor, etc., or in the methods employed in curing, as sun-cured, air-cured, flue-cured, or cured by open fires. *Grades* represent the different degrees of excellence in a type, as lugs, low-leaf, medium, good, fillers, binders and wrappers.

To illustrate more fully: The heavy shipping tobacco is a *class* adapted to the requirements of the consumers in foreign markets. The yellow tobacco is a *type* that may be used for exportation, for smoking and for chewing, thus belonging to several classes. There may be eight or ten *grades* of yellow tobacco, each differing from the other in points of excellence, but all belonging to the same type.

A district may produce only one type, which may be referred to several classes; that is, it may be suitable for exportation, for chewing, smoking, or the making of snuff.

A district may produce many types of the same class, as in New England, where several types of seed-leaf and Havana seed are grown, yet all belong to the class of cigar tobacco and are used solely for that purpose. A district may also produce only one class of one type.

The classification first made in the census reports of 1880 has given the greatest satisfaction to the tobacco trade, and it is appended below, with a few changes rendered necessary by changes in demand. It must be observed, however, that many of these classes are interchangeable.

CLASS I.

CHEWING TOBACCO.

(*a*) *Tobacco for fine cut and plug fillers.*

Fine cut Burley.
Fine cut Mason county.
White Burley fillers.
Red Burley fillers (plug work).
Virginia sun and air cured fillers.
Virginia flue-cured fillers.
North Carolina flue-cured red fillers.
Carolina and east Tennessee flue-cured yellow fillers.
Missouri air-cured fillers.
Fire-cured fillers.
Tennessee and Kentucky air-cured fillers.
Green River fillers.

(*b*) *Tobacco used for plug wrappers.*

Virginia yellow and mahogany.
North Carolina yellow and mahogany.
South Carolina " " "
East Tennessee " " "
West Virginia " " "
Clarksville and Missouri dark and red.
Kentucky and Ohio Burley.

PLATE IX. WHITE BURLEY (topped).

Wilted when photographed, but the peculiar appearance of the narrow-leafed or twist-bud sub-variety is well represented. Grown at Kentucky experiment station, Fayette county, on soil not especially adapted to tobacco. The crop on this exhausted soil, when fertilized with potash, is as large as on typical tobacco land. Hight of this plant, 35 inches; average top leaf, 21 inches long, 8 inches wide; middle leaves, 32x11 inches; lower leaves, smaller and variable. This sub-variety holds its leaves straight up, while in the White Burley, shown in Plates VII and VIII, the leaves hang down, often touching the ground when ripe.

CLASS II.

TOBACCO FOR EXPORTATION.

(a) *English shippers.*

Bird's-Eye cutting leaf.
Brown roll wrapper.
Spinning leaf.
Heavy cutter.
Plug wrapper.
Plug fillers.
Navy leaf.
Irish filler.
Scotch Elder.
Scotch and Irish spinners.

A large portion of English shippers are sent abroad deprived of the stem or midrib, and are called strips.

(b) *Continental shippers.*

French Regie, A's, B's and C's.
Italian, " " " "
Austrian, " " " "
Spanish, " " " "
Germany: German Saucer, German Spinner, Spangled tobacco from Ohio, Maryland and West Virginia, and fat lugs for smokers.
Switzerland: Swiss wrappers and Swiss fillers.
Holland or the Netherlands: Dutch Saucer.
Belgium: Belgian cutter.
Denmark, Norway and Sweden: Heavy Kentucky and Tennessee types.

(c) *African shippers.*

Liverpool African.
Boston "
Gambia "

(d) *Mexico, South America and West Indies.*

Baling wrapper.
Baling filler.

CLASS III.

PRODUCT SUITABLE FOR THE MAKING OF DOMESTIC CIGARS, OR FOR THE MANUFACTURE OF SMOKING TOBACCO.

Seedleaf and Havana seed grown in New England, Pennsylvania, New York, Ohio, Wisconsin, Illinois and Florida.
White Burley lugs.
American-grown Havana.
Perique.
Lugs from the yellow and heavy tobacco growing districts.
Indiana and Kentucky cheroot and stogy wrappers.

Fine-fibered Clarksville wrappers.
Indiana Kite-Foot.
Little Dutch, of Ohio.

Going into a more minute description of the various members of the different classes, we begin with—

CLASS I.

CHEWING TOBACCO.

Fine Cut and Plug Fillers.—White Burley is the product of a new variety which originated in Brown county, Ohio, in 1864, as has been already described. There are two sub-types now produced from the White Burley:

1. A thin, chaffy leaf, almost destitute of gum and oils. This is used for manufacturing fine-cut tobacco.

2. A heavier leaf, with more body and more gum, used for plug fillers, and generally called, in the commercial world, Red Burley. This sub-type is soft, elastic, spongy, with a large capacity for absorbing the sauces with which it is treated in the process of manufacture. It has about three per cent of nicotine, which is about half the quantity contained in the heavy-shipping tobacco. It will absorb, without dripping, two and a half times its weight of water. It is not naturally so sweet as the flue and sun cured tobacco of Virginia, or the air-cured product of Missouri. The fine-cut Mason county tobacco has less gum than any other tobacco grown in the Burley district.

The Red Burley fillers are not so bright in color as the White Burley cutting leaf, but they have a characteristic cinnamon color.

The Virginia sun and air cured fillers, which are chiefly grown in the counties of Caroline, Hanover, Louisa, Spottsylvania and Fluvanna, in Virginia, consist of a leaf of medium size, light brown in color, very sweet and fragrant, with a fair proportion of gum and oils. This sun and air cured tobacco is very popular for chewing, on account of its peculiar richness of flavor and pleasantness of taste. It contains about 3.27 per cent of nicotine, and will absorb, without dripping, about twice its weight in water.

The most popular and the highest priced brands of tobacco are manufactured from the flue-cured Virginia fillers grown, for the most part, in Henry and Patrick counties, Virginia, but mainly in Henry county. This product is of medium size, brown or mahogany in color, fine in texture, delicate in fiber, oily and elastic. It is usually made from the variety known as the Little Orinoco, which is peculiar in the irregularity of its veins, or smaller fibers, and the frequent bifurcations of these fibers.

The best North Carolina Red fillers, resembling somewhat those grown in Henry county, Va., come from Rockingham, Guilford, Forsyth, Surry, and to a smaller extent from several other counties in the western section. They are flue-cured, of a cherry red in color, with whitish fibers. They are sweet, tough and leathery, but of small leaf and delicate fibers. They are made from thoroughly ripened plants, and while not great absorbers of the sauces with which they are treated in the process of manufacture, yet they are highly popular because of their peculiarly sweet, natural flavor. When the plants are cut before they are ripe, the product is subject to "gray veins," which are highly objectionable, inasmuch as such veins do not disappear, or blacken, when manufactured, and reveal the immaturity of the product.

The yellow fillers of Virginia, North Carolina, South Carolina, and of east Tennessee, though used, to some extent, in the manufacture of chewing tobacco, are yet wanting in the natural sweetness and toughness of leaf, which are so much to be desired in chewing tobacco.

PLATE IX*a*. WHITE BURLEY (topped).

This is a picture of a plant of this variety somewhat different from the plant shown in Plate IX, although belonging to the narrow-leaf variety and finer type of the White Burley. It is grown on a field having a typical blue grass soil, in Fayette county, Kentucky, well suited to the growth of White Burley. This plant was 3½ feet high; top leaf, 28 inches long and 8 inches wide; middle leaves, 31x9 inches.

The Missouri air-cured fillers make what is called a "tough, sweet chew," that is pleasant to the taste, but the texture of the leaf is not so delicate or silky as that of the Henry county flue-cured tobacco, nor does it command such high prices in the market.

A chewing tobacco with a large percentage of nicotine, much used by miners, sailors, lumbermen, farm laborers, and others employed in outdoor work, is made of the strong, new-land tobacco grown in the heavy-shipping districts, and even, to some extent, of that grown on heavily manured plots. This product rises sometimes as high as six per cent in nicotine, and is totally unfit for use by delicate persons, or those having weak nerves. Owing to the large amount of gummy substances stored away in its vascular tissue, it rarely has the capacity of absorbing, without dripping, more than an equal weight of water.

The air-cured fillers of Tennessee and Kentucky, other than the Burley, are of light to medium weight, not coarse in texture or fiber, but far from being as delicate as the flue-cured products of Virginia. This product is not gummy or waxy, but it has a mild, sweet flavor, free from acridity or bitterness, porous in structure, and generally of a bright, pale-red color. It possesses a high absorptive capacity. It is distinguished from the Burley fillers by having more body, with less delicacy of fiber, and by being darker in color.

Plug Wrappers.—Equally as essential for making plug tobacco, are plug wrappers. The yellow and mahogany types of Virginia, North and South Carolina, east Tennessee and portions of Kentucky, may be considered grades of the yellow type. The highest grade of yellow wrappers is small in size, lemon-yellow in color, soft and silky to the feel, with yellow or white fibers. It sparkles with minute, golden colored granules, apparently sprinkled on the upper surface of the leaf, that give a splendor to its appearance, especially in the sunlight. Other grades, less perfect in the yellow color, follow this, by almost imperceptible gradations, to the mahogany or mottled yellow and brown. The lemon colored leaf stands at the head as a wrapper for plug, especially if it will withstand heavy pressure without blackening. The mahogany and red wrappers are generally larger than the yellow wrappers. They usually contain a large proportion of oily substances in their composition, and will blacken the more readily under a heavy pressure. The absorptive capacity of the yellow wrapper is over two and a half times its weight. The dark and red wrappers of the Clarksville (Tennessee) district, as well as those of Missouri, have a strong and elastic texture, heavy in body, soft, smooth and flexible in structure, of fine stem and fiber, varying in color from a light brown to that of port wine. The leaf must be free from worm cut or field fire, of good width, and of well rounded proportions. These wrappers are in demand for the Canada trade, and sometimes by the manufacturers of stogy cigars.

The Burley wrappers grown in Mason county, Kentucky, are distinguished for their fineness, softness, strength and elasticity. In color, they run from a reddish-yellow to a dark brown. The best grades of the White Burley product of Mason county make excellent wrappers for plug work.

CLASS II.

EXPORT TOBACCO.

English Shippers.—Great Britain furnishes the best foreign market for American tobacco. The United Kingdom, composed of England, Scotland, Ireland and Wales, took the following quantities of American tobacco for the years named: For 1891, 62,945,623 pounds; 1892, 54,594,449 pounds; 1893, 69,493,638 pounds; 1894, 83,273,149 pounds; 1895, 89,945,565 pounds. Both leaf and strips are taken, and a variable quantity is re-exported. Among the requirements are about 40,000 hogsheads of Western tobacco, of which there are some 28,000 hogsheads of Western strips, and 10,000 hogsheads of dried leaf, and about 2,000 hogsheads of White Burley. From 8,000 to 10,000 hogsheads of Virginia and North Carolina leaf, and from 10,000 to 14,000 hogsheads of Virginia, North Carolina and East Tennessee strips are also included in the demand for the trade and consumption in the United Kingdom. Within recent years the consumption of leaf tobacco has increased in the English markets, under an arrangement with the revenue department by which the manufacturer is allowed to return the stems into the hands of the proper officer, for destruction or exportation. In some forms of manufacture, the stem is compressed in the leaf into a thin plate, and then split, so as to divide the leaf into two parts.

The Bird's-Eye cutter is the only type used exclusively in the leaf in English consumption. It consists of a very bright, smooth, thin and clean leaf, with as little gum and oil as possible. The color of both the upper and under sides of the leaf must be of uniform and similar shades of bright color, and the stem must be of a brightish brown color on the outside, and white on the inside, or upper side, of the leaf. Each section into which the stem is cut presents an appearance on the cut surface of the eye of a bird, and hence its name. This type, formerly grown only in the lower Green River district of Kentucky, and in the Clarksville district, is now largely grown in the Burley districts, and in Virginia and North Carolina.

Fine Roll wrapper is a bright red or full bright leaf, of good breadth, thin and smooth in texture, almost destitute of oil, resembling the leaf used by our domes-

PLATE X. HEAVY SHIPPING TOBACCO (topped ready for harvesting).

Name of variety, Yellow Mammoth. Hight, 30 inches; bottom leaves, 30 inches long and 19 inches wide; middle leaves, 34x20 inches; top leaves, 35x22 inches wide. The lower leaf is 10 inches from the ground; the upper, 30 inches from the ground. Distance between each leaf on the stalk, 2 2-9 inches. Grown in Robertson county, northern Tennessee.

tic manufacturers for making fine cut. It is used in England as a wrapper for spinning brown roll. The wrapper is filled with suitable fillers, and the whole spun into a strand about one inch in diameter. This is coiled like a rope, from which sections are cut for retail. The filler for the brown roll is of the same type as the wrapper, but of a lower grade. The midrib for this roll is always removed.

Spinning leaf, or strips, is a type consisting of a long, rich and oily leaf, of full brown color, good weight and body, strong and elastic in texture, and of general smoothness. Brighter colors are growing in demand for spinning leaf. Formerly the "fatty" types of the Clarksville district were in demand for this purpose, but the requirements of the German market depreciated their value so much that less oily types are now substituted. The strand into which this is spun is of a smaller size than that of the brown roll. A still smaller strand is spun, called Lady's Twist, which is consumed principally in Scotland, Ireland and in the north of England. The wrapper for the latter consists of a smaller and shorter leaf, but of the same general quality as that used for the larger strand.

There is a coarsely cut manufactured product, known as Shag, much used in England. The supply of tobacco for this is drawn mainly from southern Indiana and the Green River district of Kentucky. This tobacco has but little gum, but more than has the leaf used in the United States for making fine cut. It is called a heavy cutter. Substitutes for it came from Japan, Java, Paraguay and the Dutch possessions.

Plug wrappers for the English market consist of rich brown leaves, smooth in structure, medium in size, and strong and elastic in texture. Plug wrappers are in limited demand in the United Kingdom because the consumption of plug tobacco is very small. Plug fillers used in England are the short, common and imperfect leaves of the same general character as the wrappers.

The Navy plug, for use in the English navy, was made of the best of Green River redried fillers, until the substitution, in a large part, of the White Burley fillers. These now compose the largest portion of the material used in the manufacture of Navy plug in quarters, half pounds and pounds. A short, fully ripened, clean and oily leaf is used in Ireland for fillers. The Bird's-Eye and Irish fillers are sold in the English market in the leaf for the special consumption to which they are adapted.

Scotch Elder is a type very popular in England and Scotland. It is a leaf of good size, and reddish in color. It has great absorptive or drinking capacity, very porous, containing a small content of gummy matter, with a medium texture as to fineness. The cause of its great popularity is that as much as fifty-five pounds of water may be added to one hundred pounds of tobacco before it is sold to consumers. As the tax on every pound of tobacco imported to England is about seventy-six cents, it will be seen that the greatest profits to the retailer come from the capacity of the tobacco to absorb and retain moisture.

The Scotch and Irish spinners are almost identical in character with the English spinners.

CONTINENTAL SHIPPERS—REGIE TYPES.

French Regie Types.—The exports of American tobacco to France were, 35,363,885 pounds in 1891; 39,773,013 pounds in 1892; 39,508,592 pounds in 1893; 38,268,008 pounds in 1894; and 34,943,161 pounds in 1895. This amount is usually made up of about 11,000 hogsheads of Western tobacco, 1000 hogsheads of Virginia, 4000 hogsheads of Maryland and a variable quantity of eastern Ohio tobacco, possibly 2000 hogsheads.

Of the Western tobacco, about half is Burley, and the demand for that type is rapidly increasing. This is manifested in the changes made for the requirement of the French Regie, for 1896, which called for 8,038,530 pounds of Burley, as against 5,894,922 pounds in 1895; 1,339,755 pounds of heavy Kentucky, as against 1,607,706 pounds in 1895; 8,842,383 pounds of light Kentucky, as against 15,005,256 pounds in 1895; and 1,607,706 pounds Virginia, as against 2,277,584 pounds in 1895. The demand for Burley was increased by about 2000 hogsheads. The demand for Maryland tobacco was also increased, but no call was made for the tobacco of northeastern Ohio.

It will be seen that there is a considerable variation in the character of the tobacco taken by the French Regie. Usually the French demand may be reduced to two distinct lines of classification, as heavy and light, with considerable irregularity as to grade, and deficiency as to distinctiveness in type. Two things are usually insisted upon: The stem must be absolutely free from mold, and the leaf must be supple enough to open freely. There are types of both heavy and light, known as A's, B's and C's. Type A consists of a leaf from twenty-three to twenty-five inches long, of moderately smooth appearance, dark brown in color, and heavy or light, according to the classification. This type is supplied by White Burley, Maryland, Kentucky and Tennessee tobacco. Type B is of the same quality as type A, except as to length, which may be from eighteen to twenty-two inches. Type C consists of good, sound, clear lugs, or common leaf of moderately heavy body, running from the Clarksville and western Kentucky type of medium weight and body, to the lower Green River product of medium weight of body.

It is said that France puts up the best smoking tobacco in Europe, and the product is made absolutely

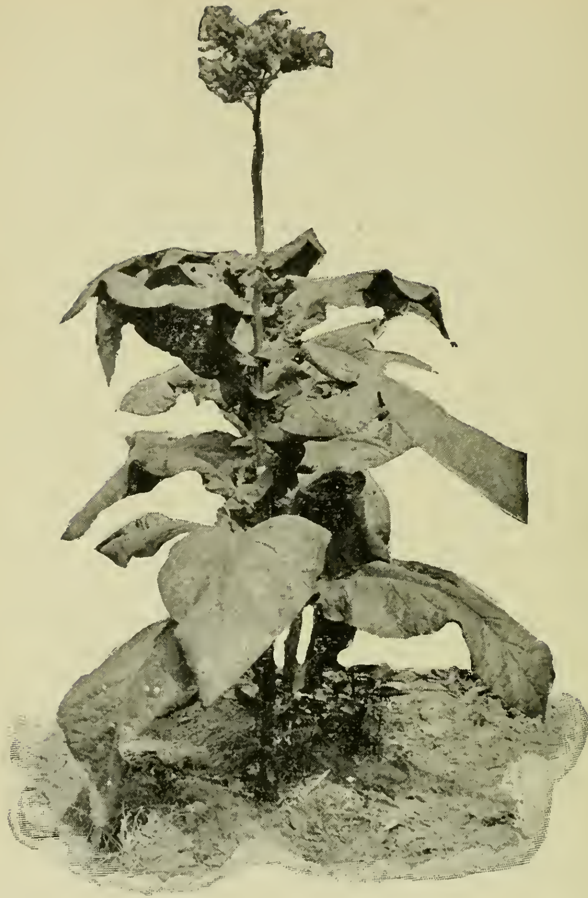

PLATE XI. HEAVY SHIPPING TOBACCO.

Seed plant from same field as Plate X. Hight, 5 feet 9 inches; bottom leaves, 30 inches long, 14 inches wide; middle, 30x14 inches; top, 24x13 inches.

uniform, one year with another, by proper mixing of tobacco in large bins containing from thirty to forty hogsheads each. France also consumes from 15,000 to 25,000 hogsheads of tobacco grown in Alsace-Lorraine and about 5000 hogsheads of Hungarian tobacco.

Italian Regie.—The exports of the tobacco of the United States to Italy were: 32,436,011 pounds in 1891; 30,096,355 pounds in 1892; 27,515,456 pounds in 1893; 24,484,406 pounds in 1894; and 24,626,836 pounds in 1895. Italy usually takes from 15,000 to 18,000 hogsheads of heavy tobacco annually, and 2000 to 3000 hogsheads of Burley. The tobacco taken from Italy is also classified into A's, B's, and C's.

Type A is a large, smooth, showy and silky leaf, twenty-five to twenty-six inches long, of delicate fiber and texture, and of a solid dark brown color. Moderate weight only is required in this type, and just oil and fat enough to make it elastic and strong. This type is used as wrappers in the manufacture of cigars.

Type B varies between heavy and light tobacco, sometimes the one, and then the other, being called for in the contract. When the heavy is required, the type consists of leaf of heavy body, dark brown color, and of more general richness and weight than type A, and it must be from twenty-two to twenty-five inches long. This type is used partly in the manufacture of snuff. Type B, light, consists of leaf of second and third grades of the same length of the heavy type, of showy appearance, light brown, or red, in color, and of moderate weight of body. Type B, light, is used in the manufacture of cigars of milder flavor than those made of the heavier type, and it is also used largely for cutting into smoking tobacco.

Type C consists of short, common leaf, eighteen to twenty inches in length, of moderate weight of body, and is used as fillers and binders in the manufacture of cigars.

Of these various types, A is chiefly selected from the lighter-bodied and smooth product of the Clarksville district and of the western Kentucky district; B, heavy, from the heavier bodied products of these districts; B, light, from the lower Green River district. The tobacco of southern Indiana and Illinois has sometimes been used for B light. Type C is the common leaf of the heavy-producing districts, and the heavier bodied product of the light-producing districts. Intermediate types are frequently allowed in the Regie contracts. A small quantity of White Burley tobacco is taken for trial. Italy uses a considerable amount of Hungarian-grown tobacco.

Austria Regie takes only one type from the United States, and this is divided into A, B and C grades. This is a wrapping leaf, very smooth and fine in fiber, of very solid, firm and glossy texture above medium heavy body, but not of the heaviest and most fleshy type, and of a perfectly uniform brown and piebald color. A very essential quality is toughness in the leaf and a capacity of stretch. It must be well cured by fire, but not injured in curing. The length of leaf is not an essential part of the fitness, but good length is preferred. This type is used in Austria as wrappers for cigars, and is supplied partly from Virginia, but in the main from the Clarksville district. The lower grades of tobacco for the Austrian Regie are supplied from Hungary. Austria is also taking a small quantity of White Burley tobacco experimentally.

The Spanish Regie.—The Spanish contract is let for periods ranging from one to six years, and is filled by sound, common and medium lugs and low leaf of all types and districts, except the Burley and bright-tobacco-producing districts. It is also, in part, filled by the low and nondescript leaf of light type. Most of the tobacco for this contract is taken from the Western product, only about 2000 hogsheads of Virginia tobacco being found suitable in character and price. The order is generally made for one-third of leaf of low grade and two-thirds lugs. The tobacco is classified into A's, B's and C's. Most all of it is used for smoking, the better grades for wrappers, binders and fillers in the manufacture of cigars, and the lower grades are granulated and used for the manufacture of cigarettes and a moderate amount in snuff. The tobacco taken for Gibraltar is not embraced in the following statement: The quantity taken annually is from 15,000 to 18,000 hogsheads. There were 13,865,549 pounds of the tobacco of the United States exported to Spain in 1891; 22,862,875 pounds in 1992; 12,611,810 pounds in 1893; 30,054,113 pounds in 1894; and 26,262,432 pounds in 1895.

German Types.—German Saucer is a sweet, fair-bodied leaf of fine fiber and stem, gummy, without fatness, and either of a clear, cherry red in color, or mottled with yellow, technically called piebald. The surface is gummy, the leaf of good length, with considerable weight of body. It is prepared for consumption in Germany by treating it with sweet sauces of a peculiar flavor and character. The fiber must be yellow after being treated with these sauces, and the leaf black. It is supplied mainly from Virginia, though some excellent tobacco for this purpose is grown in the heavy-tobacco districts of Tennessee and Kentucky.

German Spinner consists of a very heavy-bodied leaf, from twenty-four to twenty-six inches long, full in width, of fine stem and fiber, very oily and fat, so that it will come out of the process of fermentation supple and strong, tough and elastic in texture, and of a very deep dark-brown color. This type is used in Germany and the north of Europe for spinning into strand. It is supplied chiefly from the Clarksville district and in part from the Green River districts of Kentucky. It is this

PLATE XII. BRIGHT YELLOW TOBACCO (Silky Pryor, topped plant).

Photographed in same field and on same date (Aug. 21) as Plate XIII. Hight of plant, 3½ feet. Bottom leaf, 13x25 inches; middle leaf, 16x28½ inches; top leaf, 13x24 inches. Season: Rains up to about July 15, excessive heat and dryness for next 22 days.

type that has given the Clarksville tobacco its most distinguishing characteristics.

German Spinning fillers are of the same character of tobacco as the wrappers, differing only in grade, and consist of very fat, clean and heavy-bodied lugs, which are also supplied from the Clarksville and upper Green River districts.

Germany also takes most of the Spangled tobacco of West Virginia and Ohio, and also that of Maryland. This is a leaf of full breadth, moderate length, and small stem. It is deficient in oil, has a medium strength in texture, and in color is yellow, yellow spangled with red, red spangled with yellow, and fine red. It is cured with open fires, but has a mild, sweet flavor. The fine yellow and yellow spangled go to Bremen, where it is rehandled, and packed in lighter casks, and sent to Russia for consumption. A portion, however, is taken to Austria and England, the two latter named countries taking also the red spangled. England takes the fine red. Germany takes all grades for consumption or distribution, mostly, however, dark tobacco. It now takes about 500 hogsheads of bright fillers. Very little of the French and Italian types are taken; and only scraps of these types which are used in the country for smoking tobacco. Germany is also a large market for Burley lugs, and for seedleaf for cigars.

Next to the United Kingdom, Germany is the best customer for American tobacco. Tobacco is sold in an open market, and is not a government monopoly. There were 48,055,408 pounds sent to that country from the United States in 1891; 53,116,734 pounds in 1892; 61,235,195 pounds in 1893; 51,632,897 pounds in 1894; and 54,184,621 pounds in 1895.

Russia takes some Maryland tobacco directly from this country, but nothing else of consequence. Southern Russia is supplied from Greece, Turkey and North

Africa. Sweden and Norway take direct from the United States, from 1,629,755 pounds in 1892, to 351,495 pounds in 1895. Portugal takes a very variable quantity, running from 2,657,256 pounds in 1893, to only 5091 pounds in 1895. The demand for Gibraltar was, for 1893, 1,470,916 pounds; for 1894, 2,301,883 pounds; for 1895, 1,896,332 pounds. Much of this is re-exported to Africa. The Azores and Madeira Islands take annually from 3000 pounds to 320,000 pounds of the tobacco of the United States.

Snuff Lugs and Smokers.—The very fat, heavy and oily lugs of the Clarksville and other heavy-producing districts are consumed largely in the United States and Germany in the manufacture of common snuff, and for baling and spinning fillers, as noted elsewhere. They are also used on the Continent for the manufacture of common cigars.

Switzerland takes from the United States only one type, known as Swiss wrapper. This is a broadleaf, twenty-six to thirty inches in length, silky, of fine fiber and stem, and of a dark brown or chestnut color. The spaces between the lateral fibers should be wide, and a combination of thin web and strong fiber is desired, so that the largest number of wrappers may be obtained from a given quantity. It is used in Switzerland as a cigar wrapper, and is supplied principally from the Clarksville district, but to a small extent from other heavy-producing districts. It must be cured by fire. The quantity of tobacco grown in the United States, taken directly to Switzerland, is very small, perhaps from five hundred to seven hundred hogsheads annually.

The Netherlands take one distinct type from the United States, known as Dutch Saucer, which is similar in all respects to the German Saucer, except that it is thinner and more silky in texture. The other types taken are very much like those required for Germany, including Burley lugs. The quantity of tobacco of the growth of the United States required for exportation to the Netherlands was, 18,791,146 pounds in 1891; 17,188,641 pounds in 1892; 18,168,278 pounds in 1893; 18,974,661 pounds in 1894; and 20,651,086 pounds in 1895. Black, fat and heavy tobacco, and a small percentage of light tobacco, are the types required for consumption in the Netherlands.

Belgium likewise takes one special type, known as Belgian Cutter, which is a short leaf of a mottled, or piebald color, and of fair body, without fat or oil. The general quality and structure are such as have been noted as characterizing the German and Dutch Saucers, except that the grade is lower. It is used in Belgium for cutting purposes. Belgium also buys largely of Burley lugs. The export of American tobacco to Belgium was, 18,108,975 pounds in 1891; 16,644,542 pounds in 1892; 12,509,366 pounds in 1893; 17,695,375 pounds in 1894, and 25,104,707 pounds in 1895. Most of the tobacco taken belongs to the low grades.

Denmark, Norway and Sweden.—The tobacco consumed in these countries is for the most part grown in the United States, but rehandled and prepared for their markets, mainly in Bremen. A bright mottled, or red, fleshy, sweet leaf, not fat, prepared in Germany from the product, usually, of Virginia and the Clarksville, Tennessee, districts, is a great favorite in Denmark, Norway and Sweden. In addition to this, many of the heavy Clarksville types cured with fire are largely consumed in these countries. The leaf is dipped in sweet preparations of licorice and sugar, redried, repacked and shipped to Norway and Sweden, where it is said to be "first chewed, then smoked and then snuffed." The direct exports from the United States to Denmark vary from 138,567 pounds in 1893 to 430,976 pounds, in 1895.

PLATE XIII. BRIGHT YELLOW TOBACCO (Silky Pryor, seed plant).

Hight to tip of seed, 7½ feet; hight to top leaf, 2 feet 10 inches. Bright type of tobacco grown in Coffee county, Tennessee, and on the Cumberland plateau, 1070 feet altitude.

Yellow Tobacco.—Of yellow tobacco, a large quantity is exported to Europe, ranging in quantity with the different districts, from one-third to one-half of the product grown. The following grades are chiefly taken for export:

1. Cutters: Usually thin and bright, occupying a position, as to grade, intermediate between a wrapper and a lug. This grade contributes about one-fourth of the amount exported. Used for cigarettes and smoking tobacco.

2. Bright, greenish yellow and lemon colored stripping leaf, used for fillers and partly as an English cutter. It is shipped both in leaf and in strips. All this grade, for the most part, is exported, and makes nearly half the quantity that goes abroad. It is used for plug and plug cut.

3. Leafy cutting lugs, three grades, which make nearly one-fourth of the foreign shipments of yellow tobacco.

In addition to these grades, a very small per cent of bright wrappers go abroad.

African Shippers.—These are usually divided into three classes:

1. Those which are suitable for the western coast of Africa, embracing Liberia, Sierra Leone, Senegambia and those French and Portugal possessions bordering on the gulf of Guinea, known as the Guinea coast. The tobacco for these markets should be of long, dark leaf, strong body, small tie, packed into hogsheads of small size, and made to weigh about 1500 pounds gross. The tobacco must be neatly handled.

2. The tobacco suitable for the coast further south should be of long leaf, medium to light color, fine fibers, nearly of the same length of leaf as class one, and handled neatly. The hogsheads should weigh 1450 pounds gross.

3. The tobacco suitable for the more northern parts of Africa should consist of a light or piebald leaf, not so long as classes one and two, and packed in hogsheads of medium size, weighing not more than 1450 pounds gross.

Tobacco for the African market is often packed in boxes or quarter hogsheads, which will hold from 300 to 400 pounds gross, by hard prizing. Tobacco thus prepared is more subject to atmospheric influences than when prized in hogsheads.

Most of the tobacco which finds its way to the African markets is put up by rehandlers in this country, but there is a fair proportion of leaf of suitable quality and handling put up by farmers, which is taken usually by Boston merchants, who send cargoes of various articles to the African coast. It requires 3000 hogsheads to supply the African demand for the tobacco grown in the United States.

Shippers for Mexico, South America and the West Indies.—The baling wrapper is a heavy leaf, twenty-eight to thirty inches in length, of fair width, very fat and oily, of heavy texture and of a very dark color. A necessary requirement of this class is that it should be neatly tied in small bundles, strongly and carefully packed in casks, and moderately pressed. It is put up as a wrapper leaf in preparing stock for the trade of the several markets named. It is taken from the hogshead, after fermentation, and packed in bales weighing from one hundred to two hundred pounds. These bales are covered with a cloth. They are so prepared that two bales may be balanced across the back of a pack mule, for convenience of transportation over the mountainous regions in the districts in which the tobacco is consumed.

Baling fillers are made of common, rich and heavy leaf, and fine lugs of heavy body, having a full supply of oils and fatness. Some of the exports to the West Indies are called "black fats," and are made dark by heavy pressure and the application of water.

Nondescript Tobacco.—This name applied to tobacco indicates that it cannot be classified. It has the merit of cheapness, and in times of scarcity of some well-defined type, a nondescript variety, resembling it, is often substituted. The lowest and commonest grades of lugs, especially if air cured, like the trash of the White Burley, are often used in the United States for making the cheapest grades of pipe-smoking tobacco. Sometimes stems are mixed with them to increase the bulk and reduce the cost. The lowest qualities of lugs and nondescript are also sometimes used for making sheep wash.

Stems, or midribs, are exported in considerable quantities to Germany and Sweden, and are used in the manufacture of cheap grades of snuff and chewing tobacco. They are also extensively used in the United States for the protection of fruit trees from the borer and other insect enemies. Stems for exportation are prized in a very dry condition, so as to save duty. Sweden uses about 2000 hogsheads of stems annually. The net weight of a hogshead averages from 1800 pounds to 2000 pounds.

CLASS III.

CIGAR AND SMOKING TOBACCO.

Havana Seed or Seedleaf.—Both varieties are assorted by the cigar manufacturer in practically the same manner. Seedleaf is used mostly as a binder. Comparatively little can be used for wrappers, as the leaf is too rough, and its growth is not fine enough. Some manufacturers, however, still cling to seedleaf wrappers, and choice crops of this variety command a premium. The leaf from all varieties of cigar tobacco is assorted for manufacturers' use into grades of leaf called wrappers, binders and fillers. These three grades are each again subdivided into long and short grades, or into A and B grades, and sometimes even into C and D. Short wrappers are not infrequently known as "lights." On the growing tobacco plant, the top and bottom leaves are of about the same size, the extremes of each being worthless. On the other hand, the cream of the plant is found in the leaves at the center of the plant. Between the center leaves, or wrappers, and the end, or small, leaves, are the binders, while the end leaves, those from the bud to the upper binders, and from the taproot to the lower binder leaves, are the fillers.

The innermost tobacco in the cigar is the filler, the next leaf used is the binder, to keep the filler in the form or shape of a cigar, and the finishing or outside leaf is the wrapper.

In buying cigar leaf, the manufacturer looks for the right burn, taste, texture, color, "feeling," general appearance and "strength." The views of different manufacturers on each of these points may vary widely. No hard and fast rule can be laid down as to precisely the degree of each of these qualities that the majority of cigar manufacturers require. Moreover, the style, or fashion, in cigars frequently changes, while the whims, or demands of smokers are almost as varied as the number of these individuals. Formerly, dark, coarse and strong-flavored cigars were the favorite, but now the general preference is for light colors and sweeter flavors. Still, many smokers want dark cigars of strong flavor. No one can tell when the fashion will change.

The old style of assorting cigars, as to color, was to make them up without assortment of the wrapper leaf before wrapping. After the cigars were made, they were assorted to six colors. With improvement in all lines of manufacturing, a finer ranging of colors was believed possible, so that in recent years, manufacturers open each hand of wrapper tobacco and assort it to the six colors. These are called,

Claro, very light brown.
Colorado Claro, light brown.
Colorado, brown.
Colorado Maduro, dark brown.
Maduro, dark.
Oscuro, black.

Of the latter, but little, if any, has been used for years.

The cigars are wrapped with the above shadings, and each lot is kept by itself. As a leaf varies in color at opposite ends, a second assortment, this time of the cigars, is made. This is essential, as the tip of a leaf may be of a Colorado color, while the stalk end may be a Maduro. As finally placed in the box, the colors are so arranged by shadings that only an expert will notice any difference of shades in the same box among the finer grades of cigars.

Large manufacturers nearly always manipulate leaf, more or less, after its purchase, for their particular needs. They will take a crop and sweat it over again during a season, and by regulating the heat and temperature, the leaf will come out two or three shades darker. This can be done by the experienced shop foreman, nearly to a certainty, every time. On the other hand, no process has, as yet, been devised for changing a leaf to a lighter color; to the man discovering such a process awaits an immense fortune.

As used in the cigar, binders may be a shade lighter than the wrapper, but binders are never put through the six-color assortment, as are wrappers. Binders are assorted into grades of sweetness and strength.

The filler has much the same assortment; it is the filler that makes the cigar; that is, produces the taste,

PLATE XIV. YELLOW TOBACCO (Lacks or Wand variety).

Grown in Halifax county, Virginia. Hight, 26 inches; top leaves, 10x23 inches; middle leaves, 13x27 inches; bottom leaves, 13x24 inches.

sweetness and strength. For that reason, filler leaf is selected for a character in itself, as sweetness, strength and perhaps catchy taste. A filler leaf may be most desirable, but wrapped with an undesirable wrapper or binder, its desirable quality may be detracted from and its chief value rendered worthless. On the other hand, the filler leaf may be "flat," and the wrapper or binder, or both, may give to the cigar nearly its entire value.

The gum in cigar leaf is what produces much of its value in smoking. The taste, strength, texture, etc., are all more or less dependent on the amount of gum present. Sometimes a crop has too much gum; this was especially true of the '93 and '94 crops of all sections of the country. The leaf raised in the section around East Hartford, Ct., should be kept two years for proper curing, as it contains an unusually large per cent of gum.

To make cigars of the great variety of requirements called for by the trade, involves much skill and experience in selecting and putting together the grades of leaf necessary to accomplish any desired result. The judgment, or ability, to do this commands a high premium in American cigar factories. It can only be learned by close observation and wide experience. It cannot be described in a book. To still further complicate the matter, crops from the same region may vary greatly in quality from year to year. It is customary to refer to the Connecticut seedleaf crop grown in 1871 as the type of absolute perfection, while the Havana seed crop of 1892 was in many sections of remarkable quality when it came out of the sweat. The curing, and the subsequent fermentation, of the leaf, also profoundly affect its quality. The best the grower can do is to follow the matter closely from year to year, and strive for those qualities in his leaf which are in most demand—and he must follow the demand closely to see just what it is.

The Pipe-Smoking Tobacco now most highly prized, and in greatest demand, is made mainly from the bright lugs of the yellow-tobacco districts. These lugs are of three sub-grades, viz: Common or sand lugs; medium or smooth lugs, and bright or wrapping lugs.

A mixture of heavier lugs, or dark, low leaf, is made when greater strength is required in the tobacco. White Burley lugs, which are usually fine and bright, are much used for making granulated pipe-smoking tobacco. These lugs are usually of sweet flavor, thin in leaf, light or yellowish-brown in color, inclined to be trashy and chaffy, and, when mixed with the Carolina and Virginia bright lugs, make the very highest grade of smoking tobacco for pipes. It is sweet to the taste, mild in the effects, and exceedingly popular with persons of sedentary habits. A strong pipe-smoking tobacco is preferred by persons who live an active, outdoor life. Some of the Burley lugs, especially those that are bright in color and thin of leaf, are granulated, and form good stock for the manufacture of cigarettes.

Perique tobacco, grown exclusively in Louisiana by the descendants of the Arcadians, is peculiar in the methods used in its curing and its preparation for market. It emits a highly spirituous odor, much liked by some smokers. While but few pipe smokers prefer the Perique in its unadulterated state, a suitable mixture of it with other tobacco makes a popular brand for pipe smoking. The total amount of Perique grown now reaches 175,000 pounds per annum, according to the authority of S. Hershein & Co., who handle the entire product. This is said to be twice as much as there is any demand for. The production has extended and largely increased during the past few years. Common lugs from the various tobacco districts constitute the lower grades of many types. These lugs are trashy, earth-burned, deficient in body and weight of leaf, of every color known to the cured-tobacco plant, and milder than the better grades of the types from which they are taken.

By a proper admixture of colors and strength of leaf, many brands of pipe-smoking tobacco are made from such lugs, as bright, dark, brown, red, spangled, yellow, mild, medium and strong. Some air-cured lugs are granulated for cigarettes, the stock being furnished from the light, thin products of Kentucky, Tennessee, Indiana, Illinois, Missouri, eastern Ohio and Maryland. The lugs selected for this purpose are light in weight and color.

Some heavy-bodied lugs are used for snuff; some lighter grades for cigar fillers, and still lighter for the pipe—either cut or granulated.

Stogy wrappers and fillers, used for making a coarse, common, domestic cigar, is a western-grown leaf, of full length and breadth, and of light body and fine fiber. Uniformly dark colors are selected. To a very small extent, a red or cinnamon color is required. The tobacco for this purpose must be air cured and entirely free from any flavor inparted by fire or smoke. It is necessary, before being used, that it shall be somewhat soured by sweat or fermentation. The manufacture of this class of cigars is carried on in Louisville, Ky., Cincinnati, Ohio, Pittsburg, Pa., and in Wheeling, W. Va. The difference between the wrappers and fillers is in grade only. What are called "self-workers" consist of packages in which both fillers and wrappers are put up in proper proportions.

A plug tobacco, wrapped with fine-fibered Clarksville tobacco, of good breadth of leaf and of a port wine color, is put up in the United States for making cigars, and nearly all is exported. These wrappers impart a rank flavor to the cigars. They are also produced in some parts of Virginia. A few of them only are used in the manufacture of stogy cigars.

The Indiana Kite-Foot, a variety having a broad, short leaf, grown in Owen and Clark counties, in Indiana, is used for making common cigars. This tobacco is cured with fire, and the color is generally brown, sprinkled with yellow spots.

Little Dutch is a small variety, with thin leaf, sweet, dark brown in color, with a glossy surface, and it is grown in the Miami Valley of Ohio. It makes a very pleasant pipe-smoking tobacco. It is easily injured by the process of fermentation and for that reason is not popular with manufacturers of tobacco or cigars. It loses twenty per cent of its weight by sweating, and has less nicotine than any other tobacco grown, having only 0.63 of one per cent.

CHAPTER V.

SCIENCE IN ITS APPLICATION TO TOBACCO.

Few plants are so susceptible to soil, feeding and culture, as tobacco. Certainly no other crop requires more scientific knowledge to grow it to perfection. Men who have raised it for years, who have closely studied their own and others' experiments, agree with the authors that the scientific aspect of tobacco culture is just beginning to be understood. The curing of the leaf, and its subsequent fermentation, are also only just beginning to be understood. All these matters open up most fascinating fields in chemistry, physics and bacteriology, upon which we have space to but briefly touch.

AS TO THE COMPOSITION OF TOBACCO.

Constituents of Tobacco Leaf.—Nicotine is the active principle of tobacco upon which its peculiar value depends. To it the narcotic and intoxicating qualities of the leaf are mainly due. It is an oily substance that quickly evaporates, and has a strong, pungent and peculiar odor. Nicotine is present in the plant from the time it commences to grow in the seed bed, until it has reached maturity and gone through all the fermentative changes incident to curing, sweating and manufacture. The flavor and characteristic odor of tobacco are supposed to be due to a volatile substance called nicotianine. For practical purposes it may be considered with nicotine, or as a part of it.

The percentage of nicotine varies in the different parts of the plant, and this variation increases as the plant reaches maturity, but every part contains some trace of this alkaloid. The percentage of nicotine is greater just as the leaf reaches maturity, than in either the green or overripe leaves. Apparently the formation and accumulation of nicotine in the leaf continue as long as there is growth. The effect of nicotine, after plant growth ceases, is not understood, nor is the office of nicotine in the economy of the plant definitely stated. The amount of nicotine in the whole leaf (exclusive of the stem or midribs), of American-grown tobacco, ranges from less than one per cent to nearly six per cent of the chemically dry substance.

"This variation in the percentage of nicotine," says Carpenter, "is due, in some measure, to different varieties, but whatever variety is grown, or what other conditions prevail, it is almost always noticed that those influences which tend to produce a coarse, rank growth, containing a large percentage of albuminoids, also produce a comparatively large amount of nicotine. The climate, nature of soil and fertilizers, treatment of crop, etc., all have their influence. Of all these conditions, that of soil and fertilizers seems to be the most important. A rich, heavy soil, fertilized with a strong nitrogenous manure, is apparently favorable to the production of a high percentage of nicotine, while the reverse is true of a light, sandy soil containing little organic matter. Havana-grown tobacco, which contains a low percentage, has, in addition to soil, the benefit of a very moist atmosphere.

"For this reason, some have attributed the reverse conditions as favorable to the production of nicotine. From the results of the investigation of tobaccos grown in the United States, we can find no ground for this assertion. Tobacco of the seedleaf variety grown in Connecticut, on a rich loam, gave over four per cent of nicotine, while that grown on a sandy loam soil contained only about one per cent. There we have different conditions of soil in the same climate; and other instances of a similar character might be cited.

"As nicotine is the active principle of tobacco, upon which the stimulating effect largely depends, it would naturally appear that its development to a high degree would be desirable, but such is not the case. What are considered the best qualities almost always contain a small percentage, while a large percentage usually indicates coarseness. While, as stated, certain conditions are conducive to the development of nicotine, it is undoubtedly true that the subsequent treatment has some influence on the amount present in the finished product. The different fermentative processes required to develop proper flavor and color necessarily decompose, to a greater or less extent, the different compounds present in the leaf. It may be true, therefore, that in some cases the nicotine content may be appreciably less in the fermented product than was present in the green plant. For this reason, the analyses of the different varieties which have been subjected to different processes of curing and fermenting, cannot safely be relied upon as giving the exact amount developed by certain conditions in the field, but the results, in a general way, confirm what has been previously noted."

Davidson finds that changes in the amount of nicotine in leaf at the time of topping, curing, and after being properly cured, are very slight, but in the cured state it seems to be much greater. He questions this latter point.

Other Substances in Tobacco.—Tobacco, like other plants, contains small proportions of starch, sugar and woody fiber, or cellulose, the amount and nature of which governs, to some extent, the burn of tobacco. These elements, together with the fatty and resinous substances present, also have much influence on the flavor of the leaf. The nitrogen-containing substances or albuminoids, also form an important constituent, the effect of which is but little understood, and the same is true of the acids in tobacco—nitric, citric, acetic and pectic. There are other organic or carbonaceous substances, of which still less is known.

Ash or Mineral Ingredients make up a large part of the tobacco plant. The ash constitutes from 15 to 25 per cent of the chemically dry leaf, 5 to 15 per cent of the stalk, and from 5 to 15 per cent of the root. The quantity and character of the mineral ingredients have a profound influence on the quality of leaf, especially for smoking. These mineral ingredients vary widely in different varieties, and also in the same variety under different conditions (see Table IV, Pages 112 and 113). Potash and lime each constitute about one-third of the ash, the other third being composed of phosphoric acid, magnesia, soda, sulphuric acid, carbonic acid, chlorine, silica (sand), alumina (clay) and iron (ferric oxide).

Effect of Constituents.—The principal ingredients that are supposed to most affect quality are, nicotine, nitrogen, potash, lime, magnesia and chlorine. The quantity of nicotine in the leaf is governed, to some extent, by the amount and character of the nitrogenous substances the plant feeds upon. The other elements also vary in amount with variety, soil, climate and fertilizer. One cannot speak positively of their effect upon the curing or chewing quality of the leaf.

Why certain crops of leaves of tobacco burn well and others burn badly, is not fully understood. Nessler demonstrated that tobacco which contains large quantities of chlorides does not burn well, especially when the quantity of potash present is small. Nessler found, from examination of forty-six samples of tobacco grown in different parts of Baden, on soils of diverse character, that the more potash and the less chlorine a leaf contains, the longer it will continue to glow when lighted. The higher the per cent of potash, the more chlorine may be present without seriously affecting the burn of the leaf. A Sumatra leaf with 0.64 to 0.78 per cent of chlorine and 5 per cent of potash, burned very well, while a Baden tobacco with 0.4 per cent chlorine and only 3 per cent of potash burned badly. On the other hand, the less chlorine there is in the leaf, the less potash is necessary to secure a good burning quality. He concludes that no tobacco burns well which has less than 2.5 per cent potash, if there is with it more than 0.4 per cent chlorine.

Schloesing made some experiments on poor, sandy soil that was somewhat calcareous, and yet clayey enough to be rather tenacious. The soil contained very little chlorine, sulphuric acid or potash. Plots to which no potash was applied gave bad-burning tobacco; those fertilized with chlorides gave tobacco which contained about four times as much chlorine as the others, showing that chlorine is readily assimilated by the plant; and the tobacco containing this large proportion of chlorine burned badly.

Both Schloesing and Nessler, from independent experiments and investigations, agree that the burning quality of tobacco is governed by the presence of the soluble carbonate of potash, and that when the potash is combined with chlorine, the combustibility is poor. This is not fully confirmed by the Poquonock experiments, which seem to indicate that a small amount of chlorine is not objectionable, while it is essential to normal plant growth. But an excess of chlorine is unfavorable to a good burn. This is true both before and after fermentation. Plots K and L received much more chlorine than the others, it being supplied in the double manure salt; the leaf from these plots had less capacity to hold fire than most of the others.

Other investigations in this country also do not sustain the idea that the burning quality is entirely controlled by the composition of the ash, and it is now believed that combustibility is the result of several conditions, of which the ash is but one. These conditions are, the abundance of organic potash salts (i. e., those yielding carbonate of potash), the abundance but not excessive quantity of woody tissue, and the abundance of sulphates. Mineral salts which fuse at the burning temperature, such as the chlorides and phosphates of potash and soda, hinder free burning; and sugar, gum and albuminous matters are difficult of combustion, and therefore impede burning.

Composition at Different Stages of Growth also varies widely in both organic and mineral substances. Original analyses of three Virginia tobaccos, set forth in the Appendix, show that at time of cutting, the leaf contains about twice as much ash as the stalk, and the same quantity of nitrogen, more lime, and twice as much insoluble matter; but the stalk contains over twice as much phosphoric acid as the leaf, one-third more potash and four times the chlorine. The composition of the leaf alone undergoes but little change from time of topping until cured. The stalk, when cured, has gained slightly in nitrogen and phosphoric acid, much in lime, but has lost nearly one-fourth of its potash.

How to Supply the Principal Ingredients is the vital problem, in growing fine tobaccos. But a sharp distinction must be drawn between what the tobacco plant contains, and how large a supply of the elements of the plant food are essential for a successful crop. Chemical analyses are valuable in determining absolutely the percentage of the food elements contained in the plant, and they give an excellent basis for intelligently framing a manurial supply, but afford little indication of the quantity required. Under the old English system of farming, the great desideratum was to make a soil rich in plant food, that could be called upon to grow any crop suitable to the climate; of late years, in this country, the tendency has been to fertilize especially for the crop under cultivation. One system is fertilizing the land, the other is fertilizing the crop. With tobacco, and in fact with all market garden crops, fertilizing the soil is the method to be followed, except that for tobacco an excess of phosphoric acid is unnecessary, and also that special care must be taken to exclude all compounds of chlorine.

This system of stocking the land with an excess of manurial matter is the more essential for tobacco, because lands are very differently affected by the fertilizing elements. Some lands have a great power of fixing and retaining potash in an almost insoluble form; others have a strong affinity for lime; and much difference is noticed in the ease with which the nitrogen supply is developed for the use of the growing crop. The only safe rule is to give a superabundance of all forms of plant food that are required. More care is necessary in the selection of manurial supply for tobacco than for any other crop, because it is a remarkably delicate plant, and the texture and burning qualities of the leaf are largely influenced by the materials upon which it feeds.

Another reason why tobacco and many other quick-growing crops require much larger stores of plant food in the soil than is found in the chemical analyses of the product, is because the roots of the crop cannot occupy every portion of the soil, especially in the early stages of growth. The demand made on the soil, or on fertilizers, by the tobacco crop, is greater than that made by any other crops which receive as much of nearly every kind of plant food. Hay is almost as exhaustive as tobacco, measured in total extract from the soil, but grass grows the whole year throughout, save when the ground is frozen or covered with snow, or for more than eight months. It is true, the period of active growth required to mature a hay crop begins in spring, and is finished in three months; but during the year previous, for at least five months, the grass roots are storing up food in their root stocks, or bulbs, for the more rapid aftergrowth. Tobacco, on the other hand, cannot be set out in the field before summer is begun, and it should be in the shed in about three months. Thus, its growth must be a very rapid one, and the supplies of food in the soil must be very abundant, so that the rapidly extending roots may be met at every point with their necessary pabulum. An acre of first-rate grass land yields, as the result of eight months' growth, two to three tons of crop, while the tobacco land must yield that weight in three months.

The real disparity, however, is much greater. The principal growth of tobacco is accomplished in the hottest summer weather and in a period of some forty or sixty days. Very heavy fertilizing is, therefore, necessary, to provide for its nourishment, and the more so because the best tobacco lands are light in texture and may suffer from loss by drainage, evaporation or decomposition, to say nothing of drouth.

TOBACCO DOES NOT EXHAUST THE SOIL.

One of the most important truths established by the application of science to tobacco, is the annihilation of the old idea that this crop exhausts the soil to an extraordinary degree. It is true that tobacco requires plenty of food in the soil, as we have just pointed out. But if this is obtained by growing the crop on virgin soil, and by not returning to the land what the crop takes from it, then tobacco does exhaust the soil; so will any staple crop under the same treatment. This was the method long followed, especially in the South, to clear up new land, as old fields became barren from constant cropping without manures or fertilizers. Cocke declared against tobacco years ago, because "its culture had exhausted whole counties in Virginia, from the Atlantic to the head of tide waters," but the same exhaustion is found in sections where tobacco was never grown.

In both instances, soil poverty was due to soil depletion—constant taking away of crops and not putting back what they removed from the soil. Low in prices as lands were, it was found much easier and cheaper to occupy fresh soils than reclaim exhausted ones. Complaint is now made in the White Burley districts of Kentucky and Ohio, that the soil is becoming rapidly exhausted under tobacco culture, even where manuring is practiced. This is easily accounted for. The surface of the country is rolling, or extremely broken, and when planted in a crop that requires clean cultivation, vast quantities of the surface soil are swept into the valleys with every rain that falls, gullies form rapidly, and the earth becomes scarified with gaping, ugly wounds, down which flows the very lifeblood of the soil. The remedy for this waste is rotation with grasses, clover, alfalfa and grain crops, to bind the soil.

The truth is, no crop is exhaustive if it is properly fertilized; all that is required is to supply an abundance of every element that the plant needs, and of the right quality and condition; for if this is not done, the latent resources of the soil are drawn upon to supply the deficiency, and the soil is impoverished just so far as it is drained of any element essential to plant growth. Furthermore, the subject of the exhaustion of the soil by tobacco should be considered from two standpoints: First, what is actually removed from the soil by the sale of the crop; second, what is required in the soil to produce the crop. And a casual view of the subject would fail to find an intimate connection between the two, as is explained below.

What Tobacco Takes From the Soil.—This has been very carefully determined by Johnson for Connecticut-grown seedleaf, and by Davidson for Virginia-grown tobaccos, as appears in the subjoined table. The seedleaf crop mentioned was grown from 8000 plants on one acre, yielding an average of 1875 pounds of pole-cured leaves (or 1400 pounds of water-free leaf), and 3200 pounds of pole-cured stalks (or about 1300 pounds of water-free stalks). Davidson's average of analyses of Bradley broadleaf, Goldfinder, White Burley and Yellow Orinoco, shows a fair crop of Virginia tobaccos to be 1000 pounds per acre of barn-cured leaf (or 928 pounds of water-free leaf), and 353 pounds of cured stalks (or 334 pounds of water-free stalks):

Table I.—POUNDS OF PLANT FOOD REMOVED FROM THE SOIL BY THE TOBACCO CROP GROWN ON ONE ACRE.

	Connecticut Seedleaf.			Virginia Tobacco.		
	1875 lbs. cured leaf.	3200 lbs. of stalks.	Total.	1000 lbs. leaf.	353 lbs. stalks.	Total.
Nitrogen,	65	32	97	44	12	56
Phosphoric acid,	8	8	16	5	2	7
Potash,	89	49	138	52	17	69
Soda,	4	3	7			
Lime,	81	13	94	49	8	57
Magnesia,	25	5	30	19	3	22
Sulphuric acid,	16	5	21			
Chlorine,	5	6	11			
Total,	293	121	414			

The Connecticut crop of 1875 pounds of cured leaf takes relatively large quantities of nitrogen (100 pounds), potash (140 pounds) and lime (100 pounds), and very little phosphoric acid (16 pounds). The Virginia leaf also draws heavily on these elements, and a crop of Virginia tobacco yielding the same weight (1875 pounds of leaf) contains, of nitrogen 98 pounds, potash 120 pounds, lime 99 pounds, and phosphoric acid 13 pounds, in the leaf and stalk.

It also appears that the stalks in such an acre of Connecticut tobacco weigh, at the time of cutting, about 9500 pounds, of which about 8300 pounds is water. Two-thirds of this is evaporated in curing, and the rest is carried back to the field in the cured stalks. The later the crop is cut, the more nitrogen and mineral elements it contains; stalks cut on August 22 contained 26 pounds of nitrogen per acre, which increased to 42 pounds when not cut until September 7. Like gains occur in Virginia and other types of tobacco. No determination is at hand of the amount of plant food in the roots of such a Connecticut crop as that above named, but the Virginia crop of 1000 pounds leaf per acre contains in its roots, of nitrogen eight pounds, potash seven and one-half pounds, lime five and one-half pounds, phosphoric acid and magnesia, one pound each. Whatever plant food the roots contain, of course, remains in the soil, and it is not necessary to consider it after the first season, but on new land, sufficient plant food must be present to develop the roots freely, in addition to the other parts of the plant. In any rational system of tobacco culture, the stalks are always returned to the soil as fertilizer; hence the only fertility really lost is that sold in the leaf.

But since the entire plant must be fed, the necessity of large quantities of plant food is at once apparent, for everything essential to the perfect development of every part of the plant must be present in the soil in a thoroughly available condition. The demands of tobacco can be better appreciated by comparing it with other leading field crops. And since cigar leaf is grown under the highest state of cultivation and with a lavish supply of fertility, it is only fair to use for comparison other crops grown under similar favorable conditions. Prof. Johnson used for comparative purpose a crop of rye yielding 32 bushels of grain and 3800 pounds of straw, corn yielding 75 bushels of grain and 8000 pounds of stalks and leaves, 2¾ tons of hay, and 300 bushels of potatoes. Davidson compared the yield of 1000 pounds of Virginia leaf per acre (and 353 pounds of stalks) with 30 bushels of corn and stover, or oats, 30 bushels and straw:

Table II.—PLANT FOOD REMOVED FROM AN ACRE OF LAND BY TOBACCO AND OTHER CROPS.

Connecticut Seedleaf.	Phos acid	Pot ash	Lime	Mag nesia	Total ash	Nitro gen
Tobacco, 1875 lbs, leaf and stalks,	16	138	94	30	424	97
Potatoes, 300 bu.,	32	101	4	7	170	58
Hay, 2¾ tons,	23	96	43	19	373	73
Corn, 75 bu., and stalks,	53	147	42	28	430	105
Rye, 32 bu., and straw,	22	39	13	9	186	41
Virginia Leaf.						
Tobacco, 1000 lbs, leaf and stalks,	8	78	64	12	184	59
Corn, 30 bu., and stalks,	15	46	12	13	121	45
Oats, 30 bu., and straw,	9	36	5	5	72	27
Wheat, 30 bu., and straw,	23	28	10	8	95	45

Under a rational system of husbandry, cornstalks, oat straw, wheat straw and hay are fed to stock, and their ingredients return to the soil in manure, just as tobacco stalks return to the land. Hence, we should only compare plant food removed in the grain alone with that taken off in the tobacco leaf alone. Rye straw, however, is usually sold, also potatoes, so that the total quantity these crops take from the soil may be compared with the plant food in tobacco leaf.

Table III.—POUNDS OF PLANT FOOD TAKEN FROM THE SOIL BY AVERAGE YIELDS PER ACRE OF SO MUCH OF TOBACCO AND OTHER CROPS AS IS NOT RETURNED TO THE LAND.

Connecticut Leaf.	Nitrogen.	Potash.	Phosphoric acid.
Tobacco, 1875 pounds,	65	89	8
Corn, 75 bu. grain,	74	16	30
Rye, 32 bu.,	31	10	15
Potatoes, 300 bu.,	58	101	32
Virginia Leaf.			
Tobacco, 1000 pounds,	44	52	5
Wheat, 30 bu.,	43	11	16
Oats, 30 bu.,	20	6	8

It appears that the full yield of Connecticut tobacco takes from the soil less nitrogen than a good crop of corn grown under similar conditions, but little more than potatoes, but twice as much as rye. Of potash, tobacco takes even less than potatoes, but several times as much as corn or rye. Of phosphoric acid the other crops take two or three times as much as tobacco. In Virginia leaf, the same relative proportions hold, though the quantities differ, the average crop of tobacco taking about the same quantity of nitrogen, nearly five times as much potash, but only one-third as much phosphoric acid as a wheat crop of thirty bushels per acre.

SOME RELATIONS OF BACTERIA TO TOBACCO CURING AND MANUFACTURE.

BY WILLIAM FREAR.

There are several distinct classes of organisms to whose activity the various fermentations are traced. First among these may be named the **molds**, distinguished by the formation of a closely interwoven network of white, thread-like cells, or *hyphæ;* from this network, or *mycelium,* spring little stalks, swelling or branching into larger heads; these heads, in turn, bear the colored *spores,* or reproductive elements, appearing as a fine dust upon the upper surface of the grayish-green or black molds to which jellies, cheese and bread kept in damp places are subject. Molds also multiply by the branching out of new hyphæ, affording the root from which new stalks may spring.

Another class of organized ferments is that to which **yeast** belongs. The organism is much simpler in these cases than in the molds. It is composed of only a single cell, or papery sac, filled with jelly-like protoplasm. This protoplasm carries on, however, most of the functions of more highly organized beings. Yeasts reproduce by budding,—the sprouting from the side of the parent cell of a little, bubble-like offshoot; this, when sufficiently developed, detaches from the parent and assumes an independent existence.

Most important of all is that class of ferments known in general as **bacteria**. There are many species of these, differing in shape, mode of aggregation, conditions of life and products. If a liquid containing bacteria be examined, it will often be found swarming with these little organisms, ranging from $\frac{1}{300}$ to less than $\frac{1}{20000}$ of an inch in size, according to the species. The little beings are not quiet, but are vigorously active.

Reproduction of the various species is accomplished in two ways: First, by *fission*, or the splitting in half of the single-celled parent; the small halves then separate and grow to full size. Second, many species develop within the body of the parent a number of thick-walled bodies, or spores, which are later discharged, and which, under favoring conditions, develop into the normal, mature bacterium.

Most important features of these organisms are their wide distribution and their wonderfully rapid multiplication. Though requiring a certain amount of moisture for their active life, they are not destroyed by slow drying at a low temperature. In consequence, they are carried as dust by every passing wind, to new lodging places, where they develop if the conditions are favorable. As, under most favorable conditions, the individuals of some species can reproduce in twenty minutes after their own birth, it is a simple arithmetical process to show that a very short time would suffice for them to occupy the globe. Such favorable conditions never occur; but the multiplication often observed is, nevertheless, tremendous; and the fermentative changes produced are correspondingly great.

The conditions surrounding them greatly influence their activity and multiplication. Some require free access to air, and are called *aerobies*, in consequence; others, when cut off from the air, are able to obtain from oxygen-containing compounds all of this element they require for respiration; such are called *anaerobies*. Usually, bacteria require a slightly alkaline medium for their development; only a few can survive in an acid liquid; whereas, molds require the latter medium for their best growth. When, therefore, the lactic ferment, which sours milk, and the nitrifying ferment, which forms nitric acid in the soil, have produced an excess of acid, they cease to act until the excess is neutralized, when they renew their production of acid. Vinegar, therefore, serves as a preventive of bacterial fermentation in food preparations. Other substances, conspicuously carbolic acid, copper and mercury salts, similarly prevent the action of bacteria, and destroy them.

While diffuse light is not fatal, direct sunshine is the most destructive natural foe of these ferments. They require for their best action certain temperatures, varying for different species. In general, 100° F. is most favorable; below 50° and above 150° F. few are active, and many are destroyed. The process of pasteurizing milk by heating to 150° for thirty minutes is based upon this fact. Some bacteria, and especially spores, which are more resistant, owing to their thick walls, are not killed by dry temperatures as low as 315° F., or above 212°, the boiling point of water; very few, however, withstand the latter temperature if they be moist; consequently, boiling the liquid containing them, or steaming them, are among the most commonly employed methods of sterilization of liquids or solids—that is, the destruction of the bacteria the latter contain.

Bacteria differ, not only in these respects, but in the color, form and consistency of the colonies they make in various liquid and solid media.

The most sharply distinctive characteristic, however, and that most frequently useful for their determination, is that the products they form are distinctly different. Some liberate gas, and the gases from various species differ in composition. In other cases, substances of pronounced odor or flavor are developed, as in the putrefactive fermentations, and in those of ripening cheese and ripening cream. The disease germs accomplish their fatal results, it is now believed, more frequently through the poisons they form in the blood—poisons similar, chemically, to the active principles of snake venom—than through any direct action of their own.

Ordinarily, the conditions favorable to the development of one species of bacterium are also such as permit the development of other species. Hence, under natural conditions, a single species rarely occurs alone. By selection of the most congenial nutritive medium for a given species of which it is desired to secure a pure culture,—that is, a colony in which no foreign species exists,—and by regulation of temperature so that that most favorable to the species in question may be maintained, it is possible to gradually eliminate undesirable species from a series of cultures, and secure a culture in which only the species desired remains. The process is much hastened, first, by using a sterilized culture medium and sterilized apparatus; second, by preventing access of foreign germs from the air—this is accomplished by filtering the air to which the solution is exposed, through cotton-wool, or some similar substance, which removes all floating dust from the air, including the dried germs; third, by diluting the primary material from which the germs are taken, and using a very small quantity of the diluted substance to act as a starter for the new solutions; often, this process introduces into some of the cultures very few, if any, foreign species, so that these cultures may be made the basis of further operations, and others, less pure, be rejected at once.

Not only does this great world of organisms, hovering unseen about us, bristle with enemies to man and his friends, the domestic plants and animals, but among these enemies are numerous active, friendly species, contributing much to our wealth and comfort. Thus, vinegar, one of our most important condiments, is made only through the agency of the acetic ferment; alcohol, a source of fearful injury from its misuse, yet invaluable in science and the arts, is made by the action of the yeasts; clover, the hope of the despairing farmer, owes its soil-enriching power to a humble parasitic bacterium which seizes its roots for a home; and the finer flavors of the most aromatic butter are traced to the products of the action of particular species of bacteria in the ripening cream.

OFFICE OF BACTERIA IN CURING TOBACCO.

Turning now to the consideration of the influence of bacteria in tobacco culture, we omit all reference to the fungous diseases to which the growing plant is subject, and confine attention to the relations of these organisms to the processes of curing and sweating. As the result of these processes, instead of the green color, rough, hard surface, brittle web, black ash, dark, tarry, ill-smelling smoke and bitter, burning flavor possessed by a quickly dried tobacco leaf, the leaves have a beautiful brown color, silky texture, elastic web, light blue and pleasantly aromatic smoke, a white or gray ash, and little of the unpleasant flavor of the green leaf.

A very large fraction of these changes in quality is wrought during the first of these processes, the curing. Despite the fact that the Germans term it *das Trocknen,* or *drying,* it is neither a simple physical process, nor a purely chemical one. The results of late studies by Müller-Thurgau * and Dr. J. Behrens, † show that dur-

* Landwirthschaftliches Jahrbuch, **14**, 485-512.
† Landwirthschaftliche Versuchs-Stationen, **43**, 280-293.

ing the process there is a large decrease in the dry matter of the leaf, as well as in the water. The starch is turned to glucose, and the latter passes back into the veins, midrib and stem, and is finally destroyed there and breathed off as carbonic acid gas and water, owing to an abnormally increased respiration. There is no loss of nitrogen, either in the form of nicotine, nitric acid or albuminoids; the latter compounds are, however, largely split up with the resultant formations of asparagine and other amides,—a change similar to that which occurs whenever leaves are for a long time shaded, or to that observed in the process of ensilage. Mere drying, and the slow oxidation caused by the direct action of the oxygen of the air, do not suffice to explain these changes. They are the result of life action.

It is not probable, though, that the lower organisms are important in the normal curing process. Behrens remarks,* "micro-organisms were not found in an active condition upon the curing leaves, and their development upon the surface of the leaves, the sole point open to their attack, is rendered well-nigh impossible, owing to its dryness, to say nothing of the general dry condition of the inner tissues."

The changes occur only while the protoplasm of the leaf cells retains life. If the leaf be frozen, or chloroformed, the protoplasm is killed, and no normal curing can be effected thereafter. Evidently, the changes observed during the curing are due to an abnormal action of the dying protoplasm of the leaves themselves; and bacterial aid offers no advantages.

During this process, however, the lower organisms sometimes act injuriously. "Pole-burn" is prevalent during warm, damp, foggy weather; in a few hours, the whole crop may be turned to a dark brown, wet,

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*Loc. cit., p. 285.

soggy and easily torn lot of leaves, hopelessly damaged. Dr. Wm. C. Sturgis,* in describing this disease, says: "It is characterized by the appearance on the surface of the leaf, of small blackened areas, giving the leaf the aspect of having been sprinkled with some corrosive liquid. . . . These areas increase in size, become confluent, and sometimes within thirty-six hours, or at most, forty-eight, not only is the whole leaf affected, but the entire contents of the curing barn may be rendered quite worthless as tobacco. Microscopic study revealed in the center of each blackened spot a minute, elevated pustule. Sections through the center of one of these pustules showed that the tissue of the leaf was largely disintegrated, and the cells themselves were largely filled with bacteria. . . . They develop rapidly in the tissues of the leaf, raising the epidermis, and finally breaking through at one or more points in the blackened area, . . . they spread out in a thin, slimy film, . . . forming a brown, translucent crust of cheesy consistency, and composed entirely of the bacteria themselves."

In tracing the development of the disease, this author states that, at first, the surface of the leaf is attacked by a fungus of the genus *Cladosporium*, related to the leaf-spot disease of the tomato. This does little direct injury, but after some time the leaf is attacked by the bacteria, which swarm into the interior through the breaches made by the *Cladosporium*, the remains of which are found mingled with the bacteria. Of the latter, there are, at least, two species, one a true *Bacterium*, the other a *Micrococcus*, of the variety *Streptococcus*.

These bacteria develop best between 70° and 90° F., but a temperature above 90° to 110°, or below 35° to 40°, checks their development. Furthermore, all attempts to inoculate the cured tobacco with them failed; the

*Report of the Connecticut Ag. Exp. Sta., 1891, pp. 168-186.

crop is in little danger after a period varying from ten to twenty days after the beginning of curing. The remedy suggested is free ventilation and control of temperature by aid of artificial heat.

Behrens,* in a similar study, found instead of a *Cladosporium*, *Botrytis cinerea* P., a spore-bearing fungus, and *Sclerotinia Libertiana*, Fckl., acting as the forerunners of decay, while others † have noted *Pleospora* sp., *Botrytis vulgaris*, Fr., and two species of the genus *Mucor* as thus active.

Another disease to which curing tobacco is also subject, is "stem rot," or white vein. This often attacks the stalk a few days after cutting, but sometimes appears, late in the curing, upon imperfectly dried ribs and veins. These parts of the leaf are covered with patches of a long-piled, velvety mold of pure white color. Later, the web of the leaf is often invaded. These white patches are the mycelium of a species belonging to the genus *Botrytis;* the threads of the mycelium, first attacking the surface, later penetrate deeply into the underlying tissues. From the mycelial threads spring erect fibers, one-fourth of an inch high, giving the velvety appearance. These erect stems bear branches, extending at right angles, and at the tips of these branches are formed the reproducing spores. This advanced state of development is rarely reached on the curing tobacco, because the time is too short and the moisture insufficient. The formation of spores occurs in the stems and ribs after the stripping, and often the fungus springs up over the floor of the curing barn, and the next crop of leaf hung in the building will be in danger of inoculation by means of the spores developed by this growth of the fungus. The remedies suggested by Sturgis ‡ are

* Zeitschrift für Pflanzenkrankheiten, 3, p. 82.

† Sturgis, Report of the Connecticut Agricultural Experiment Station, 1893, p. 85.

‡ Report of the Connecticut Agricultural Ex. Sta., 1891, p. 185.

the burning of all infected waste material from an old crop; the thorough fumigation of the curing barn, by burning sulphur after the removal of the crop, and again two weeks before the introduction of the new crop; the sprinkling of the floor with a mixture of equal parts of dry air-slaked lime and sulphur; or even the covering of the earthen floor with an inch of clean soil.

OFFICE OF BACTERIA IN TOBACCO FERMENTATION.

While the curing of the tobacco is, in all probability, the effect of modified activity of the leaf cells themselves, the same cannot be said of the sweating. At the close of the curing process the leaves are fully dead. If the leaves be remoistened, packed closely together and allowed to stand, an action sets up, liberating heat and introducing new qualities into the tobacco. Nessler* was the first to explicitly declare that the process was distinctly a fermentative one; although Köller† notes the addition of yeast to promote the rapidity of the action, implying a more or less clear recognition of the analogy between this process and alcoholic fermentation.

At the time Nessler wrote, the principles and methods of bacteriological research were unknown, so that his reasoning from analogy could not be submitted to direct proof by experiment. Since then, however, a number of interesting researches have been made. Of these, one of the earlier is that of Th. Schloesing‡ upon the fermentations of tobacco used for the preparation of snuff. Work by the elder Schloesing had shown that there was a heavy consumption of atmospheric oxygen by the fermenting tobacco. Th. Schloesing set out to ascertain whether this was due to a purely chemical change, or whether bacterial action was wholly or par-

*Der Tabak, 1867, pp. 122-136.
†Der Tabak, Augsburg, 1858, p. 75.
‡Memorial des manufactures de l'état, Vol. I, Part 4, pp. 514-552; Vol. II, Part 1, pp. 119-136; Part 2, pp. 192-210.

tially responsible for it. He used samples sterilized, and others unsterilized, taken from the same lot of tobacco; some was kept at a uniform temperature and some simply prevented from cooling below a certain point. He concludes that at a temperature below 104° F., or above 158° F., and possibly varying little from 122° F., the action is a purely chemical one, with which lower organisms have nothing to do. Theoretically, he believes the changes brought about by snuff fermentations might be accomplished entirely without the aid of lower organisms. In practice, however, they serve to start the changes and develop the heat that is necessary to setting up the more rapid oxidations. "The physical properties of a good snuff tobacco," he says, "can be secured in two months at 158° F., in less time at 176° F., and in ten to twelve days at 212° F., while the desired internal chemical changes are accomplished in the same period at the latter temperature." He finds that a new fermentation is set up every time the tobacco is turned and repacked, and that the sum of the carbonic acid and oxygen in the air of the cases always exceeds 21 per cent, and may run up to 35 per cent. This is regarded as an evidence of the activity of anaerobic ferments. Schloesing found present a bacillus and a diplococcus.

He compared the snuff fermentation with the aerobic fermentation of stable manure. Fesca and Imai * think it more closely comparable to the process of ensilage. But Behrens claims that, owing to the watery condition of silage, the fermentation of brown hay, a dryer product not in use in America, is more strictly analogous.

In the "sweating" of ordinary leaf, especially as practiced in Germany, Nessler says that a temperature of 106° F. is attained in the heap at a depth of one foot

*Landwirthschaftliches Jahrbuch, 1888, p. 327.

in course of half a week and, at three feet, a temperature of 129° F. It is needful to cover the heap with cloths to absorb the condensing moisture, which would otherwise condense in the upper layers of tobacco, and cause rotting and molding. Smoking tobacco is not to be allowed to heat above 122° F. Behrens believes that these changes are to be ascribed chiefly to the action of anaerobic ferments, although a local action of aerobic forms at the same time is not excluded. He found in sweated tobacco vigorous individuals of the widely distributed aerobic form, *Bacillus subtilis,* and also an aerobic *Clostridium,* which, like *Clostridium butyricum,* formed endospores. He does not think the latter especially active, but recalls the fact that Cohn attributes the fermentation or spontaneous heating of damp hay and stable manure to the former organism. Behrens* also states that he has found the mold, *Aspergillus fumigatus* in sweating tobacco, upon six out of eight samples from three different dealers. While this organism is regarded by Cohn as the cause of the heating of piled-up malt, it is not supposed to play any large part in the sweat.

Behrens endeavored to ascertain the changes which occur during sweating. He found a loss of only 2.5 to 5.6 per cent of dry matter, although others put it as high as eight to twelve per cent—in the latter case, the loss of water is included. This loss falls chiefly upon the soluble carbohydrates and less upon the non-volatile organic acids. There is no loss of nitrogen, yet one-third of the nicotine disappears; it possibly serves as food for the lower organisms, as an earlier research † has shown that *Botrytis cinerea* can eat it. There is a loss of nitrate nitrogen and a diminution of the other

* Centralblatt fur Bakteriologie und Parasitenkunde, 11 (1894) p. 335 seq.

† Zeitschr. f. Pflanzenkrankheiten, 3 (1893), pp. 85-86.

soluble substances. Butyric acid is present as one of the products of the sweat.

The investigations of Cohn and others have shown that the flavors of butter are largely due to the products formed by special ferments active in ripening the cream. Pure cultures of one ferment produced nauseous butter; of another, a butter with all the delightful aroma and flavor of the finest grass butter. Selected cultures of the latter bacterium are now on sale to the dairymen of America.

SPECIAL CULTURES FOR SPECIAL FLAVORS IN THE LEAF.

It has recently been queried whether tobacco, which was known not to attain its finest flavor and aromatic smoking qualities until after the sweat, might not, in the finer varieties, such as the better Cuban brands, as contrasted with less excellent kinds, owe its excellence in the former cases to the favoring influence of some special bacterial ferments.

It has long been a matter of comment among the more expert buyers and manufacturers, that cases, in the center of which "black rot" had developed sufficiently to injure the leaves immediately surrounding, yielded tobacco of a finer flavor, more nearly approaching the Cuban, than was obtained from other cases of the same lot that escaped the black rot.

Emil Suchsland,* several years since, published a most suggestive paper upon this subject, from which I largely quote: "In connection with bacteriological investigations as to the influence of certain physical conditions upon bacterial development, made by me under the direction of Professor Zöpf, I have, for a long time, been studying the nature of the tobacco-sweating process. This process is, it is well known, of the high-

*Berichte der deutschen botanischen Gesellschaft, 9 (1891), pp. 79-81.

est influence upon the usefulness and excellence of all varieties of tobacco. . . . Thus far it has been regarded as a purely chemical process ; but it has always seemed to me more probably a fermentation similar to the lactic, butyric and acetic acid fermentations, which are caused by bacteria. . . . In all sweated tobacco thus far examined, it is worthy of note that bacteria are present in large numbers, but in small variety. At most, only two or three species occur, belonging especially to the *Bacteria* proper, though sometimes to the *Micrococci*. Tobacco of the following sorts was tested: Havana, St. Domingo, Kentucky, Brazil, Turkish, Grecian, Russian, Pfalz, Alsace-Lorraine, Breisgau and Uckermark. Pure cultures of the bacteria upon these sorts were prepared. When tobacco of another sort than that from which the bacteria were taken, was inoculated by the pure culture of the latter, the tobacco thus inoculated took on the flavor and odor of the tobacco from which the bacteria were derived.

"In view of these facts, the sweating process assumes more importance than it has thus far held. Heretofore, the aim in Germany has been to improve the tobacco by better culture and by the introduction of improved varieties; the latter soon deteriorate, however, in this climate, especially since the right kind of ferments are not present in the sweat. Our tobacco always suffers a sort of wild fermentation. But it is now possible to introduce the better ferments into our own tobacco during the sweat. Every experiment I have made has given positive results. So surprising have been the changes in Pfalz tobacco, that excellent judges of domestic sorts have declared the tobacco thus sweated to be a foreign product."

Unfortunately, Suchsland has never carried further the work thus interestingly outlined. Nevertheless, a firm in Berlin, Hermann Giesecke, offers for sale pure cultures of the bacteria active in the sweating of the better tobacco, and Behrens, who has most recently looked into the subject, by way of investigation, is, though rightly conservative, strongly inclined to accept the practicability of Suchsland's suggestion.

Clearly, the matter is one of vital importance to American growers and manufacturers. It is worthy of the simple, preliminary experiments that packers and makers can carry out, as well as of the more perfectly controlled investigations of our tobacco experiment stations. If, by proper inoculations and maintenance of established conditions of moistening with water, or other more suitable liquid, and of temperature, we can impart to local tobacco the flavor and aromatic smoke of Cuban and other tropical tobaccos, it will be possible to dispense with a large part of the present importations for fillers.

CHAPTER VI.

MANURES AND FERTILIZERS.

It is evident from the preceding chapter that the form, quantity and quality in which food is furnished the tobacco crop, opens up a vast field of vital importance. Yet it is only within very recent years that the scientific aspects of the influence of manures and fertilizers upon tobacco have been studied. But as the culture of this crop increases, as the area of virgin lands contracts, and as competition for fine quality grows, the problem of feeding the tobacco plant is bound to command increasing attention. We therefore elucidate the subject as fully as the present state of knowledge permits.

Very little has been conclusively demonstrated, as yet, by the recently begun work at our southern experiment stations, and the state of the art of fertilization of southern leaf is well described in the chapters on heavy leaf and manufacturing tobaccos. The most accurate data are those furnished by the experience of the most careful planters in the Connecticut valley—some of whom deserve high rank for the truly scientific character of their work—and by the several years' results of the Connecticut (Poquonock) and Pennsylvania experiment stations' exhaustive tests. From all these sources our data are compiled.

Soil vs. Manures and Fertilizers.—The soil upon which tobacco is grown may have as great or greater influence upon the leaf as the plant food artificially supplied. The soils usually preferred for the different types of tobacco are considered in later chapters, and it must be noted that effect of manures and fertilizers will vary on different soils. Indeed, the soil is one of nature's wonderful laboratories. The actions and reactions that are going on in the soil—chemical, bacteriological and physical—vary with different localities and seasons. No hard and fast rules can be laid down, but each planter, who wishes to excel in growing fine tobacco, must experiment for himself. Certain general principles, however, seem deducible from the extensive studies of Mr. Milton Whitney, chief of the division of agricultural soils, United States department of agriculture, as stated in the opening of the chapter on cigar leaf.

Temperature and Rainfall also prevent exact rules in feeding tobacco or other crops. However carefully and liberally it is fed will be to little purpose if the weather is too cold or dry. Temperature cannot be governed, nor can too much rain be avoided, except by drainage, but drouth can be insured against. Over a large part of this country, tobacco and other crops suffer almost every season from drouth. In Florida, and the middle South, as well as further north, drouth is liable to occur at most critical seasons. The extensive tobacco plantation at Fort Meade, Fla., is therefore equipped for irrigation. Since such simple methods of supplying water to crops have been perfected, tobacco should not be without insurance against drouth.

Irrigating Tobacco.—Where the hydrant or aqueduct service cannot be drawn upon for the supply of water, to be conducted through hose to the field, reservoirs may be made, by scooping a hole in the ground on the nearest elevation, and pumping it full of water by means of a windmill, gasolene engine, or other form of power. The power used for such irrigating plants can be employed for many other purposes when not needed for pumping water. The supply of water can be from brooks, ponds and wells, and the cost will often be

FIG. 11. IRRIGATING TOBACCO, MAKING A LITTLE WATER MOISTEN MANY ROWS OF PLANTS.

surprisingly small. The first outfit of this character, we believe, was set up in Polk county, southern Florida, in 1896, and has produced remarkable results. See illustration of it in the description of the Florida tobacco industry.

In irrigating tobacco, great care must be taken not to supply too much water at a time. The overplus is certain to have a deleterious effect, making the leaf darker and heavier, and injuring its burning qualities as well as its flavor and aroma. A small stream run between every second row will be better than to run it through every row. The more sandy the soil, the greater the amount needed, and the more often can water be applied, with less injury to the crop. Irrigation has been so little practiced in this country that no special directions can be laid down, but each planter must experiment for himself, keeping in mind the peculiarities of his soil and of the leaf which he is producing. Irrigation is a great aid in getting a good "stand" of plants when the ground is dry at transplanting.

PRINCIPLES OF TOBACCO FEEDING.

Tobacco has been grown for a great many years; it was grown, and successfully, too, for the market of early times, long before the advent of artificial fertilizers, and when the whole science of modern fertilizing was unknown. In those days, of course, the only dependence was upon virgin soils, or barn manure, perhaps assisted by occasional dressings of wood ashes. The quality of the tobacco was then much more governed by the natural peculiarities of the soil than is now the case, for the native food supply of the soil was drawn upon to supply the elements in which the manure was lacking, or which the manure could not supply with sufficient rapidity to meet the requirements of the growing crop. Fortunately for the reputation of the crop, the market was then satisfied with a grade of leaf entirely different from that now demanded. The question of quality was, of course, important, but the class of goods demanded was not so fine and delicate as is now imperative, and what was a fine leaf then could not now be profitably raised.

Now we find that the soil must be made rich in all elements demanded by the plant, and these elements should be in such a thoroughly soluble and available condition that the plants can assimilate them without hindrance. The plant is really "forced," just as market

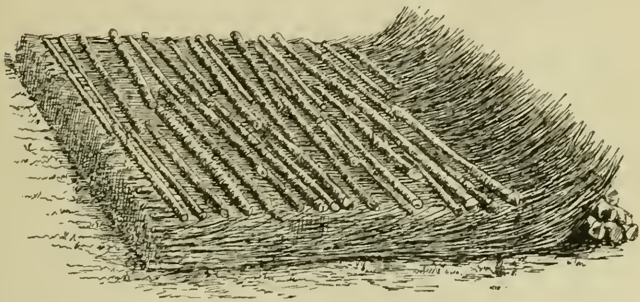

FIG. 12. BRUSH ARRANGED FOR BURNING WHEN PLANT BED IS TO BE MADE. (Tennessee, Kentucky.)

garden crops are forced, by promoting a luxuriant growth through the superabundance of fertility, kept in a state of constant availability by thorough cultivation. Tillage and fertilizing go hand in hand in the production of the crop.

What not to Use.—It is important to avoid applying to the soil substances which might injure any desirable quality in the leaf. For instance, it is going too far to assert that the use of chlorides invariably produces tobacco of inferior quality, for occasional experiments demonstrate the contrary, but growers will do well to avoid the use of chlorides, which, as the experience in all countries agrees, are likely as a rule to injure the burning quality of the leaf. Chlorides exist as chloride of sodium, or common salt and chloride of potash, or muriate of potash. Low grade sulphates of potash, such as kainit, carnallite, krugit, etc., also contain a large admixture of common salt, and therefore should not be used.

It has been found that the texture of the leaf, and to some extent its burning quality, is frequently injured by certain coarse forms of nitrogenous matter, and some substances, as castor pomace, are regarded with disfavor by manufacturers, some of whom refuse to purchase a crop grown on pomace. This is a matter of far less consequence than the presence of chlorine, for the deleterious effects of coarse nitrogen compounds can easily be eliminated. And castor pomace itself can be, and is, used with perfect safety, when it is intelligently handled. In fact, this pomace is a very popular tobacco fertilizer in some sections, and dealers who profess to refuse to buy crops grown upon it, nevertheless do purchase many a lot so grown, being kept in ignorance of the fact by the grower, and no complaint is made when the grower is skillful, and has a reputation for producing good tobacco. The Poquonock experiments certainly indicate castor pomace when it is properly used.

The same objection can be raised against coarse animal matter, such as green slaughterhouse waste, coarse meat scraps, etc. The whole point is, that when such matter is applied directly to the land, it should be done early in the fall, that the process of violent fermentation and putrefaction may pass long before the plants are set. Such matter decomposes with an excessive fermentation, amounting to a violent putrefaction and, owing to the coarse, lumpy form, this excessive fermentation is long continued, and the nitrogenous matter is not wholly converted into nitrates, and other forms suitable for plant growth, until a long time has elapsed. The early stages of this violent decay create a condition in the soil that is bad for quality in tobacco, developing a leaf with coarse texture, large veins and an excess of woody tissue. Wherever possible, all animal and vegetable matter should be ground to a fine, dry powder, in which form it is much more easily disintegrated and that, too, without excessive fermentation. Furthermore, a much more even distribution of the fertilizer can be made, which insures a thorough fertilizing of the land, avoiding the liability of omitting parts of the field.

The trouble with this class of materials is entirely in the mechanical condition. Coarse fertilizers are proverbially slow. The same matter, in a finely divided state, can be used with perfect safety. But if, as in castor pomace, this is impossible, it should be applied so long in advance of the crop, that all danger of excessive decomposition shall have passed before the plants are set. Chlorine in any form should be avoided by the skillful grower, and coarse, nitrogenous matter should be used with discretion and with an understanding of its dangers and limitations. These constitute the only forms of plant food that are positively dangerous, and that should not be used because of the danger. Phosphoric acid is not assimilated by the crop to any material extent, and its application, in more than very moderate quantity, is unnecessary, and therefore wasteful, unless the soil is deficient in this element, but its presence does not produce any markedly bad results; it is simply useless to incur the expense of an element that is not required.

Table IV.—ANALYSES OF MANURES AND FERTILIZERS EMPLOYED IN FEEDING THE TOBACCO CROP.

Names of fertilizing substances used for tobacco, and their composition.	Moisture.	Nitrogen.			Potash.			Total phos. acid.			Soluble phos. acid.	Inverted phos. acid.	Insoluble phos. acid.	Soda.	Lime.	Magnesia.	Iron and alumina.	Sulphuric acid.	Carbonic acid.	Chlorine.	Insoluble matter.
		Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.											
Muriate of potash	1.8				58.9	45.9	51.0							6.7		0.6				48.8	0.7
Sulphate of potash	2.1				51.3	21.4	58.6							4.5		1.5		45.7			0.8
Sulphate of magnesia	4.8				29.4	16.9	24.8							6.3	2.6			44.3		2.7	1.4
Kainit	3.2				16.4	12.5	13.5							19.0	1.2	9.8		20.3		33.3	2.1
Krugit	4.8						8.4							5.3	12.5	8.9		31.9		6.6	15.0
Sulphate of magnesia (kieserite)	22.7														2.8	17.3		36.1			5.7
Double manure salt, sulphate of potash and magnesia					28.4	25.7	26.7							6.3	2.6	15.8	1.4	44.3		1.5	1.4
Nitrate of potash	1.3	14.5	11.6	12.7	45.6	44.7	45.3														
Nitrate of soda	1.4	16.2	14.3	15.0										35.5						0.5	0.6
Sulphate of ammonia	1.1	21.6	19.6	22.0														60.0			
Wood ashes	10.6				10.8	1.2	5.4	5.6	0.1	1.5					33.6	3.3	1.0				14.2
Cottonseed-hull ashes	8.2				42.1	9.9	22.7	13.7	2.9	8.2					9.3	10.5	1.8				13.4
Plaster (gypsum)	8.6														32.8	5.8		45.1			3.5
Onondaga plaster (gypsum)	13.3														30.0	4.7		32.5	8.2		9.8
Lime															93.6						1.3
Peruvian guano	14.8	13.5	4.4	7.8	4.1	1.1	2.6	20.6	6.0	15.3	4.6	3.8	6.9								6.6
South Carolina floats	0.8									23.4		2.3	21.1								20.2
Soft Florida phosphate	4.8							19.9	17.7	18.7					23.7		6.8				20.9
Dissolved bone black	10.3							17.5	15.0	16.0	14.5	1.2	0.4								4.0
Bone black	4.6							30.5	16.6	28.3											3.6
Acid phosphate	14.2									14.6	10.3	2.4	1.9								10.8
Dried blood	11.9	8.1	8.1	10.5				6.2	1.3	2.0											
Ammonite	5.8			11.3						3.4											1.4

ANALYSES OF MANURES AND FERTILIZERS EMPLOYED IN FEEDING THE TOBACCO CROP.—*Continued.*

Names of fertilizing substances used for tobacco and their composition.	Moisture.	Nitrogen.			Potash.			Total phos. acid.			Soluble phos. acid.	Inverted phos. acid.	Insoluble phos. acid.	Soda.	Lime.	Magnesia.	Iron and alumina.	Sulphuric acid.	Carbonic acid.	Chlorine.	Insoluble matter.
		Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.											
Tankage	9.5	9.1	4.3	6.8	....	....	....	15.9	4.0	11.5	....	4.1	7.5	....	....	....	....	....	....	....	....
Fish with less than 20 per cent water	12.3	11.4	5.9	7.6	....	....	....	15.9	5.5	8.5	0.6	2.6	5.1	....	....	....	....	....	....	....	2.0
Fish with more than 40 per cent water	45.4	7.6	2.4	4.9	....	....	....	8.6	2.9	5.1	1.2	1.3	2.6	....	....	....	....	....	....	....	1.4
Fish with 20 to 40 per cent water	30.2	7.4	4.2	5.9	....	....	....	8.3	4.7	7.1	0.7	2.7	3.6	....	....	....	....	....	....	....	1.7
Castor-bean pomace	9.6	5.7	5.2	5.5	3.4	0.6	1.6	2.3	1.6	2.2	....	....	....	....	0.9	0.3	....	....	....	....	1.8
Cottonseed meal	6.7	7.7	4.0	6.8	2.4	0.5	1.8	3.4	0.7	1.7	....	....	....	....	....	....	....	....	....	....	0.3
Linseed meal, old process	9.0	....	....	5.4	....	....	1.4	....	....	1.7	....	....	....	....	....	....	....	....	....	....	....
Linseed meal, new process	10.0	....	....	5.8	....	....	1.4	....	....	1.8	....	....	....	....	....	....	....	....	....	....	....
Tobacco leaf	13.1	....	....	2.7	....	....	7.2	....	....	0.4	....	....	....	....	4.2	2.2	0.3	....	....	....	4.2
Tobacco stems	10.6	2.9	0.9	2.3	10.6	3.7	7.0	2.1	0.4	0.6	....	....	....	0.3	3.9	1.2	....	....	....	....	0.8
Barnyard manure	67.0	1.3	0.2	0.5	1.4	0.1	0.6	0.8	0.1	0.4	....	....	....	....	0.3	0.2	....	....	....	....	8.1
House manure	11.2	....	....	0.7	....	....	2.8	....	....	1.5	....	....	....	....	....	....	....	....	....	....	12.6
Sheep manure	50.2	....	....	1.2	....	....	0.6	....	....	0.7	....	....	....	....	....	....	....	....	....	....	12.9
Hen manure, fresh	52.3	1.2	0.8	1.0	0.3	0.2	0.2	1.0	0.4	0.7	....	....	....	....	1.2	0.9	....	1.2	....	....	23.5
South Carolina rock phosphate	1.4	....	....	....	....	....	....	30.5	24.7	27.5	0.3	0.1	27.1	....	41.9	3.0	4.8	....	....	....	9.0

WHAT TO USE AND HOW TO APPLY IT.

[For analysis of manures, manurial substances, etc., used on tobacco, consult Table IV, Pages 112 and 113.]

Manure.—In former times, the excrement of domestic animals was the only plant food at the command of the grower; it was the only dependence, and its use has not ceased, for it is still largely relied upon, although it is now generally used in conjunction with other fertilizers, as a sort of foundation upon which to build. It is still one of the most important fertilizing materials at the command of the tobacco grower, and it is more universally used than any other single substance. It is surely entitled to receive the first consideration. But it is now applied with an understanding of its deficiencies as well as excellences, and often for different purposes in a different way than formerly.

Barn Manure is a general term covering the mixture of the excrement of cattle, horses and swine, or that of cattle and swine only, or that of cattle only. Horse manure, when kept distinct from the general mass, is separately classed, and is used for special purposes. On the ordinary farm, manure is a mixture of the excrement of the leading farm animals. There are several striking characteristics that are peculiarities of barn manure. The most noticeable of these is the large quantity of vegetable matter it contains; and incidentally the large amount of water. This organic matter is the greatest peculiarity of manure, and from it certain effects are produced in the soil that cannot be obtained from any other fertilizer. Another peculiarity is that manure is a complete fertilizer, it contains some of every element that is required by growing crops,—nitrogen, phosphoric acid and potash, as the more important plant food elements, as well as lime and magnesia. A third peculiarity is the variability of the quantities of these food elements, depending upon the classes of animals contributing to its formation,—cattle, horses and swine,—some one or two of which may be absent; upon the fodder rations employed in feeding the stock; upon the export of milk from the farm; upon the quantity of foreign matter incorporated as bedding, or absorbents; upon the percentage of the urine and dry excrement, and upon the way in which it has been preserved,. whether properly housed, or exposed to the leaching of rains and winds.

The Value of Manure as a fertilizer has been appreciated for generations. The investigations of science have not displaced its standing, or curtailed its use. For it is both the cheapest, and, all things considered, the best general manure at hand. It will always be

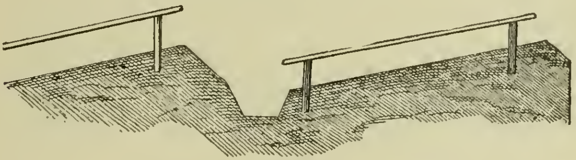

FIG. 13. PLANT BED ARRANGED TO SHED WATER (Germany).

used whenever the soil requires fertilizing, and where live stock is kept. It meets the wants of the general farmer better than any other fertilizer, and its application is understood, and its general effects are well known.

The feed has a great effect upon the quality of the manure. In its passage through the animal, the food loses what is taken out by the growth of the animal and by the milk. A good deal of carbonaceous matter, which has no fertilizing value, is also burned in the system to supply animal heat, but all the rest of the food passes into the dung or urine. The digested food is voided in the urine, the undigested in the solid manure. Of the two, the urine is the more valuable; it is also more difficult to preserve. Other things being equal, the richer the food, the richer the manure. It is calculated from Table IV of fertilizer analyses, that a ton of average manure contains about 1350 pounds of water, 475 pounds of organic matter and 175 pounds of ash. The latter contains, of potash eleven pounds, phosphoric acid eight pounds, lime six pounds, magnesia four pounds and the rest is sand, carbonic and sulphuric acids, iron, alumina and soda. The organic matter contains about ten pounds of nitrogen. Manure from poorly fed stock, especially if absorbents are not used on the manure pile, if exposed to the weather, may not contain half these quantities. On the other hand, richly fed stock, carefully bedded, may yield manure twice as rich in plant food as the average just stated. This shows the wide variety that may exist in manure.

Comparing the actual requirements of a crop of tobacco of 1800 pounds cured leaf and stalks, with the amount of plant food contained in barn manure, it appears that 15 tons (or about four cords) of average manure contain the 154 pounds of nitrogen required; 60 tons, or 15 cords, contain the 488 pounds of potash, and four tons, or one cord, contain the 26 pounds of phosphoric acid. This comparison is for the total crop of tobacco, both leaves and stalks, but if the stalks are returned to the land on which they were grown, the apparent amount of manure is much less. To supply the 80 pounds of nitrogen removed in the leaves only, 10 tons, or two and one-half cords, of manure appear to be all that is necessary; 34 tons, or eight and one-half cords, contain the 291 pounds of potash required, while two tons, or half a cord, contain the 12 pounds of phosphoric acid that is necessary.

But every tobacco grower knows it is simply impossible to obtain a crop of 1800 pounds of cured leaf from a dressing of only eight and one-half cords of manure, which is the largest quantity that the figures show is necessary. The trouble is, that the fertilizing elements of manure are not rapidly set free; their action is proverbially slow, and from this slow action comes the great "lasting power" of manure. It is lasting because it cannot be quickly used. The availability of the manure is increased, but at the loss of considerable of the nitrogen, by rotting, especially when assisted by working over the pile, breaking up the lumps, and allowing the air free access to all parts of the heap.

But eight and one-half cords of manure, however short and well rotted it may be, will not satisfy the re-

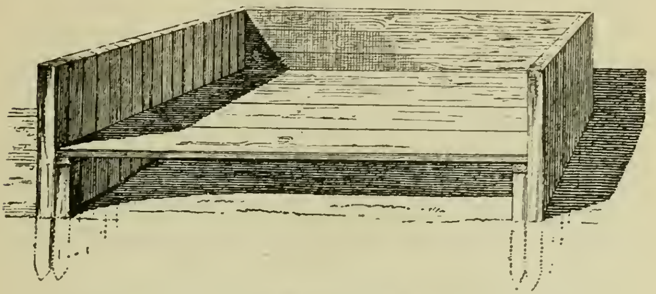

FIG. 14. WOODEN FRAME FOR PLANT BED (German).

quirements of the crop. It is likely that not more than thirty per cent of its fertilizing elements can be used by tobacco the first year, although this percentage is governed considerably by the length of time the manure remains in the soil before the plants are set, and upon temperature and moisture. Yet the longer it thus remains in the soil, the more likely is the loss of nitrogen from evaporation and leaching. This loss is again offset by the uniform distribution of what nitrogen is not thus lost, and the more available form in which it exists.

It is, therefore, very difficult to tell how much manure to use, if that, alone, is to be depended upon, not because the quantity of plant food it contains is unknown, but because of the impossibility of determining how much of it is available for the demands of the rapidly growing tobacco crop. If all the plant food is not consumed the first year, especially the potash and lime, it remains in the soil for the use of future crops. Owing to the very slow action of manure, and the great demands of tobacco, occasioned by the very rapid growth of the plant, it is difficult to bring about a satisfactory state of fertility from manure alone. And in the great majority of instances, manure is no longer expected to supply the entire amount of plant food, but is supplemented by the use of other materials.

Effect of Manure on Soil.—While manure is thus of questionable dependence, alone, for tobacco food, it possesses certain valuable qualities arising from the large quantity of vegetable matter which it contains. This vegetable matter is beneficial in many ways. It supplies a stock of vegetable mold, or humus, that is often lacking in the light soils on which tobacco is grown. This humus absorbs moisture and heat, and retains the nitrates set free in the soil. This valuable adjunct to the proper state of fertility, is too often overlooked by the advocates of exclusive chemical fertilizers. The mechanical effect of manure is also of great consequence, as it lightens very heavy soils by making them open, porous and easy of cultivation, while it supplies moisture and body to lands that are naturally of too light a nature.

Manure also promotes a quick fermentation that is congenial to all plants, one of the results of which is the conversion of nitrogen from a raw state to nitrates that are suitable for plant consumption. On this account it is used with benefit in conjunction with other nitrogen supplies, especially as it also, in a measure, fixes and retains this soluble nitrogen and thus prevents waste.

When used with other quick-acting fertilizers, manure keeps land in good heart, moist, mellow and friable, and in a condition admirably suited to the best development of plant roots. In addition to these peculiarities, the plant food which manure contains is of great consequence, especially as this may come in at the last of the season, when the more available plant food of the chemicals may have been consumed. The lasting quality of manure, which makes it undesirable as an exclusive dependence, becomes a matter of importance when used with other quick-acting fertilizers. For these reasons it is important to use a liberal dressing of manure.

The Best Time to Apply Manure is in the fall, plowing it under slightly, but not too deep. If preferred,

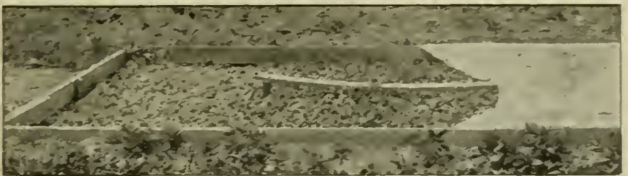

FIG. 15. PLANT BED FRAME WITH CLOTH COVER PARTLY REMOVED.

the dressing can be applied after plowing, when it should be well harrowed in. The rain, snows and frost of fall, winter and spring diffuse the fertilizing elements evenly through the soil, break down the coarse, woody matter of the manure, reducing it to the condition of vegetable mold so essential as an absorbent and for its powers of fixation of other forms of plant food. From eight to ten cords, thirty-five to forty loads, of manure should be thus applied when other fertilizers are to follow. If not done in the fall, it should be applied as early as possible in the spring, that the mellowing influence of air and moisture may transform it from a crude, raw state to one congenial to the most favorable plant growth. If coarse, rank manure is applied late in the spring, it is apt to promote a coarse-fibered leaf, deficient in elasticity and texture.

The Amount of Plant Food to Apply depends upon soil fertility, variety to be grown and quality and quantity of leaf desired. The amounts specified in this chapter are those used by the best growers in the Connecticut valley, on land of fairly good fertility. These men want at least a ton of cured leaf per acre, of the finest quality, and then have the soil left rich enough to yield two to four tons of hay per acre when seeded to grass. Such high cultivation is not yet practiced on old soils in other tobacco-growing districts of America, while on newer lands it is not necessary. As a rule, however, the average

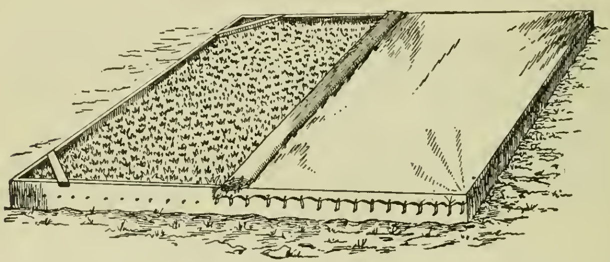

FIG. 16. MOVABLE FRAME FOR PLANT BED, WITH CLOSE FITTING CLOTH COVER PARTLY REMOVED.

planter stands more in danger of applying too little plant food than too much. On the other hand, the Poquonock experiments confirm much experience to the effect that, under the intense cultivation referred to, more plant food is put into the soil than is really profitable.

NITROGEN FERTILIZERS.

Their Necessity.—It has been shown by analyses of the plant, and by experience in the field, that tobacco requires a large quantity of nitrogen. It does not seem to possess the ability to get its nitrogen from the air, as do clover and certain leguminous plants. However, tobacco must get its nitrogen from the soil. This element must, therefore, be present in sufficient quantity, and also in a thoroughly available form, and intimately diffused throughout the soil, owing to the short period in which the plant development can be effected. Nitrogen is obtained from a number of waste products and chemicals, prominent among which are cottonseed meal, castor pomace, linseed meal, tankage, dried fish scrap, dried blood, dried animal matter, sulphate of ammonia, and nitrate of soda. Many growers use these and other chemicals, while others prefer the prepared fertilizers of

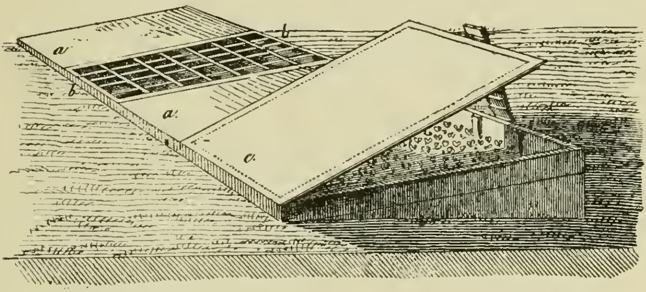

FIG. 17. PERMANENT BED, WITH BOTH GLASS AND CLOTH FRAMES.

commerce that are rich in available nitrogen, and are prepared expressly for this crop.

Availability.—Tests have been made at the Connecticut experiment station to find out the crop-producing power of nitrogen, supplied in various forms. This was determined, not by chemical analysis, which practically fails to throw much light on the subject, but by the quantity of nitrogen which the crop took from the fertilizer. The crops were grown on artificial soil that contained only traces of available nitrogen, but all the other elements of plant food were present in excess of the crop needs. Of course, a single crop cannot take all the nitrogen from the soil, even when it is supplied in nitrate of soda, which is the most soluble form, because, for one reason, the plant roots do not reach every particle of the soil. Still less can one crop take all the nitrogen from animal, or vegetable, matters, that decompose but slowly in the soil. In any case, therefore, more or less of the nitrogen contained in the fertilizer fails to enter the crop. The tests were made with oats and corn in 147 pots, and resulted for the two years, as follows (Johnson, Britton and Jenkins):

AVAILABILITY OF DIFFERENT NITROGENOUS MANURES.

Column A shows the per cent of the total nitrogen furnished the crops of '94-5 that was available—that is, was actually taken up by these crops, the balance of the nitrogen being left in the soil. In Column B, the amount of available nitrogen in nitrate of soda represents 100, and the figures beneath show the proportionate availability of nitrogen from the other fertilizers.

	A	B
Nitrate of soda,	68	100
Castor pomace, No. 4545,	53	77
Av. of castor pomace, Nos. 4545 and 4546,	50.5	74
Cottonseed meal,	49.5	72
Castor pomace, No. 4546,	48	70
Linseed meal,	47	69
Dried blood,	46.5	68
Dried fish,	45	66
Dissolved leather,	44.5	64
Horn and hoof,	42.5	62
Tankage,	40.5	59
Steamed leather,	6.5	9
Roasted leather,	6.5	9
Raw leather,	1.5	2

It will be seen that the nitrogen of castor pomace No. 4545 has shown the highest availability of any form of organic nitrogen. The other sample of pomace contained more oil, and its nitrogen was not quite as available. Cottonseed meal, linseed meal and dried blood were about equally available, thus scientifically confirming the experience of some of our most careful tobacco growers, who have found linseed meal fully as quick acting and effective as a fertilizer as either cottonseed meal or dried blood. Dried fish comes next in order, but it will be surprising to many that tankage, a popular nitrogenous fertilizer, gave up only forty per cent of its nitrogen to crops in two years, thus standing in availability at fifty-nine, compared to nitrate of soda as one hundred.

Ammonia should not be confused with nitrogen. Seventeen parts of ammonia contain fourteen parts of nitrogen. Oftentimes manufacturers give the equivalent proportion of ammonia, instead of the actual amount of nitrogen, for the same reason that the term phosphate of lime is used—because it looks bigger. Expressed in decimals, one part of ammonia contains 0.8235 of nitrogen. Thus, if a fertilizer contains five per cent (or one hundred pounds per ton) of ammonia, the nitrogen is only 4.12 per cent, or eighty-two and one-third pounds. For quick calculation, ammonia can be reckoned to contain four-fifths of nitrogen, and by deducting one-fifth from the quantity of ammonia, the amount of nitrogen actually present will be reached quite closely.

Cottonseed Meal.—Of all the sources of nitrogen, the most popular is cottonseed meal. As a concentrated food for cattle its value is highly appreciated, and it is one of the leading meals for milch cattle. But, apart from the tobacco crop, it is not much used as a fertilizer at the North. In the southern States cottonseed, fermented, to destroy the germ, has long been a favorite dressing for cotton fields, especially when mixed with plain superphosphate and kainit. Of recent years the practice of selling the seed to oil mills, and buying back the dry meal, has gradually spread, and in sections adjacent to railroads in these States, large quantities of meal are annually consumed for fertilizing purposes.

In the preparation of the meal, the cottonseed, which is about the size of a coffee bean, is taken as it comes from the gin, covered with a short fuzz of cotton fiber. In this shape the seed resembles the small cocoons in which the larvæ of many insects are encased. This downy fuzz is removed by machinery, the lint finding a sale for certain industrial purposes. The seed is then almost bare. It is next decorticated; that is, the hard flinty shell is split open and then sifted from the pulp. The pulp is rich in oil, and the shell contains enough fat to make it readily combustible. The shell, or hull, is burned for fuel under the engine boilers, sometimes being the only fuel, but more often used with wood, and occasionally with coal. The resulting ash is called cottonhull ash, described under potash fertilizers. The pulp of the seed is subjected to heavy pressure, which expresses the oil, and the dry cake is then ground. Its final condition is that of a fine dry powder of an olive or yellowish green cast. Occasionally, the hulling process is omitted, and the entire seed is crushed and ground, the result being undecorticated meal. This product is darker than the usual brand, from containing fragments of the black hulls. Such meal is inferior to the normal, both as a fertilizer and as a fodder. The shells, or hulls, are much used in the South for feeding cattle, and though it may appear incredible, cattle fed on them are kept in good condition.

Cottonseed meal is admirably suited to fertilizing purposes; it is a fine dry powder, of excellent mechanical condition, free from odor, and very easily applied. It can be distributed very evenly, which insures a thorough distribution through the soil, and owing to its fine mechanical condition, it is easily disintegrated, and the fertilizing elements soon become available. It is not so rapid in its effects as the nitrate and ammonia salts, but it compares favorably with any animal matter. Chemically it is quite uniform, as appears from the analyses in Table IV, Page 112. A clearer idea of its constituents is obtained from the following more complete analysis:

ANALYSIS OF COTTONSEED MEAL OF STANDARD QUALITY.

Moisture,		10.50
Organic matter (including 6.72 per cent of nitrogen),		83.67
Lime,	0.29	
Magnesia,	0.72	
Soda,	0.25	
Potash,	1.83	
Phosphoric acid,	2.35	
Insoluble matter,	0.39	
Total ash,		5.83
		100.00

Of course the fertilizing value of cottonseed meal depends mainly upon its nitrogen, but potash and phosphoric acid are also important. It is such a popular fertilizer and feed that in years of scarcity and high prices, cottonseed meal is adulterated by adding rice meal, etc., or by grinding the hulls into it. This impure meal contains only half or two-thirds as much nitrogenous matter as the pure article, and, if bought at all, it should be at a reduction of twenty-five to fifty per cent from the price of straight goods. The meal with hulls is dark and contains hard, black fragments of hulls. As the Connecticut station truly says, "In ordinary meal, to use as feed or fertilizer, purchasers should require decorticated upland cottonseed meal, containing at least six and one-half per cent of nitrogen, unless they are willing to use the other greatly inferior meal, which cannot be economically done unless it can be got for a greatly reduced price." Oftentimes this meal ferments and sours, which renders it unfit for cattle food, and it is then sold at a less price. This damaged meal is almost, if not quite, as good for fertilizing purposes as the sweet meal, and a considerable saving in first cost is made by using it.

This meal is such an excellent cattle food that it is almost a waste to use it directly as a fertilizer, especially as by far the most of its fertilizing elements are found in the manure, after feeding. For general farm purposes, it is more economical to feed it; but tobacco is an exceptional crop, and this meal has been found so congenial to this plant that it cannot be considered wasteful to use it directly. And laying aside its feeding value, and considering it solely as a fertilizer for direct application, it is one of the most economical fertilizers.

Cottonseed meal, however, is not a very rapid fertilizer, and it should be applied as long as possible before the setting of the plants, to allow it to decompose. When the land has been dressed with ten cords of manure in the fall, one thousand pounds of meal should be broadcasted after plowing in the spring, and gently harrowed in. This should be done a month or six weeks before the plants are set, by which time it will be well diffused throughout the soil, especially if moist weather has prevailed. When no manure is used, one ton of meal should be applied. Some growers apply it in the fall, but this is not a general custom, although it is a good plan to follow. At Poquonock, 1500 pounds of cottonseed meal per acre, with 1500 pounds of cottonhull ash, made an average crop of 1611 pounds per acre, containing 956 pounds wrappers; when the meal was increased to 2500 pounds, the total crop was not much larger, but it yielded 1065 pounds wrappers; and 3000 pounds of meal made an average crop of 1835 pounds of cured leaf per acre, containing 1226 pounds of wrappers; the ash used was the same in all cases.

Linseed or Flaxseed Meal is also a popular fertilizer in seasons when, because of its abundance, it can be sold at as low, or lower, a price as cottonseed meal. It is not quite so rich in plant food as cottonseed meal, but the difference is slight. The new process linseed meal contains only about three per cent of fat or oil, while old process contains twice as much. At Poquonock, the tests made were with new process only, and results in quantity and quality of leaf from a moderate application are such that this meal is now largely employed for tobacco. About a ton per acre is used, with potash salts or ashes. To what extent the increased oil or fat in old process meal would injure or benefit leaf tobacco has not yet been determined.

Other Meals rich in nitrogen might be used on tobacco when their price permitted, but in the absence of experiments to show their effect, they should first be tried on a small scale. Gluten meal contains five per cent of nitrogen, pea meal three per cent, wheat bran two to three per cent.

Castor Pomace.—This article is used to some extent as a tobacco fertilizer, although a prejudice exists against it among some cigar manufacturers, as the claim is made that the tobacco does not come out of the sweat in good shape. This trouble arises from carelessness in application, and not from any inherent peculiarity of the pomace. The castor bean is grown quite extensively in this country. The oil is expressed by pressure and the crushed beans are known as castor pomace. It is a coarse, lumpy material, poisonous as a food, and having an offensive odor. Because of its coarse condition, it is difficult to spread evenly, and it should always be applied in the fall and gently harrowed in. By spring it will be brought into a suitable condition for tobacco growing. If its application is delayed until spring, this process of reduction cannot be accomplished before the plants are demanding the food. It is, however, used with excellent results applied in spring. Its use in a fresh, raw state produces bad results, but when applied at the proper season very favorable results are derived from it.

Castor pomace is much more difficult to manage than cottonseed meal and the latter is rightfully much more popular. Castor pomace is liable to vary in composition. and should be bought on a guarantee of five or five and one-fifth per cent nitrogen. The large amount of organic matter it contains gives it more value than nitrogen salts, especially for light soils. As it contains about one-fourth less nitrogen than cottonseed meal, the application should be correspondingly larger, or 2500 pounds per acre where no manure is used and 1250 when used with manure. When manure cannot be obtained, castor pomace makes a fairly good substitute,—perhaps the best the market affords, as its organic matter acts similarly to that of manure. At Poquonock, leaf grown on this pomace compared favorably in quantity and quality with crops grown on other fertilizers.

Tankage is the name applied to the residue of meat entrails, fine bone, etc., that settle at the bottom of the large tanks in which such refuse is steamed, or rendered, for extracting fat. When the percentage of bone runs large it is called cracklings. It is a dry powder varying considerably in mechanical condition, the meat generally being in a very finely pulverized condition, while much of the bone is considerably coarser. Fertilizer manufacturers use this material quite largely, and they generally make a distinction between beef and pork tankage. The latter contains considerable fat, which retards decomposition, and it is held in less esteem than beef tankage, which is almost entirely free from fat. This distinction is not understood by farmers and they are probably supplied with the less marketable pork tankage.

The quantity of water in tankage varies considerably, ranging from ten to thirty per cent, and the amount of bone also varies. Of course the larger the percentage of water, the smaller is the percentage of nitrogen; when bone is largely present the nitrogen runs low. It is generally sold on a guaranteed analysis, however, and the price varies according to the contents. The average amount of water is twelve per cent; nitrogen ranges from four to eight per cent, averaging about six per cent, while phosphoric acid ranges from seven to eighteen per cent, averaging eleven per cent. It is customary to sell the phosphoric acid as bone phosphate of lime, which runs much larger than the actual phosphoric acid, and farmers often confuse the term, thinking they are the same. Phosphoric acid is combined with lime in the ratio of one to 2.183; that is, one per cent of phosphoric acid is equivalent to 2.183 of bone phosphate of lime. And when tankage contains eleven per cent of phosphoric acid it contains twenty-four per cent of bone phosphate. The term phosphate of lime looks big and is often used by manufacturers to describe the phosphoric acid present in commercial fertilizers, thereby conveying the impression that a much larger quantity of phosphoric acid is contained than is actually present. It is one of the "tricks of the trade." A similar confusion exists between nitrogen and ammonia, as explained on Page 123.

When tankage runs largely to bone, there is little difference between it and ordinary bone meal. For tobacco, the presence of bone in tankage is of little advantage, since the crop requires but a small quantity of that element. In selecting tankage for this crop, care should be taken to choose that which runs high in nitrogen and low in phosphate. The presence of the bone increases the selling price, especially when a fair proportion of nitrogen is present, so that tankage cannot be considered an economical nitrogen supply, since it requires the purchase of a large quantity of unnecessary bone. For other crops, however, where phosphoric acid is needed, it is a good purchase,—a better one than bone.

The meat of tankage is in a very fine state and is easily disintegrated in the soil. It has been supposed to be more readily available for plant food than the organic matter of cottonseed meal and castor pomace, as animal matter appears to ferment and disintegrate

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more quickly than vegetable matter, but this is now doubted. Tankage should be applied broadcast in the spring and harrowed in. Tankage and all animal fertilizers give the best results when used with manure, for the latter is rich in organic matter while meat is deficient in it.

Dried Blood.—A better article than tankage, because of its more uniform analysis, is dried blood. There are several grades of blood, since it is often mixed with tankage, when it is called blood and meat, but in the wholesale fertilizer trade, there are but two grades, the soft red blood and black blood. Both of these products arise from the coagulation of liquid blood by steam Under this heat the solid portion settles and the liquid is drawn off. The residue is then dried. If too much heat is used in drying, the blood solidifies into a solid black mass, hard and brittle. This, when ground, separates into small, black, glittering particles, having a gritty feeling, and constitutes the black blood of commerce. A lesser application of heat prevents the melting of the blood, and it comes out as a red powder, soft to the touch. It is difficult to dry this blood successfully, and dried meat or tankage is frequently added to facilitate the drying, which makes the blood and meat so generally sold, and which more properly should be classed as tankage.

Black and red blood differ materially in their action. The latter has acquired quite an insoluble condition that detracts from its agricultural value. It runs from twelve and one-half to fourteen and one-half per cent of nitrogen. Red blood contains less, only about ten per cent or eleven per cent of nitrogen, but it is a beautiful nitrogen preparation and admirably suited for fertilizing purposes, being soluble, while not too much so. It is, undoubtedly, the best animal ammoniate. Unfortunately, however, it rarely gets into farmers' hands, for fertilizer manufacturers appreciate its value and take all that is produced. It is sold in the trade by the unit of ammonia. A unit is one per cent. When ammonia is worth $2.75 per unit, the price of blood analyzing 12 per cent ammonia is 12 times $2.75, or $33 per ton.

Dried Fish.—The leading animal ammoniate, the one most largely used by both manufacturers and farmers, is dried fish. This is obtained in very large quantities from the menhaden oil factories along the Atlantic coast. The menhaden, or "porgies" are caught for oil. They are steamed in large vats until reduced to a churn, and when this is settled the oil and water is drawn off and the churn is heavily pressed, to express all remaining oil. It is then called wet scrap and contains about 50 per cent of water. This is then dried, generally by the sun, the result being dry scrap. This contains about 10 or 12 per cent of water and from 8 to 9 per cent of nitrogen, or about 10 per cent of ammonia. It also contains about 8 per cent of phosphoric acid. The percentage of nitrogen varies according to the quantity of water contained in the scrap, which is sometimes quite large, even as much as 20 per cent in dry scrap. This variation is caused by defective drying, the effectiveness of which is largely governed by the weather. In some cases scrap is dried artificially, but this is not very general.

Dry scrap is sifted to make it uniform, and the result is a light, dry powder, having flaky particles. The finest dust is called fish guano. This runs somewhat higher in nitrogen and is more valuable, because its fine mechanical condition renders decomposition in the soil very easy. Fish is classed under four heads, wet scrap, dry scrap, fish guano and ground fish; the distinction between the last two being slight and difficult to determine. The supply of scrap varies from year to year, according to the quantities caught; some seasons the fish are very plenty, while in others they are scarce. In recent years, manufacturers have become rather more independent of the fish catch, owing to the increased consumption of nitrate of soda. While menhaden is by far the leading source of fish scrap, there are some fish preparations from the cod fisheries and from the sardine or herring fisheries. The supply from these sources is comparatively small, and they are not so well prepared for fertilizing purposes. Pure dry fish scrap is an excellent source of nitrogen. Its best results are obtained on rather light land, as the more compact nature of heavy soils, together with the larger quantity of water contained in such, apparently retards the disintegration of the scrap. It should

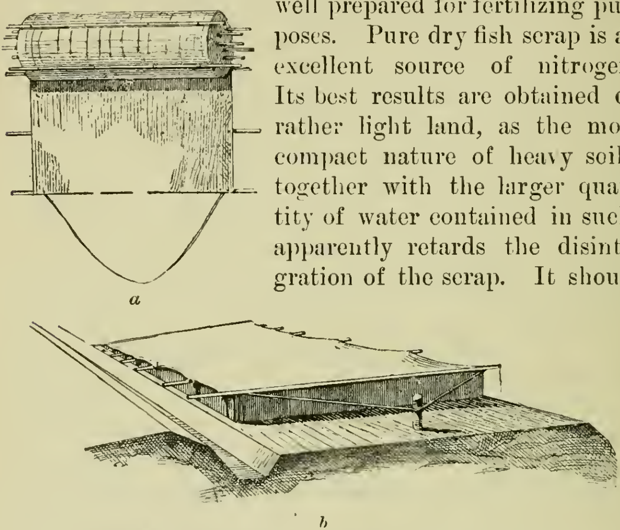

FIG. 18. *a* SHOWS A METHOD OF FIXING THE CLOTH SO IT WILL LAST FOR YEARS; *b*, ITS APPLICATION TO THE PLANT BED.

not be used in the hill, but broadcast only. It is less to be desired than dried blood, but it is far more easily obtained in the market, and it gives excellent results. Care should be taken to distribute it evenly, for if it accumulates in spots, an excessive fermentation results that is distributed to growing plants. Six hundred pounds of scrap can be used in place of 1,000 pounds of cottonseed meal, or 1250 pounds of castor pomace. As in the case of tankage, it is best when applied with manure, because of its lack of organic matter. It need not be applied in the fall, for if broadcasted and harrowed in when the ground is being prepared in the early spring, it will become available for the crop by the time the plants are set.

Other Nitrogenous Substances.—In addition to these flesh preparations, there are others known as azontine, ammonite, etc. These are simply preparations of dried meat, but are of higher grade than tankage and are more uniform in composition. They can be classified with dried blood and similarly handled.

NITROGEN SALTS.

Beside the organic nitrogen supplies, both animal and vegetable, described in the previous pages, an entirely different class exists, known as "salts." These salts are crystallized salts of nitric acid or ammonia. They are perfectly soluble in water, and the nitrogen is in an immediately available condition. They contain no organic matter of any kind, but are practically pure chemicals. They are held in very high esteem for all crops, and are of special value for tobacco, but to obtain the best results they should be used on soils naturally rich in organic matter, or made so artificially by the use of manure, castor pomace, muck, or compost.

There is nothing gained in applying these chemicals much in advance of the crop, for they are perfectly available as plant food whenever applied. In this they differ from all the fertilizing materials previously considered. The nitrogen in all animal and vegetable matter is partly inert and cannot be set free until such matter is disintegrated by fermentation. All these organic matters, therefore, require time, in which this fermentation may go on, before the nitrogen contained in them can be utilized by the plant. But experience shows that, applied as previously directed, these organic manures give up nitrogen to the crop as it can be used. The value of nitrates is modified because nitrogen in this very soluble form is so exposed to leaching. Jenkins has "seen a heavy rain leach away the whole nitrogen supply of a crop where it was in the form of nitrates." It could not do this with organic forms.

The consumption of these nitrogen salts, especially of nitrate of soda, is steadily increasing. There are three of these crystalline salts: Nitrate of potash, which is made by the union of nitric acid and potash; sulphate of ammonia, which is sulphuric acid combined with ammonia, and nitrate of soda, a combination of nitric acid and soda. Of these, the first, nitrate of potash, is rarely used as a fertilizer. It is largely used in the manufacture of gun powder, and commands such a price as to prevent its use for fertilizing purposes. It would seem to be admirably adapted to tobacco culture, owing to its large percentage of both nitrogen and potash, elements especially demanded by this crop, and it should be tried experimentally. Nitrate of potash contains about 14 per cent of nitrogen and 45 per cent of actual potash.

Sulphate of Ammonia.—This valuable salt is obtained in large quantities as a by-product in the manufacture of illuminating gas. It is a white crystalline salt having a slightly bluish tinge and may have a faint odor of ammonia, but it usually is odorless. Its value as an agricultural salt has long been known, and it is largely used for manurial purposes, both in this country and Europe. It is very uniform in composition, and is sold under a guaranteed analysis of twenty-four to twenty-five per cent of ammonia, which is the same as twenty to twenty and one-half per cent of nitrogen. The percentage of free water is very small, rarely over one per cent. It is freely soluble in water, and the liquid sulphate of ammonia is freely separated into compounds available for plant food. It is one of the quickest ammoniates in its effects and is highly prized for its great forcing power. It is especially valuable for hastening the crop if for any reason it becomes retarded.

Owing to its very soluble condition, sulphate of ammonia should be applied just before setting the plants, at the time of the last harrowing. If applied earlier there is a possibility of loss through leaching, especially on light soils. Two hundred and fifty pounds per acre takes the place of 1,000 pounds of cottonseed meal or of 600 pounds of dry fish scrap. The better way to use it is to apply in conjunction with manure, although on any but very light soils it will produce favorable results alone, until the soil becomes depleted of organic matter through continuous cultivation. The best results are obtained by using a small quantity of sulphate of ammonia with manure and organic ammoniates, for the ammonia salt gives a quick start to the young plants, while the nitrogen from the other materials comes in for the later development of the crop. Sulphate of ammonia contains a large quantity of sulphuric acid, which is a decided objection, and the results of its use in Connecticut are such as to make it unpopular with the best growers. Care is necessary that the rootlets do not come into too close contact with it.

Nitrate of Soda.—Much that has been said of sulphate of ammonia applies with equal force to this salt, which is preferred to the sulphate because free of sulphuric acid. It is perfectly soluble and should be applied in the manner indicated for ammonia, and treated in all respects the same. It is a crystalline salt of somewhat pinkish cast, slightly deliquescent (capable of absorbing moisture), and is imported in enormous quantities for manurial purposes, as well as for other industrial uses. It exists in large beds in certain provinces of

Chili, and is often called Chili saltpeter. It is clarified before shipment, and is very uniform in composition, containing about sixteen per cent of nitrogen. It is a combination of nitric acid with soda.

The use of nitrate of soda upon tobacco has not become general as yet, and possibly its large percentage of soda may have some qualifying influence on the crop; more extended experiments are necessary to determine this point. A small quantity of it, however, can be used with safety, and, like sulphate of ammonia, it has great value in giving the young plants a vigorous growth. It has been customary to apply half the nitrate at time of planting, or at first cultivating, and the balance at second cultivating. At Poquonock the application all at once, between rows, at first cultivating, gave best results.

POTASH FERTILIZATION.

The Necessity of Potash cannot be too strongly reiterated. We have shown in Chapter V that tobacco draws more heavily upon the soil's potash than upon any other single element. It also requires a larger amount of potash than does any other crop. Tobacco is a potash feeder to a remarkable extent. It is equally important to note that analyses of soils and practical experience unite in proving that in many localities where tobacco is grown, the land is deficient in potash. This is quite generally true of all tobacco lands that have not been well manured. It is also true of many other soils. Every farmer can readily test his own soil for potash, by planting tobacco or potatoes in plots without any potash, and with potash in varying quantities, moderate amounts of nitrogen and phosphoric acid being furnished in all the plots. If it appears that the absence of potash reduces the crop, and that its presence increases the yield, the imperative necessity of potash is proved.

The table of manurial analyses in Appendix shows how deficient ordinary stable manure is in potash, and how few substances furnish it in liberal proportion. Thus the deficiency of potash, both in the soil and in ordinary manurial substances, must be made good. But while potash is of paramount importance to the tobacco plant, great care must be exercised to exclude all contamination with chlorine. Potash combines freely with chlorine, and in the muriate of potash is wholly present; common salt (chloride of soda) is also frequently found in many potash salts. But the demand for a potash salt free from this defect has caused the introduction of high grade sulphates that are practically free from chlorine.

Potash Salts are obtained from the potash mines at Stassfurt, Germany, and are largely used for manurial purposes, both in Europe and this country. The native salt is a mixture of sulphate and muriate of potash with common salt, and is clarified after mining. Kainit, the lowest grade sulphate, contains 25 per cent of sulphate of potash (equal to 12 per cent actual potash), and 60 per cent of common salt, and should never be used for tobacco because of this last defect. Muriate of potash, 80 per cent purity, contains 50 per cent actual potash, and about 15 per cent common salt, and for this last reason is eschewed by tobacco growers. The first salt satisfactory for tobacco culture was the double sulphate of potash and magnesia, or double-manure-salt, and it is still used with good results. As its name implies, the sulphuric acid is combined with potash and magnesia, and also with soda to some extent; its analysis is given in Table IV, Page 112. But it contains so much chlorine that it is not now approved for fine wrappers, and the Poquonock results are against it. Whether its magnesia is of much use is also a question. Double manure salt is usually sold on a guarantee of 48 to 50 per cent sulphate of potash (equal to about 25 per cent actual potash), and lately the further guarantee "less than two and one-half per cent chlorine" is also given.

The high grade sulphate now imported is more desirable, since it contains no chlorine at all, is more concentrated and, moreover, comes in a fine, mealy condition. It is guaranteed to contain from 96 to 98 per cent sulphate of potash. This is equivalent to 50 or 51 per cent actual potash, or just about the same as is found in muriate of potash of 80 per cent muriate. The two to four per cent of other matter in this high grade sulphate is mainly composed of water. This is an admirable salt for the tobacco crop and should be used extensively.

How to Apply Potash Salts.—In Germany the usual custom is to apply potash salts in the fall upon all but very light land. In this country, spring applications are exclusively followed, and as no great additional benefit can be expected from fall applications, the present custom will probably continue. To raise a first-class crop of tobacco there should be at least 300 pounds of actual potash in the soil available for plant use. To furnish this it is necessary to apply 500 pounds of high grade sulphate, or 1000 pounds of double sulphate, per acre. In addition to this is the potash obtained from cottonseed meal, manure, stems or other articles. The same rule advanced in applying nitrogen,—the necessity of a much larger supply than the plant actually requires,—holds good in furnishing potash, though in a less degree. Potash does not leach, and what is applied remains permanently in the soil, but the trouble is that it is often too permanent. It has a tendency to form insoluble compounds, and when these are formed a certain per cent of potash becomes locked up and lost to the plant. Potash, however, has no forcing effect, and the only reason for an excess is to avoid the possibility of a deficiency, either from uneven distribution or from the formation of insoluble compounds. The salts should be applied broadcast, in the spring, at the time of the first harrowing.

Cottonhull Ash is extremely popular as a fertilizer, especially with scientific growers of prime tobacco for cigar wrappers. This is mainly due to the large quantity of potash the ash contains, and also to the fact that this potash is soluble. It also contains a goodly amount of magnesia, as well as lime and phosphoric acid; the two former elements being as essential for this crop as is the potash or the phosphoric acid. It is quite probable, too, that the soluble carbolic acid in cottonhull ash adds to its excellent effect on the soil. The following are complete analyses of a fair average sample of cottonhull ash, made by Jenkins at Connecticut station, and by Goessman at Massachusetts station:

	Connecticut.			Mass.
	Sol. in water.	Insol. in water.	Total.	
Potash,	25.20	2.65	27.85	28.2
Soda,	.50	.80	1.30	?
Lime,	none	5.23	5.23	10.5
Magnesia,	.20	11.04	11.24	15.3
Oxide of iron and alumina,	none	1.64	1.64	?
Phosphoric acid,	1.52	8.29	9.81	8.1
Sulphuric acid,	2.32	0.09	2.41	?
Carbonic acid,	8.28	3.31	11.59	?
Chlorine,	.21	none	.21	?
Silica and sand,	.16	9.34	9.50	10.6
Water and charcoal,			19.22	17.2
	38.39	42.39	100.00	

Cottonhull ash varies widely in composition. Different samples contain from 10 to 40 per cent potash, average 23 per cent; phosphoric acid 3 to 14 per cent, average 8 per cent. Hence, this ash should only be bought on a guaranteed analysis, and at a price that will make the actual potash cost only four to six cents per pound. The wide variation is due to the carelessness with which the hulls are burned in Southern mills, being mixed with wood or coal. When screened and free from excessive moisture, the analysis is not liable to be much below the average stated. The fact that skilful Connecticut valley tobacco farmers continue to purchase this article in increasing quantities year after year, at from $25 to $35 a ton, is good evidence that a fair equivalent for the money is received.

A better idea of the peculiar composition of cottonhull ashes can be obtained by comparing them with the analysis of wood ashes, given in the next line above it (Table IV, Page 112). Average cottonhull ash contains nearly 25 per cent of potash and about 8 per cent of lime. In wood ashes this condition is nearly reversed, the lime being 33 per cent, while the potash is 5 per cent. To furnish as much potash in the form of wood ashes as is obtained in an average ton of cottonhull ash, five tons of wood ashes would be necessary, which, at $11 to $15 per ton, makes a total cost of $60 to $75, or double the cost of cottonhull ash. The quantity of phosphoric acid obtained from cottonhull ash is also four times as much as from wood ashes—as lime is a very cheap article, costing about $12 per ton, it is economy to purchase the cottonhull ash and supply the deficiency of lime, than to use wood ashes. These facts have been determined by experience as well as analysis, and the custom of applying cottonhull ash and lime to tobacco lands is quite general wherever this ash is extensively used, oyster shell lime being preferred.

Another Objection to Wood Ashes is the great bulk of matter that must be handled if they alone are used as a potash supply. There is, however, some compensation in the large quantity of lime obtained, and wood ashes can be used in part on tobacco lands. The reasonable price of cottonhull ash has prevented any extensive use of wood ashes, and the latter can only be regarded by the tobacco grower as a source of lime so long as cottonhull ash can be obtained in the present quantities. Cottonhull ash is applied broadcast in the spring at the time of first harrowing, at the rate of 750 to 1000 pounds per acre. As the ash is generally considered to contain about 25 per cent of potash, 750 pounds gives about 187 pounds of potash, and 1000 pounds of ash about 250 pounds of potash.

As the fine quality of the present sulphate of potash salts becomes more generally appreciated, there is a tendency to use them instead of cottonhull ash, the only reason for the abandonment of the latter being the uncertainty of composition. This ash, however, is yet the most popular potash supply, and it will long continue to be so because the potash in it exists as the carbonate of potash, which is by far the best form. Carbonate of potash exerts a powerful influence on the soil through its caustic properties, and this gives it a greater value than an equal amount in the form of sulphate of potash. Another important point is the entire absence of chlorine in cottonhull ash.

OTHER MANURIAL SUBSTANCES.

Tobacco Stems supply both nitrogen and potash. These stems must not be confused with tobacco stalks. Stems are the midribs of the leaf that are discarded when the leaf is cut into wrappers, or stemmed for the English markets. They are largely employed in fertilizing tobacco fields, and at one time the demand for this purpose was very strong. Stems vary considerably in analysis, according to the quantity of sand and water present; but they are usually a good purchase at $10 per ton, but during the boom, prior to the panic of '73, they sold as high as $35 a ton. Kentucky stems contain about 25 per cent water, organic and volatile matter 62 per cent (including nitrogen 1.8 per cent), and mineral matter 13 per cent, of which about 8 per cent is potash and 1 per cent phosphoric acid. Seedleaf stems are usually drier, containing about the same quantity of nitrogen and phosphoric acid, but one-fourth less potash. As with all coarse material, stems should be applied very early in the spring, and the better plan is to plow them under in the fall. They supply both nitrogen and potash, and are well suited to the tobacco crop. They are so popular in the Connecticut valley that all the stems available have been used, and before the season for selling closed (about June 10), each year has found the dealers with their stocks exhausted and their late orders unfilled, from 3000 to 5000 tons of stems being used annually.

Lime is used to a considerable extent upon tobacco lands in the seedleaf districts, and its effect is somewhat peculiar and not wholly in the way of a food element. Tobacco ash contains a large percentage of lime, but on some lands sufficient is present in the soil to meet the demands of the crop. But the opinion is growing that a sufficiency of lime is more often lacking in the soil used for tobacco than is usually supposed. Lime is constantly leaching from the upper layers into the lower strata of soil. All saline manures make it leach further. Tobacco, as well as other plants, possesses the power of substitution, and where lime is abundantly present and potash is lacking, a larger quantity of lime is consumed than would otherwise be the case. It is, therefore, well to have a fair quantity of lime present, more, even, than is usually found in the soil.

The most important action of lime, however, is not that of a plant food, but rather that of a mechanical agent. It promotes nitrification, or the conversion of crude animal and vegetable matter into nitrates. It destroys woody tissue, and when used in excess, burns out the vegetable matter present in the soil, impairing its future value. A little of this burning effect is valuable, since by it latent plant food is made available, but lime should not be used on light lands unless plenty of vegetable matter also is present. Lime corrects the acidity of soils by combining with any excess of acids that may be present. It also, to some extent, acts upon the mineral elements and sets free potash that would not otherwise be available.

Another characteristic of lime is that it improves the texture of both light and heavy soil, but in entirely different ways. It binds together the loose particles of light soils, making them more compact, increasing their capacity to absorb and retain moisture, thus correcting the waste features of such land. On heavy, especially on clay, soils, it has an entirely different effect, as it overcomes the tenacious nature of the land, causing the particles to fall apart, thus promoting ease of cultivation and the better development of plant roots. On cold, wet lands it improves the mechanical condition of the soil by making it lighter. It also corrects the acidity usually present in wet soils, promotes nitrification, and gives it life and energy. Almost any soil that becomes hard and compact can be improved by a moderate use of lime. On tobacco lands it is not used now as much as in former years, although it is resorted to whenever the mechanical condition of the soil requires it.

How to Apply Lime.—The power of lime to liberate dormant plant food is very great and fully understood, and where land has been heavily dressed with manures for a number of years, an application of lime produces very favorable results. On this account it was formerly the custom to make quite a heavy application at intervals of three or four years, but it is now believed that small, annual applications are better. On the general run of lands, 500 pounds is ample, and more often one cask per acre is used. Nova Scotia lime, such as is used for building purposes, is the best. Some advocate the use of air-slaked lime only, while others prefer to apply it in a more caustic state.

A favorite way is to dump the contents of a cask on the plowed field, leaving it a few days to slake by the influence of the moisture of the air and the soil; if then it is lumpy, sufficient water is added to reduce it to a fine, dry powder, care being taken that it does not become pasty. It is then scattered broadcast over the field, after the manure has been applied.

As in the case of manure, the best time to apply it is in the fall, or if not done then, very early in the spring. It absorbs the excessive water in the land, and also assists in reducing coarse manure to the more congenial form of vegetable mold. Lime exists in large quantities in wood ashes, and to a smaller extent in cottonhull ash, and some of the beneficial action of wood ashes results from the lime. In leached ashes, which are highly prized in some sections for grass lands, lime is very abundant, and the effect produced is almost entirely from the lime. Where it can be cheaply bought, oyster-shell lime is particularly prized because of its fine mechanical condition, and its use is on the increase.

Sulphate of Lime, gypsum or plaster, is used to some extent on tobacco, and at one time was highly recommended. While the plants have the power of obtaining lime from the plaster to some extent, its principal function is that of an absorbent only. It takes up water greedily, and has an affinity for ammonia, but whether sufficient to prevent in part the liability of loss of nitrogen by leaching is not demonstrated. Sulphate of lime also has some influence upon the potash compounds of the soil, setting the potash free from inert combinations. For these reasons, about five hundred pounds per acre have been used on light lands, especially where a large quantity of organic matter is present. But in the absence of tests to determine its value, the use of gypsum on tobacco land is not to be recommended, for it is not yet shown to possess any advantages over lime alone, while it may be objectionable.

FERTILIZER FORMULAS.

From the previous pages it appears that a wide range of materials can be used for fertilizing tobacco lands. And if one material should be difficult to obtain, another can be substituted. Of course, the greatest variety is in the nitrogenous compounds, as the materials are animal, vegetable and purely chemical. The sources of potash are confined to two materials, ashes and salts. To summarize the facts given in the foregoing pages, the best plan will be to give formulas, or methods of mixing. It should be emphasized, however, that barn manure should be used with these formulas to as large an extent as possible. All the following formulas are based on a previous application of eight to ten cords of manure per acre, or three tons of tobacco stems, and each one has been widely used. While the use of cottonseed meal is very general and has given good results, it can be replaced with other ammoniates in case meal cannot be obtained, and, in fact, it would probably be an improvement to use other ammoniates in conjunction with the meal. A mixed nitrogen-supply gives better results, as a rule, than when a single material only is used, for if the action of one is hindered, or too rapid, the others correct this defect. This is the rule used in compounding commercial fertilizers.

No. 1. Composed of	Containing
2000 lbs. cottonseed meal,	Nitrogen, 130 lbs.
1000 lbs. cottonhull ash,	Potash, 230 lbs.
500 lbs. lime,	Phosphoric acid, 126 lbs.
500 lbs. plaster,	

The essential elements are derived from the meal and ash; the plaster and lime only being supplied to affect the soil mechanically and to assist the burning qualities of the tobacco. Linseed meal is used instead of cottonseed when it can be bought to better advantage. This formula has also been modified by omitting the lime and plaster, adding more ash or meal, and sometimes by adding small quantities of superphosphates, or tankage. It is also used in the following combinations:

No. 2. Composed of	Containing
1000 lbs. cottonseed meal, 1250 lbs. castor pomace, 500 lbs. cottonhull ash, 500 lbs. double sulphate of potash, 500 lbs. lime, 500 lbs. plaster,	Nitrogen, 128 lbs. Phosphoric acid, 45 lbs. Potash, 288 lbs.

No. 3. Composed of	Containing
1000 lbs. cottonseed meal, 600 lbs. dry fish scrap, 500 lbs. 96 per cent sulphate potash, 500 lbs. lime, 500 lbs. plaster,	Nitrogen, 116 lbs. Phosphoric acid, 60 lbs. Potash, 267 lbs.

No. 4. Composed of	Containing
1000 lbs. castor pomace, 500 lbs. dry fish scrap, 100 lbs. sulphate of ammonia, 500 lbs. 96 per cent sulphate potash.	Nitrogen, 113 lbs. Phosphoric acid, 60 lbs. Potash, 267 lbs.

No. 5. On old tobacco fields that are in good heart, a favorite formula at present is 2000 lbs. cottonseed meal and 1000 lbs. cottonhull ash.

No. 6. One well-known tobacco grower says: "My formula for a homemade tobacco fertilizer is 2000 lbs. cottonseed meal, 1000 lbs. double sulphate of potash, 1000 lbs. plaster and 1000 lbs. lime, and it is the best and cheapest fertilizer for tobacco I have ever tried."

No. 7. Another applies 10 cords of manure per acre, from 1000 to 2000 lbs. cottonseed meal, and 400 to 500 lbs. Peruvian guano.

No. 8. A formula used by several successful growers is for one acre of land that has a good supply of manure or vegetable matter in the soil:

Composed of	Containing
300 lbs. lime, or about 1 cask, 400 lbs. sulphate of potash, 500 lbs. pure bone meal, 2000 lbs. cottonseed meal,	Nitrogen, 166 lbs. Phosphoric acid, 140 lbs. Potash, 234 lbs.

No. 9. Another favorite formula is

Composed of	Containing
1500 lbs. cottonseed meal, 1500 lbs. cottonhull ash, 500 lbs. lime, 500 lbs. plaster,	Nitrogen, 97 lbs. Phosphoric acid, 150 lbs. Potash, 400 lbs.

No. 10. A homemade tobacco fertilizer that gave good satisfaction:

Composed of	Containing
2000 lbs. cottonseed meal, 1000 lbs. cottonhull ash, 1000 lbs. lime,	Nitrogen, 152 lbs. Phosphoric acid, 164 lbs. Potash, 360 lbs.

No. 11. Another, used with excellent results at the rate of two tons per acre:

Composed of	Containing
1000 lbs. cottonseed meal, 500 lbs. cottonhull ash, 50 lbs. lime,	Nitrogen, 76 lbs. Phosphoric acid, 82 lbs. Potash, 160 lbs.

COMMERCIAL OR MANUFACTURED FERTILIZERS.

In the early years of the fertilizer industry, the presence of large quantities of chlorine in the potash salts, and the use of animal matter, tankage, blood and fish, together with the general ignorance of the peculiarities of the tobacco plant, resulted in the production of unsatisfactory commercial fertilizers for tobacco, and a distrust of such preparations grew up among tobacco growers, which may still exist in some measure. As the value of the crop increased and large areas were devoted to its culture, more attention has been given to its requirements by fertilizer manufacturers. Some of them have made a study of the results of scientific and practical experiments, and there is to-day almost no risk to even so delicate a crop as tobacco, from the judicious use of the best known brands of tobacco fertilizers. The Connecticut valley crop of the finest quality that sold for the highest price in recent years, was grown on a well-known tobacco fertilizer.

The one condition of fertility that is deficient in prepared fertilizers is organic matter. And manufacturers make a mistake in advertising the exclusive use of their fertilizers, when far better results can be attained by applying them in conjunction with manure and other organic matter. This has resulted from the idea that where manure is used, fertilizers will not be employed, and, therefore, the less said about manure by the manufacturers and the more farmers are led away from it, the larger will be the sale of commercial preparations. While this may be true with some crops, it is not so with tobacco. All artificial fertilizers, whether prepared by the manufacturer or the farmer, give the best results on soils in good heart; that is, rich in organic matter.

The manufacturers of the best tobacco fertilizers guarantee that the potash is from sulphate salts only, and that chlorine is not present in appreciable quantities. Some also state that no nitrates are present. These fertilizers come prepared in admirable mechanical condition and contain from 4 to 6 per cent of nitrogen, from 7 to 11 per cent of actual potash, while the phosphoric acid does not much exceed 6 per cent, and sometimes is less, but little of it being in an insoluble form. Each fertilizer is compounded by a private formula, whereby the manufacturer seeks to preserve the uniformity of results

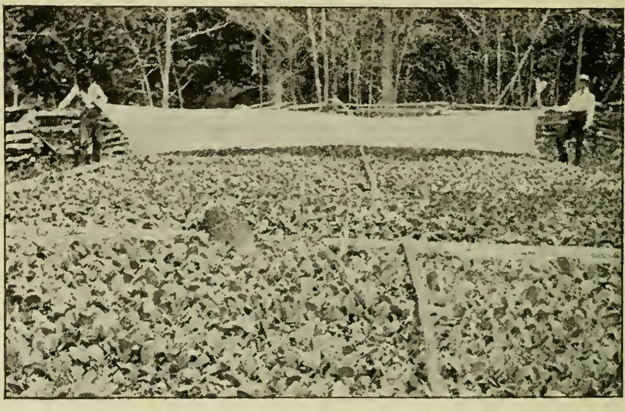

FIG. 19. REMOVING CLOTH COVER FROM LARGE BED OF PLANTS.

obtained, and each one very naturally claims that his own brand is the best for the peculiar requirements of the crop. Undoubtedly, the plant food in the different brands is obtained from different materials, or from different proportions of the same materials, as each variation produces a somewhat peculiar influence on the soil and plant. The popularity of the brands differs in different sections, or with different growers. Where a brand has demonstrated its value by producing satisfactory crops, it is a good plan to continue its use. But the average analysis shows that, taken as a whole, without allowing for peculiarities of composition of the fertilizer itself, or of the soil on which it is used—which cannot be told by analysis—any of the standard brands are good; and experience shows that they can be used with safety to the crop and profit to the grower.

How to Use Commercial Fertilizers.—The following directions as to how much fertilizer to use, how to apply it, etc., are given by a well-known manufacturer, and his remarks apply with equal force to all brands. Alone, without anything else, a ton of high grade commercial fertilizer is good manuring. Sow one-half ton or more per acre before plowing, then plow under lightly (half depth). In ten days or two weeks plow the land at full depth and sow on the balance, thoroughly cutting in with a long-toothed wheel, or any of the improved harrows. This will leave the land, so far as manuring goes, ready for fitting in the usual way before setting plants. If one-half quantity stable manure is used, then sow half a ton per acre at last harrowing, working it into the land thoroughly. Then fit the land for setting, as usual. If three-fourths quantity of stable manure is used, apply 500 to 600 pounds per acre and harrow in at last harrowing, and fit the land in usual way. When fertilizer is used alone on sod land, apply 2000 pounds per acre after plowing, and thoroughly cut in with wheel, disk or long-toothed harrow, *as long as possible before the time* of fitting the land. Then harrow again, and fit the land for setting in ordinary way.

CHAPTER VII.

THE SEED BED—RAISING SEED.

No step in the culture of tobacco is more important than proper care in the preparation and the sowing of the seed beds. This work cannot be neglected in manner or season without running the risk of making a partial, or total, failure of the crop. To make good beds is a laborious task, and requires ripe judgment, both in the selection of the location, the soil, and in the preparation of the land. To have plenty of good, strong, healthy plants is the surest foundation for a good crop of tobacco, provided they are from seed true to the desired standard.

1. *As to Location.*—The land selected should have a slightly southern exposure, if possible, to get the full benefit of the warm rays of the sun in early spring, so as to hasten the growth of the plants, in order that they may be transplanted before the hot summer weather sets in. A southeastern exposure is next to be preferred, then a western. The worst of all is a northern slope. All trees standing within thirty feet of the bed should be cut down. Protection on the north and west sides by a skirt of woods is desirable, inasmuch as the young plants are thus sheltered from the cold blasts of early spring. The best possible situation is on a sloping hill on the north side of a running stream, but sufficiently elevated to be above any danger from overflows. In such a situation the fogs will quicken the germination of the seeds and accelerate the growth of the plants, bringing them forward from ten days to two weeks earlier than on level land.

2. *As to the Soil.*—The best is a rich, friable, black virgin loam, or sandy soil. Black is preferable because it absorbs to a greater degree the rays of the sun, and brings forward the plants several days earlier, which is highly important to the tobacco grower. A difference of a few days often makes the difference between a rich, fancy article and a dull-colored, frosty one. The preference in the Clarksville heavy-shipping district is a spot in the woods, covered with a dense, hazel thicket, or black gum with a few scrub hickories. This wild growth invariably indicates rich, loose, deep soil, with a large content of potash. In the White Burley district of Kentucky, beds are originally burned and prepared on old sod lands. Many good farmers select a place in their vegetable garden, cover it with virgin mold taken from the woods, and sow it after thoroughly burning the land. In the North a dark but rather sandy soil is preferred as best adapted to a strong growth of roots; the surface does not bake or crack when dry, and the plants can be lifted easily without much damage.

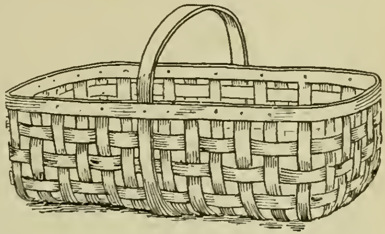

FIG. 20. BASKET FOR CARRYING PLANTS.

3. *As to Burning.*—The wild growth should be cut off near the surface of the ground with an axe, not dug up; the leaves carefully raked from the land, and then, beginning at one side, a layer of trash should be put down longitudinally, until it is about four feet high and four wide. Against this, brush should be set up, nearly vertically, leaning just enough to prevent it from falling back on the bed. This is continued until about eight feet of the length of the bed is passed over, when a layer of wood, eight feet long, is set on the end lean-

ing against the brush. After this, eight feet more of brush is set up, and a layer of wood, and so on until the whole space is occupied. It should then be set on fire, and when the brush burns out the whole bed will be thickly covered with burning wood, which will be consumed upon the ground and burn it sufficiently hard. The brush may all be set up without interspersing the wood and then afterward the whole should be covered with a layer of wood, as shown in Fig. 12. Old rails laid upon skids, so as to keep them from lying on the ground, three or four deep, or the logs of an old house, are admirable materials for burning plant beds. They are easily set afire and burn the ground well. In repairing fences, the old rails should always be kept for this purpose. They save much valuable timber and a great deal of hard labor. The burning destroys all weed seed.

4. *Preparation and Sowing.*—The ground should be burned until it has a reddish, or soft, brick-like appearance, and will pulverize into an impalpable powder. It should then be coultered, or spaded up, and chopped over with hoes until it is well prepared. The ashes should not be raked off, but thoroughly incorporated with the top soil. At the North, a heavy dressing of well-rotted horse manure, hog manure or cottonseed meal is applied in the fall, so that the fertility can be well spread through the soil. Then in the spring about 150 pounds of some high-grade commercial fertilizer is raked in to every 100 square yards.

As soon as the ground can be worked in the spring without packing, and danger from hard frosts is over, it should be harrowed, or lightly spaded, and made very fine and friable by both harrow and hand rake, and to a depth of two or three inches. Care should be taken not to reverse the soil. All roots and rocks should be picked up, the land receiving a good raking after each digging. When in nice order, mark off beds four feet wide, and it is ready to be seeded.

It is usual at the South to sow at the rate of one heaping tablespoonful of seeds to every 100 square yards. In the Connecticut valley the rate is to sow a tablespoonful of seed to each square rod of bed; this gives about 60,000 seed, but many will be covered too deep and therefore fail to grow. Some sow the seed by taking a small quantity between the thumb and finger and scattering over the bed, first one way and then the other, to ensure even seeding; others mix the seed, before sowing, with a pint of corn or cottonseed meal, or ashes or land plaster, as it is then easier to handle, and the meal can be seen upon the ground and a more perfect sowing made. Some sprout the seed and claim they save a few days in starting. While such seed comes up a little quicker, it is doubtful if any material difference in the size of the plants can be seen in three or four weeks. To sprout seed, place a piece of dark, woolen cloth in a dish, and cover the cloth about one-fourth an inch deep with seed; then place another woolen cloth over it, and saturate with warm water, and place in a warm spot near the stove. In three or four days small white spots can be seen on the seed, indicating germination, and it then should be sown at once; longer sprouting would develop rootlets, and this should not be done until the seed is in the ground.

Do not rake in the seed; that would cover it too much. The best plan is to run a heavy hand roller over the bed, or press it with a board, or with the feet, until the entire surface is smooth and compact. Southern planters tramp in the seed by going around the bed, one foot following the other, with toes pointing outward, making a smooth, well-tramped surface. Firming the soil is very essential to success, as the compact surface

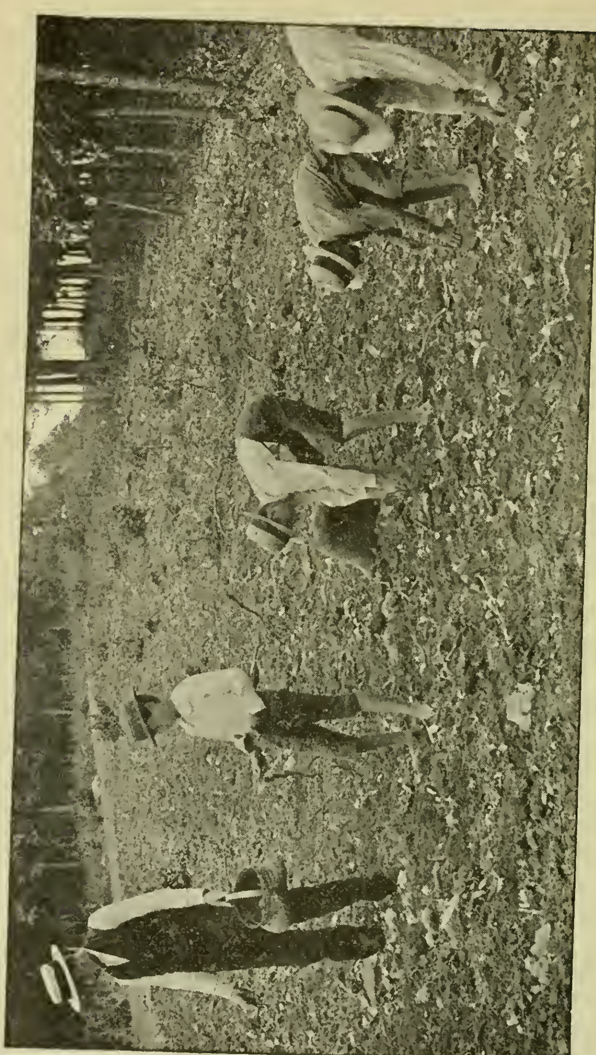

FIG. 21. SETTING TOBACCO PLANTS IN TENNESSEE.

retains the moisture in the ground, which materially assists in the growth of the seed and tiny plants.

A frequent mistake is made in using too much seed. It is better to err in using too little. In the latter case, the plants will be large, healthy, low and stocky, and will withstand a very hot sun, and may be set with very little moisture in the soil. When plants are crowded in the bed the stems are small, delicate, white and crisp. They have such a weakness of constitution that hundreds of them perish after being transplanted, and even if they survive this shock, their vitality is so feeble that several weeks must elapse before they show a healthy growth. In the meantime, they are preyed upon by cutworms, grasshoppers and other enemies, so that a good stand is almost impossible to be secured with such plants. In consequence, the tobacco field is of uneven growth, which entails much unnecessary work upon the farmer and seriously impairs the value of his crop. Trenches should be dug on the upper end of the bed and on both sides, so as to keep any floods of water from running over the bed. In Germany this is done as shown in Fig. 13.

Sprouting the Seed, which is not practiced in the South, is frequently resorted to by northern growers in order to hasten the growth of the plants. In Wisconsin, the seed is mixed with finely pulverized, rotten wood, taken from the hollow of an old stump or log, and placed in a pan or dish in a warm place, where it is kept moderately damp by sprinkling with tepid water. Under such conditions, the seed will germinate in about two weeks, and is sown as soon as the danger of frost is passed. Another plan is to sprinkle the seed thinly upon a piece of dampened cotton cloth and cover it with another cloth made of wool. The two are rolled together, the woolen cloth on the outside. This roll is kept in a warm place, or under a stove, and dipped in tepid water every day. In from four to six days the white germs will appear. In the northern part of Illinois such cloths are kept moist in a pan of earth, of which there is a layer below as well as above the cloth. Great care must be observed in all these forcing processes. It often happens that the soil of the plant bed is too wet, or otherwise not in proper condition when the seed is ready, and when the delay of a day or two may render the sprouted seed useless. Prudence would suggest, in such a case, the preparation of several parcels of seed at intervals of a few days.

Covering for Plant Beds.—Nothing that has ever been invented or devised has effected so much for the tobacco grower, at such a small cost, as a canvas covering for the seed bed. It is an absolute protection against the ravages of the flea beetle; it hastens the growth of the plant by keeping the bed moist and warm, and it prevents the accumulation, on the bed, of drifted leaves or trash. The heat absorbed by the soil from the sun's rays during the day is radiated, and lost at night in the open air; but under this covering it is reflected by the canvas to the soil again, and thus a warm temperature is preserved, highly promotive of the growth of the plants. A given area, protected by canvas covering, will furnish at least a third more plants. Its construction is very simple. A frame or box is made around the bed, four or five inches high, as shown in Fig. 15. A few wires may be stretched across the frame, and closely tacked on the edges to uphold the canvas. In place of wire, a small quantity of light brush thrown over the bed will help to sustain the weight of the cloth. Better than either are a few bows made of wire, like the wickets used in croquet sets, and stuck at intervals over the bed. These will hold up the canvas and yet leave it flexible.

Instead of making the frame the full size of the bed, a more convenient plan, probably, would be to construct a number of smaller frames, eight or ten feet square, over which the cloth may be stretched and securely fastened, a sufficient number of these frames being provided to cover the beds. Such frames, well braced, with their covering, could be removed when no longer needed and put away for future use. If the cloth is treated with a single coating of white lead and oil, it will last for several years.

Still another method may be more economical. The frames may be made, and properly braced with diagonal pieces inserted at the corners, flush with the

FIG. 22. SETTING PLANTS BY HAND.

upper edges of the plank. The cloth or canvas should be cut some three inches longer and wider than the frame and hemmed along the edges. Eyelet holes worked along the edges make it easy to fasten the canvas to hooks, pegs or nails driven in the outer faces of the frame, two or three inches below the upper edge. Constructed in this manner, the canvas may be rolled up so as to let in the air and sunlight to harden the plants, see Fig. 16. Such coverings for beds amount to a positive insurance of the plants at a very small expense, for the cost of a frame and canvas to cover one hundred yards need not exceed four dollars, as the price of suitable cloth ranges from three to three and one-half cents per yard, and will, if taken care of, last several seasons. At the North, glass is often used instead of cloth—regular hotbed sash, five and one-half feet long. Cloth-covered frames of the same size are made to take the place of the glass sash after the plants are well started, this arrangement being shown by Fig. 17.

Other Methods.—Some planters select a place and make a standing bed, which is kept and used from year to year. After the planting season is over, and before the grass and weeds have gone to seed, the standing bed is coultered, and then covered with straw, leaves, or brush with leaves on, so thickly as to hide the surface and prevent vegetable growth. The trash and brush are burned off at some dry time in November, or later. Such standing beds, if well manured, are said to become better each succeeding year. They are heavily dressed with fresh loam from the woodlands, and composts of stable manure, thoroughly rotted, care being taken to handle it so as to destroy all foreign seeds, and also with frequent topdressings of good commercial fertilizers.

In Louisiana the soil is not burned at all in making seed beds, because the immense quantity of undecomposed vegetable matter contained in the soil makes it too light and porous when burned. A spot is selected, generally of old land, which is highly manured with cow dung spread on to a depth of six inches, and turned under with a spade or plow. After this, the bed is chopped fine with a hoe and pulverized with frequent rakings. This is done in October. The bed is worked again in December, and beaten with the back of a spade, or compacted with a roller; channels to secure drainage are cut through it every three feet, and the seed is sown in January.

In Tennessee and Kentucky, when beds are made upon rich virgin soils, manurial applications are rare, but in all the Atlantic States it is the general practice to chop fine well-rotted stable manure in the soil when the bed is being prepared for sowing. Many sow the seed, and even the surface of the bed with well pulverized manure free from grass seed. A light dressing of the sulphate of lime (land plaster) has been found of great service, also one of the superphosphate of lime. Liquid manure applied after the plants are up will probably be found the best of all applications to promote a rapid and healthy growth. A good liquid manure for this purpose is made by taking a tight barrel half filled with cow dung or well-rotted stable manure, and adding water enough to fill it. The whole should be stirred until it becomes a thick, soapy mass, which should be applied to the bed by using a broom as a sprinkler. A gallon of guano in a barrel of water will also be found to stimulate the growth of the young plants. This quality, without detriment, may be used on one hundred square yards.

As to the Best Time for Burning Plant Beds, there is a variety of opinion. They may be burned at any time from the first of November until the 25th of March, when the ground is dry enough. A bed burned when the land is wet or frozen rarely does well. When the land is too wet to plow, it is too wet to burn plant beds. Those burned in the fall usually require less fuel, are more easily prepared, and the ashes have more time to rot, thus making better plant food. The ashes should not be removed, but incorporated with the earth. When beds are burned in the fall, they should be dug up and prepared for sowing. In this condition they should be left to the ameliorating effects of the freezes until the latter part of January or the early part of February, or even as late as April, when canvas coverings are intended to be used. One of the best tobacco growers in the South gives it as the result of his experience for thirty-

FIG. 23. BEMIS TRANSPLANTER AT WORK.

This machine sets cabbage, tomato, strawberry and other plants, as well as tobacco plan
It is made by the Fuller & Johnson M'f'g Co., of Madison, Wis., U. S. A.

five years, that a rod of land well burned and prepared in the fall, will furnish as many good plants as double the area burned at the usual time, in February or March. This planter, however, had never used the canvas covers.

The question has been frequently asked, why soils unburned will not answer as well as burned soils. All the good effects of burning have never been accounted for. We do know, however, that soils well burned will bring strong, healthy plants, and those unburned will often produce yellow, small and sickly ones. One effect of the fire is to destroy all the seeds of weeds and grass, giving the entire land to whatever seeds are sown upon it. A second effect is to render the soil more permeable to the roots of the plants, and by increasing its absorptive capacity, preserve the proper degree of warmth and moisture. A third effect is the inducing of a more thorough pulverization of the soil, rendering it more friable, and increasing, as it were, the area of the feeding ground of the roots, thus rendering more plant food available.

Another beneficial effect is produced by the presence of minute particles of charcoal, which, being black, makes the bed warmer, and being a good condenser of the gases within its pores, particularly of carbonic acid gas (absorbing, as it does, 90 times its volume), it collects a rich supply of food for the plants. And finally, it is well known to chemists that burned clay, being more porous, absorbs ammoniacal and other gases from the soil and from the atmosphere more readily, and fixes them for the use of plants. All clays, says Mr. Johnson, contain sensible quantities of most of the mineral substances,—potash, soda, lime, etc.,—which plants require for their healthy growth. They are, however, in an insoluble condition, which circumstance, united to the stiffness of the clay, prevents the roots of plants from readily taking them up. The chemical condition of the constituents of the clay is altered when burned by a gentle heat, and the substances which the plants require are rendered more soluble.

CARE OF PLANT BEDS.

The covering, whether of glass or cloth, should be removed after the plants are up, in the sunny part of the day at first, and gradually for a longer time, until

FIG. 24. FIELD READY FOR MACHINE TRANSPLANTING (Connecticut).

finally no covering is used. This "hardening" process is absolutely necessary, to give the plants sufficient strength of constitution to withstand transplanting into the open field, and to make a vigorous start when so transplanted. The plants may be so uneven as to require that part be covered while the rest are exposed (Figs. 15, 16, 17), but usually the entire covering is removed (Fig. 19) after the sun is well up, but is spread again at night, until all danger of cold or frost is past. The bed must be kept clean and free from weeds, and well watered.

The aim of the grower is to raise early, strong and stocky plants, and not those of a weak or spindling nature. It is a good plan to have two or three beds planted at intervals of a few days. This ensures plenty of plants, and also meets the possibilities of the season. If the season opens early, those from the first bed can be used; if later, those from the second or third bed. Plants from the later beds are just what are wanted for resetting.

A bed ten yards square, if well prepared, should set six or seven acres. But it is always safe to prepare double the area or number of seed beds thought to be necessary, for no tobacco grower ever regrets having a surplus of plants; in that case, he may select the best. For transplanting to old land, the plants should be larger than for new land.

RAISING THE BEST TOBACCO SEED.

To raise good tobacco requires, in the first place, good seed. This is more essential in tobacco than any other crop, because the range of types, grades and prices is wider in this than any other crop. And the seed controls all these as much, if not more, than any other one factor. Tobacco, apparently, has a natural inclination to depart from a fixed type and break into sub-varieties, thus adjusting itself to the climate and soil in which it is placed. Moreover, the pollen is easily disseminated, and may be carried half a mile or more, causing much crossing where several varieties are grown near together. To grow good seed requires time and patience, but it will pay better than any other work done on the crop. Seed is often saved from any well-growing plant, regardless of the chances of cross-fertilization, in a careless, shiftless way, resulting in much confusion of varieties and a great lowering of quality. This is all wrong, but it is the general practice at the South, and too often done at the North. There are a few farms in the United States that make a specialty of growing tobacco seed. A bushel of seed, of manufacturing varieties, is worth from forty to fifty dollars, but cigar-leaf growers often pay as high as two dollars per ounce, and the prices of cigar-leaf seed varies from fifty cents to two dollars and a quarter per ounce, a fair average for good seed now being one dollar per ounce. "Cheap" seed is always the most expensive. The best growers cheerfully pay the highest price for seed known to be pure and of the best quality.

The largest, and possibly the best, tobacco seed farm in the world is the Ragland seed farm at South Boston, Virginia. On this farm is grown, every year, from 100 to 125 bushels of tobacco seed, which embraces all the standard, as well as the rare, varieties of tobacco. The yield per acre is from four to five bushels, weighing thirty-five pounds per bushel. In regard to the vitality of tobacco seed, it is curious to note that not more than 75 per cent of the most carefully grown seed will germinate. Mr. W. C. Slate, the manager of the Ragland tobacco farm, has made many tests in this matter, and he says it is very rare to find any seed that will show a larger per cent of vitality.

The best way to secure a perfect leaf is to grow the seed plants in an isolated place, removed at least a mile from any other field of tobacco. There must be several plants near each other, so that the pollen may be interchanged between the flowers of the different plants. There is a greenish striped worm, much like the bud worm, that feeds upon the seed pods when young and tender. These worms must be destroyed, as they will make the pods upon which they feed seedless. In turning out plants for seed, the earliest, the healthiest and most vigorous growers should be selected. The plants selected should be as nearly perfect as possible, the stalks firm and the leaves near together on the stalk. The leaves should be perfect in size, shape and texture, with small midribs and veins. When the plant blossoms, carefully and frequently remove all suckers and side shoots, leaving only the large clusters of flowers at

FIG. 25. WATERING SET PLANTS.

the top to produce seed; also remove two or three of the upper leaves to prevent the plant becoming top-heavy. If the weather is windy and the plant liable to lean, drive a lath near the plant and tie the stalk to it. When it has developed a good head and the earliest seed pods begin to turn brown, pinch off all remaining blossoms and small seed buds, and continue to do so if any blossoms appear later on. The ideal seed would be taken from the central cluster of capsules of a well-developed and carefully selected plant. A smaller quantity of seed will be obtained, but it will be plump and healthy. The great object is to force all the strength of the plant into the production of a limited number of very nice seed, and great care should be taken to keep the plant growing vigorously until this is attained. If there is danger of early frost, the plant can be covered at night with a flour or grain sack, or newspapers pinned around it. Should there be any danger of a freeze before the seeds are ripe, wet the roots and pull up the plants, with the dirt adhering to the roots, and carefully place in a warm, dry barn, and the seed will mature from the juices in the stalk and roots.

When the seed is ripe, which is shown by the seed pods turning brown, cut off the head with about a foot of the stalk attached and hang in a warm, dry chamber. When the bulbs and stalks are entirely dry, remove the bulb shell from the seed, and carefully winnow it until the chaff and all the lightest seed are removed. Some, however, do not shell the seed until wanted, claiming that it keeps better in the pod; in which case the pods, when dried, are picked and placed in a flour sack or pasteboard box and kept in a warm place until the seed is wanted for planting, when the quantity desired is shelled.

SELECTION OF SEED FOR SPECIFIC PURPOSES.

Some growers of fine cigar wrappers import seed from the best Vuelta districts of Cuba and grow it, as previously described, for four years in succession before saving seed for crop purposes, and then succeed in raising a uniform article year after year. Crops are never raised from freshly imported seed, because several years are necessary to thoroughly acclimate the plant. The idea that Havana seed should be used only a few years from importation, that it deteriorates, runs out, runs into seedleaf, etc., is disputed by many of the most skillful growers in the Connecticut valley, who believe that these results arise more from cross-fertilization than from any other cause. It is true that soil and climate gradually change the size and fragrance of the leaf in the course of a long term of years, but this change does not necessarily lessen the quality of the leaf for wrappers, if proper attention is paid to raising and selecting seed. They believe that the quality, instead of deteriorating, steadily improves under the careful cultivation given to it. There is an opinion held by some careful growers that it is wise to occasionally get seed from a different locality, say 50 or 100 miles from the section in which their seed has been grown.

TESTING THE VITALITY OF TOBACCO SEED.

Tobacco seed retains its vitality for 10, 12, and even 20 years, but many experienced growers believe it loses in vitality after it is 10 years old. The individual seeds, however, often vary in vitality, and to determine the proportion of good and bad seed, place pieces of dark woolen cloth on an earthen plate, sprinkle some seed over these, cover the whole with more woolen, moisten it thoroughly and keep warm by placing on a mantel near a warm stove. In time, the seed will sprout, and the proportion of good seed can be determined, as the sprouts will readily show against the dark ground of the woolen. Another test is to drop some seeds on a hot stove, or other hot iron. The good seed will pop and hop around like popcorn, while the poor will lie still and burn. Still another test is to place some seed in the palm of the hand and rub it. If good, the seed will feel like grains of sand, and if bad, it will rub into dust.

The number of seed in an ounce varies with the varieties and conditions under which it was grown. We found, by actual count, 378,000 to 389,000 seed in one ounce of Tennessee-grown Burley leaf; each large seed pod, when properly fertilized and fully developed, contained about 5000 seeds, and an average head contained eighty pods. An ounce of Havana seedleaf seed grown in Massachusetts contained 287,600 seeds, and 308,820 were found in an ounce of seed of Havana leaf tobacco grown at Poquonock. A single plant can produce seed enough to set 250 acres, if all the seed germinated and the plants all thrived.

CHAPTER VIII.

TRANSPLANTING.

The field having been properly prepared to receive the plants, according to the directions for the various kinds of tobacco, given in later chapters, the work of transplanting requires the utmost care. Carelessness and neglect here are certain to tell seriously on the results of the crop. To avoid tramping down the bed, while pulling plants, it is a good idea to have a board as long as the bed is wide, this board to be one foot wide and one and one-half inches thick. Put short legs in each end and one in the center, this making a low bench to stand upon that will keep one off the bed, while pulling and weeding.

The most careful hands are set to work to draw the plants from the beds. In removing plants, wet the bed thoroughly, unless this has just been done by a good rain; take a common, two-tined dinner fork, or a stick sharpened to a point at one end; run this down by suitable sized plants and loosen them by gently prying under them. The plants should be drawn one at a time, so as to leave the smaller ones uninjured in the bed for future planting, and so as not to injure the rootlets of the plants taken. In drawing the plant, never catch by the stem or on the heart or bud, but always by the leaves above the bud. If the leaves are slightly bruised, it will not hurt the plants, as the leaves come off any way. Don't pull the plants one day and set them the next, as they will grow crooked and never do well. As the plants are drawn, they are laid down in straight piles, the roots being all kept together. After this they are carefully placed in baskets, or in the bed of a wagon, or in a transplanting machine, and taken to the field. The plant beds, after the first drawing of plants, demand some attention and care. Should the weather be dry and hot, they should be generously sprinkled with water thickened with cow manure, late every afternoon. For a few days it will be well to keep the canvas covering on the bed, for many small plants, being partially

FIG. 26. OLD STYLE SOUTHERN TOBACCO BARN.

From a photograph taken in Kentucky.

uptorn in drawing those beside them, need to be reestablished.

The Manner of Setting by Hand.—A dropper with a basket of convenient size goes in advance, dropping plants upon each hill in two rows. Two setters, or planters, follow, each taking one row, see Figs. 21 and 22. A smooth, round peg, eight inches long and from one inch to one and one-half inches in diameter, made of some hard seasoned wood, with a rounded point, is used for making a hole in the hill, of proper depth and size. The plant is then placed in position and the soil pressed compactly about the roots by the pressure of the planting peg against one side of the hole. The use of a hand plant is very convenient to the setter of tobacco. When he begins, he takes an extra plant in his left hand and adjusts its roots down-

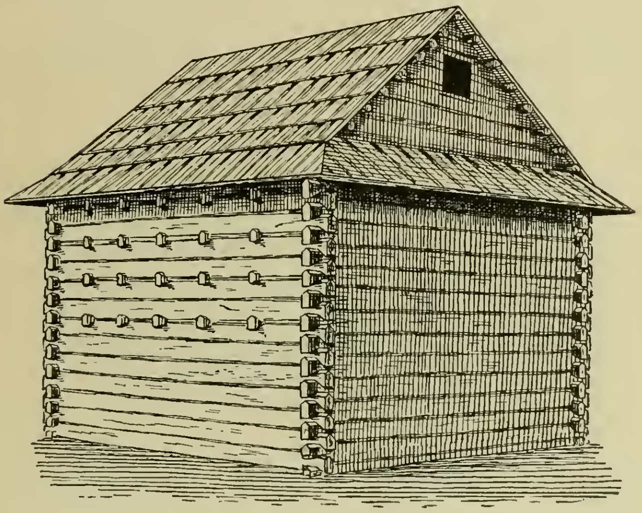

FIG. 27. FIRST IMPROVEMENT ON OLD STYLE SHOWN IN FIG. 26.

ward, while he is making the hole for the plant with the peg in his right hand. When this hand plant has been set in the first hill, he takes up the plant dropped on that hill and passes to the second, adjusting in his left hand as he moves from the first to the second hill, so as to be ready to thrust the roots into the hole made in the second hill. The plant on the second hill in like manner is carried to the third. Such an extra plant is called a "hand plant" and greatly facilitates the work of transplanting.

The test applied to determine the thoroughness of the work is to catch the top of a leaf, and pull it. If the tip breaks, the work is well done; if the plant is drawn up from the ground, it is evident that the planting has been imperfectly performed. Careful planting is very essential to insure a good stand and a ready growth. If the whole field is carefully set with plants of uniform size, and the soil is of uniform fertility, and the cutworms are not troublesome, the very best con-

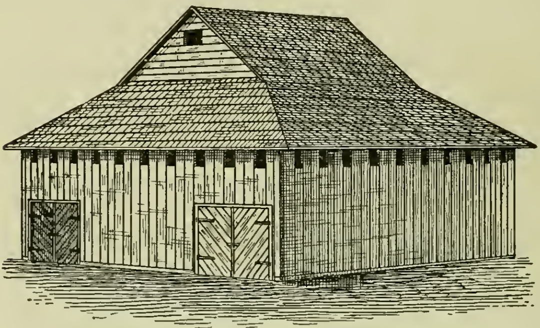

FIG. 28. IMPROVED LOG BARN WITH NIPPED SHED.

ditions are secured for raising a crop of tobacco of uniform quality and size.

After setting, water the plants, unless the field is too large. Watering should be done late in the day or early in the morning, Fig. 25. If properly set and watered, nine out of ten will live. Some shade the plants with short grass or leaves, but on large fields this is impossible. If it rains soon after they are set, or if the ground is quite wet, the plants will soon take root and commence growing. If irrigation is possible, apply the water after transplanting, if soil is dry. Much depends upon having a good setting. If there are not plants enough, get them somewhere else, if you can (they can generally be obtained for from fifty cents to one dollar per 1000), if you have a good time for setting. They will generally wilt down during the day, but if they look fresh in the morning, they will do well. A little plaster sprinkled on the leaves helps them at this time. Watering is almost essential if the plants are becoming too large in the beds. When it can be done economically, watering is preferred by many planters.

Replanting of the missing hills ought to be done just as early after they are found as possible. Larger plants should be used for this purpose, and the greatest

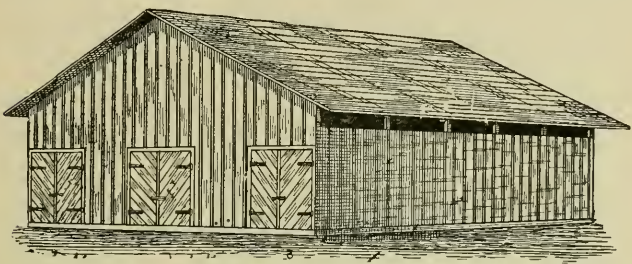

FIG. 29. MODERN FRAMED BARN, CLARKSVILLE DISTRICT HEAVY LEAF.

effort should be made to give to every plant in the field an even start. Watering with liquid manure will help the backward plants. Don't make the liquid too strong; the leach from a manure pile, diluted with water, is good; or a teaspoonful of sulphate of ammonia and two spoonfuls of sulphate of potash dissolved in warm water and added to a barrel of water.

Machine Set Plants.—A much more expeditious, and in every way satisfactory, method of setting is to use a transplanting machine. It is a great labor-saving device, and enables the grower to plant a much larger area for the same, or even less, expense. A transplanter is a two-wheeled machine drawn by two horses, but such a machine cannot be used where there are small stones or undecomposed vegetable matter on the ground. The land must be clean. It requires one man to drive and two boys to drop the plants. It plants one row at a time and can set from 3 to 6 acres per day, the amount set depending on the skill of the droppers and the space between the plants. In a few hours, operators of average intelligence will learn how to do good work, and in a few days very fast work. Plants are set with mathematical regularity at any desired distance, 15, 18, 23 or 30 inches apart. The machine carries a supply of water,

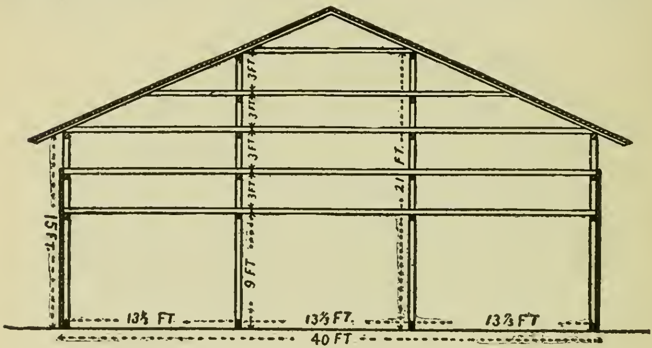

FIG. 30. END VIEW OF FRAMED BARN.

and the roots of each plant are thoroughly wet below the surface of the ground, while being set. This insures a far better start than can be obtained by hand setting, and, moreover, the grower is independent of the weather, and can set his plants whenever the land is prepared, regardless of rains. Machine-set tobacco plants start quicker, and grow and mature more evenly and quickly than hand-set plants. The machine can also be used for setting cabbage, strawberry, tomato and many other plants. Some of these machines make it unnecessary either to lay off the land in rows or to make the hills with a hoe. We have been fortunate enough to obtain a fine photograph of the Bemis transplanter, from which Fig. 23 was engraved, which shows most clearly the *modus operandi* of this useful machine, which may be used with or without fertilizer attachment. It is such a saver of work, time and money, that the transplanter is destined to come into universal use.

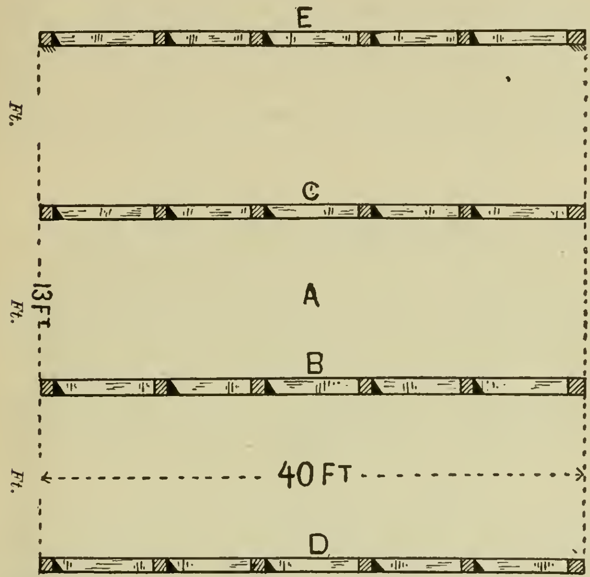

FIG. 31. GROUND PLAN OF MODERN FRAMED BARN SHOWN IN FIGS. 29 AND 30.

When the land is prepared for using this machine, it is only necessary to harrow it until it is finely pulverized, then roll or firm the soil with a planker. It is better for the ground not to be very moist when it is used, as the heavy driving wheels, in that case, compact the soil too much. Where the ground is very loose, or ashy dry, the work will not be so good. A field laid out in model style for transplanting by machine is shown in Fig. 24.

Time of Transplanting.—When this work is done by hand at the South, or in the shipping tobacco districts, it is customary to wait for gentle spring rains, or a "season," as it is called, to put the land in moist condition to permit the transfer of the plants from the seed bed to the fields without endangering their vitality. Usually, in the great shipping tobacco districts, the first general planting is done about the 10th to the 20th of May. In the yellow-tobacco districts of eastern North Carolina and South Carolina, tobacco is often set

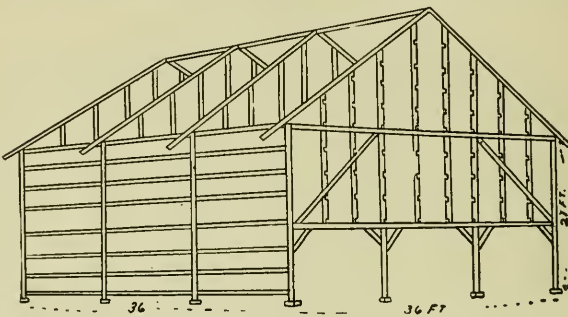

FIG. 32. ANOTHER STYLE OF FRAME.

in April. If the weather should be seasonable, with gentle showers, drawings from the bed may be made once a week. It is the greatest folly to set out small plants on old land after the first of June, unless the ground is very moist, in the latitude of Kentucky, Virginia, Tennessee and North Carolina. After that period, very vigorous, stocky plants must be used. It is more and more becoming the custom among the best growers to have plants enough to set out the entire crop the first "season" that comes after they are large enough.

Some southern planters do not wait for a "season." During the month of May, tobacco plants may be set out in freshly made hills late every afternoon, with fair chances of living. If the dirt is pressed closely to the roots with the fingers, and if the leaves are pulled together over the bud, and the dirt pulled up around them, 19 out of 20 plants will live and thrive. New lands, when well prepared, may be set out at any time. Very small plants will live on such lands that would perish on old lands. If possible, throughout the great heavy shipping districts in all the States, this crop should be planted not later than the 10th of June, though many will plant as

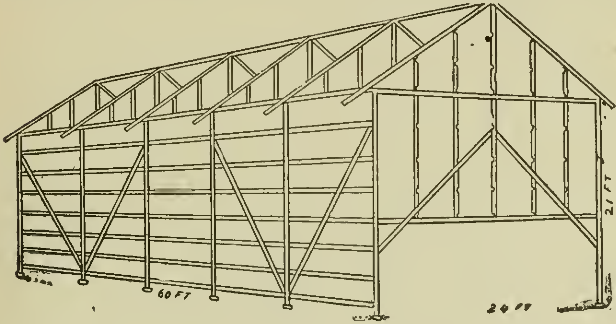

FIG. 33. WELL BRACED FRAME.

late as the 1st of July. Such late planting rarely proves satisfactory or profitable. It ought to be remembered that "a bud in May is worth a plant in June." The later the planting is deferred after the 25th of May in Tennessee and Kentucky, the more difficult it is to get a "stand," and the risk of making a good crop increases more and more as the season advances.

This last remark is equally true in setting tobacco for cigar wrappers and fillers at the North. Then the best time to transplant must be governed by circumstances. Between June 5th and 20th is the best time in southern New England, in an ordinary season, also in New York and Wisconsin. Earlier planting than June 5th rarely gives as large growth of leaf, or as fine qualities in the cured leaf, or as large a yield per acre, as plants set during the medium season. The plant needs the most favorable portion of the growing season in which to develop to advantage. The warm nights of early August are especially favorable to the production of the crop, and the more advanced settings have so far matured, at this season, as not to receive the greatest benefits. Again, the condition of the weather during the curing season has much to do with the outcome of the crop. Very early tobacco must be housed proportionally early, and at a season marked at the North by hot, dry weather, which causes the leaf to dry, rather than cure; and it also runs greater risk of pole sweat. On the other hand, late-set tobacco is liable to be damaged by early frosts; it has the advantage that it doesn't have to contend with the cutworm, which usually disappears early in July. About the 10th of June is usually the best time in New England, New York and Wisconsin, or a week or ten days earlier in Pennsylvania and Ohio. Tobacco will then ripen while the nights are cool, and the leaf will have greater body, character and weight.

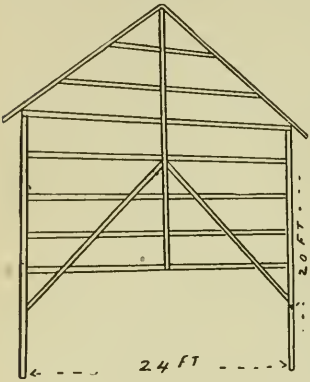

FIG. 34. END OF FRAME SHOWN IN FIG. 33.

In the extreme South, or with certain varieties of tobacco, the time for setting is quite different, as stated in connection with those topics.

CHAPTER IX.

TOBACCO BARNS AND SHEDS.

The gradual improvement in the style, convenience and character of tobacco barns and sheds during the past thirty years is very marked in all the tobacco-growing districts of the United States. It was an unusual thing, at that date, to see any other structure in the heavy-tobacco growing region for the hanging and curing of tobacco, except a pen built with logs, which was often shedded with a hip roof, leaving the sheds open. Fig. 26 gives a good idea of these old-fashioned barns. In the cigar-leaf sections, also, the crop, in early times, was hung to dry and cure in any vacant shed or barn, or unused stalls. But with the progress of the crop, these haphazard arrangements have been superseded by substantial buildings known as tobacco sheds or barns, that are constructed for the sole purpose of hanging and curing tobacco. But it will be seen, from the portions of this work on the curing of the various kinds of leaf, that the perfect structure is yet to be devised, though for its purposes Snow's modern barn is certainly a great step in advance.

BARNS FOR HEAVY LEAF AND MANUFACTURING TOBACCO.

The size of the old log barns in the South varied from twenty to twenty-four feet square on the inside, containing five to six "rooms." A "room" is the vertical space included between two sets of tier poles extending from bottom to top. These tier poles are placed

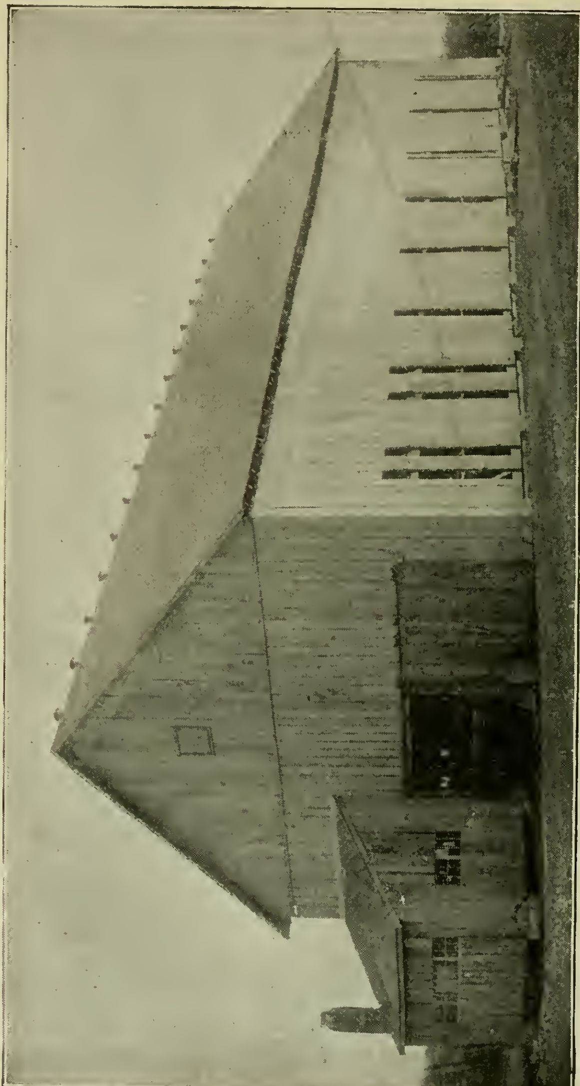

FIG. 35. BARN FOR CURING WHITE BURLEY.

about three feet ten inches apart horizontally, and three feet apart vertically. The log barns were usually built high enough to contain five of these tiers, besides those in the roof. Many of these log barns were chinked and daubed with mud all the way to the top, the only opening left being a window in each of the gable ends. Other farmers preferred to have the cracks between the logs closed only as high as the first set of tier poles. When the firing is kept up to a good degree of heat for three or four days, the tight barns are unquestionably the best, but where the firing is gentle, the barns should be open, otherwise there will be injury to the tobacco from "house burn," which is a breaking down of the vesicular system through the effects of heat and moisture—a partial decomposition of the leaf, which destroys the oily and gummy matter and renders the tobacco nearly worthless.

The body of a barn that is twenty-four feet square will contain thirty tiers for firing, six across and five high. The sticks are usually placed eight inches apart, so each tier will hold thirty sticks. The body of such a barn, not including the roof tiers, is capable of holding 1080 sticks of tobacco. The roof tiers, or collar beams as they are called, hold from 200 to 250 sticks more, according to the pitch of the roof. This makes the entire capacity of such a building about 1300 sticks, each containing eight plants, thus giving room enough to house about three acres of tobacco. The lowest tier upon which the green tobacco is put is about eight or nine feet from the floor. Sometimes a set of tier poles is arranged below those containing tobacco, but this is done for convenience of standing upon when lifting the tobacco to the higher tiers. A barn five tiers high in the body and 20 feet square will hold about 900 sticks, or it has the capacity to house two acres of tobacco. One built 16 feet square and four tiers high and wide will house about one acre of tobacco.

FIG. 36. CURING BARN FOR YELLOW TOBACCO.

Originally, barns were built of round logs, about ten inches through, but such were not durable and soon rotted down. The first improvement was to hew the logs and extend the roof, so as to give protection to the sides, and hoods were put on the ends for the same purpose, as shown in Fig. 27. Two of these pens were sometimes built with a passageway between. The next improvement was to build hipped-roofed sheds around

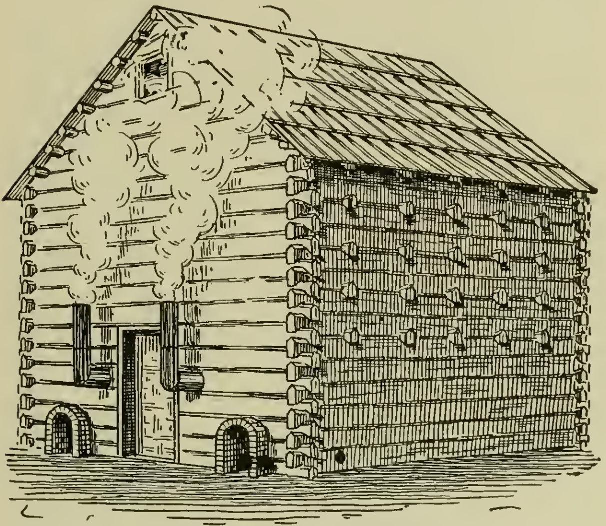

FIG. 37. FIVE-TIER SIX-ROOM BARN, FOR YELLOW TOBACCO.

the single log pen (see Fig. 28). These sheds fully doubled the capacity of the barns. They were generally 12 to 15 feet wide. A shed 12 feet wide, if built around a pen 24 feet square, has 36 ground tiers 12 feet long, and if the shed is built three tiers high, such a building will provide 118 firing tiers, besides the collar beams, which will be equivalent to 18 additional ones, making 136 tiers. A shed so built is capable of holding 2448

FIG. 38. FIVE-ROOM FIVE-TIER BARN, FOR YELLOW LEAF.

sticks of tobacco. This, added to the capacity of the pen, will give a total capacity of 3748 sticks, equal to the housing of between eight and nine acres of tobacco.

In the heavy-shipping districts of Kentucky, Virginia and Tennessee, very few log barns are now built. They are more troublesome to build than framed barns,

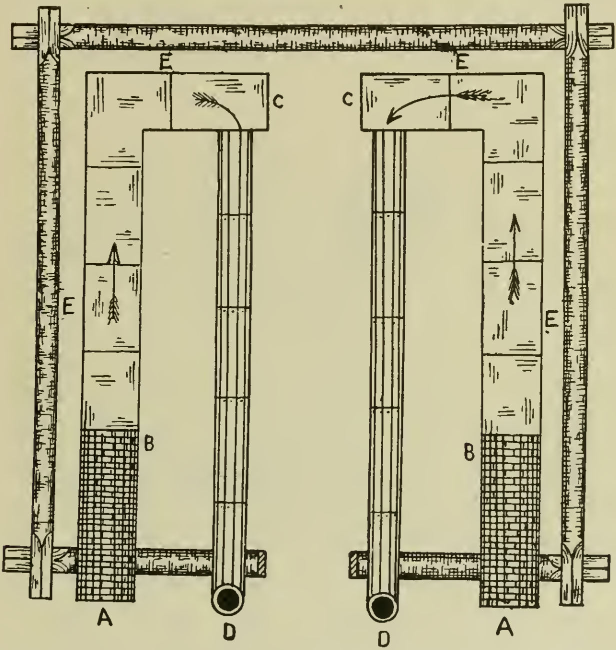

FIG. 39. FLUES FOR CURING YELLOW LEAF, USED IN THE BARNS SHOWN IN FIGS. 36 AND 37.

and cannot be provided with so many conveniences. At present, framed barns are constructed of all dimensions, from 20 to 48 feet square, with doors entering through the three divisions of the barns high and wide enough to pass through with a loaded wagon. Figs. 29, 30 and 31 give a good idea of a modern framed barn in the heavy-tobacco regions. The passageways are about 12½ feet wide between the sills, though from outside to outside is 40 feet. These passage ways are separated by sills set on stone pillars. The posts set on the outside sills are 15 feet high, capped by a stout plate 4x6 inches. At the hight of nine feet from the level of the sill, the first set of girders, 4x3 inches, is let in the posts from the outside. The second set of girders is placed three feet above the first, and the plate, which answers in the place of a girder, three feet higher on

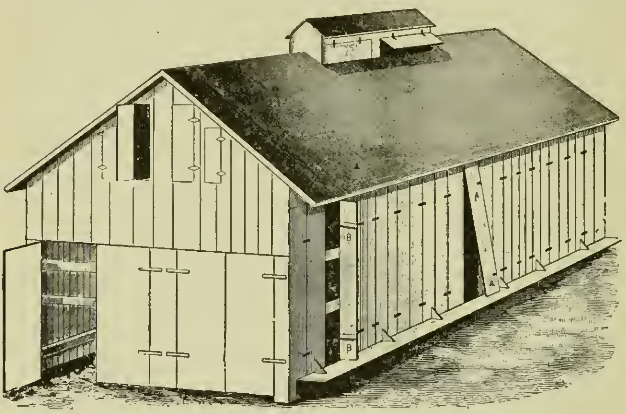

FIG. 40. CIGAR LEAF BARN.
The type most commonly used in the Connecticut valley.

the top of the outside set of posts. The two sets of posts set on the inside sills are 21 feet high, and girders are let in at 9, 12, 15 and 18 feet from the level of the sills, and stout plates put on the top of these central parts. Tier poles are arranged 3 feet 10 inches apart on the girders. Between the high central posts there are 10 tiers arranged horizontally and 5 vertically, besides the collar beams in the roof, thus giving 50 tier poles in the center of the barn and 10 collar beams, each of the latter 7 feet long.

On each side there will be 10 tier poles arranged horizontally and three vertically, giving for both sides 60 tier poles 13 feet long. Add the collar beams, which will average about half the length of the tier poles, and there will be 10 additional ones. These, all added together, will give 125 tiers, capable of holding each about 20 sticks, making the capacity of such a barn about 2500 sticks, or with room enough to house about six acres of heavy tobacco. In such a barn, doors are made to enter between the four sets of sills. This makes a great convenience in driving a load of tobacco immediately under the tiers to be filled. There are no end sills. The planks, or boards, for inclosing the barn are nailed to the sills, girders and plates. In arranging the tier poles, which are 3x4 inches, every alternate one should rest on the girder beside a post, the posts on the sides of the barn being eight feet apart. The tier poles are arranged perpendicular to the sides. The entire cost of such a barn is about $250 to $300, varying somewhat according to the prices of lumber and the wages of rough carpenters.

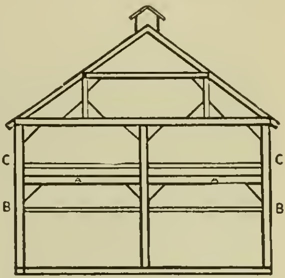

FIG. 41. CROSS-SECTION OF BARN SHOWN IN FIG. 40.

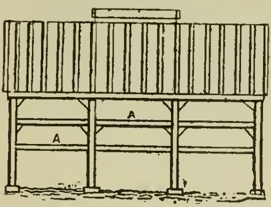

FIG. 42. SECTIONAL VIEW.

Many barns are constructed without any sills whatever, the posts resting upon flat rocks. These seem to be as durable as those in which sills are used. The bracing must be well done, however. Several of this style are shown in Figs. 32, 33 and 34.

A method of building barns with excavations, or cellars, has recently been practiced in some of the heavy tobacco districts. A log or framed barn is erected, with the first tier poles put in about three feet from the surface of the ground. The center is then excavated to the depth of seven or eight feet. It is claimed that the fires built in the bottom of such an excavation or cellar may be better regulated, that they are not disturbed by

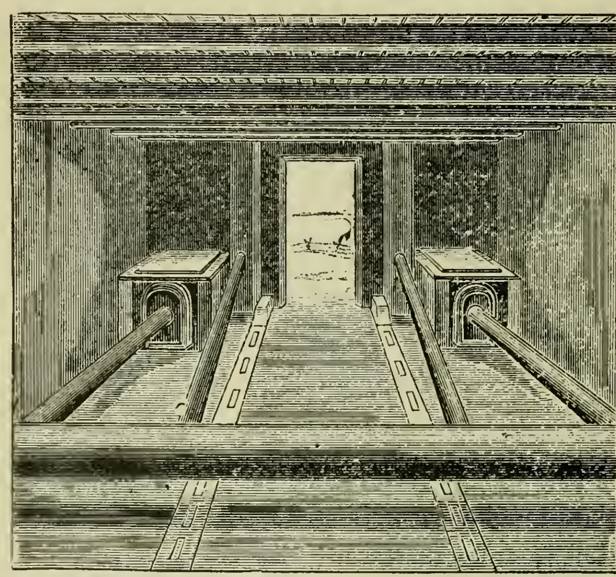

FIG. 43. BASEMENT OF SNOW BARN, SHOWING STOVES SET IN BRICK ARCHES, AND PIPES THROUGH WHICH HOT AIR IS DISTRIBUTED.

winds, and that the danger of setting the barn on fire is greatly lessened. A large amount of valuable space is secured also. It is likewise claimed that the moisture arising from the cellar will bring the tobacco in condition to be handled without the necessity of waiting for rains or humid weather.

Experiments made as to the best localities for building barns justify the conclusion that low places, free from overflows or standing water, are to be preferred. High situations dry out tobacco too rapidly, and it is much more difficult in such places to have the cured product come into uniform condition for handling. Land sloping to the east is thought to be a good situation for a barn, if furnaces are to be used for curing the

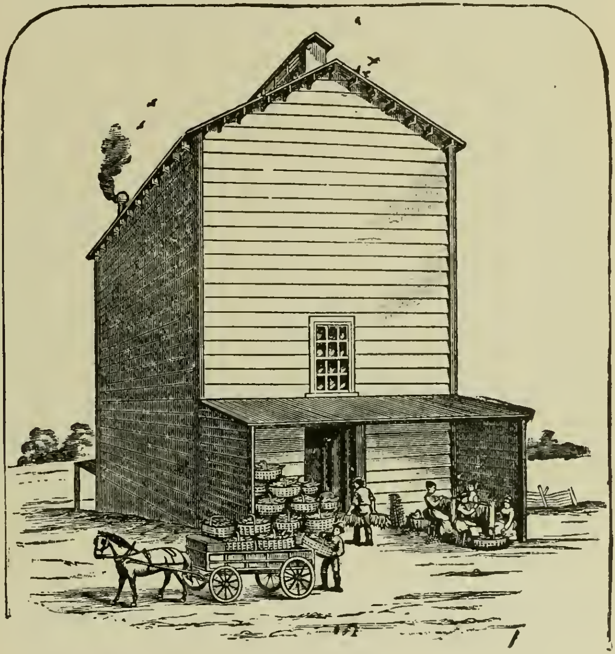

FIG. 44. ELEVATION SNOW BARN.

tobacco. The reason for such a selection is that the western winds are most prevalent during the curing season, and the smoke issuing from the chimneys or flues should be blown away from the barn.

In the White Burley district all the tobacco is air cured, and the tobacco houses are, or should be, so constructed that the air may be freely admitted or excluded, as the necessity of the case may demand. Many of the barns of that region, however, are built of logs, but are not chinked or daubed. They are poorly fitted for cur-

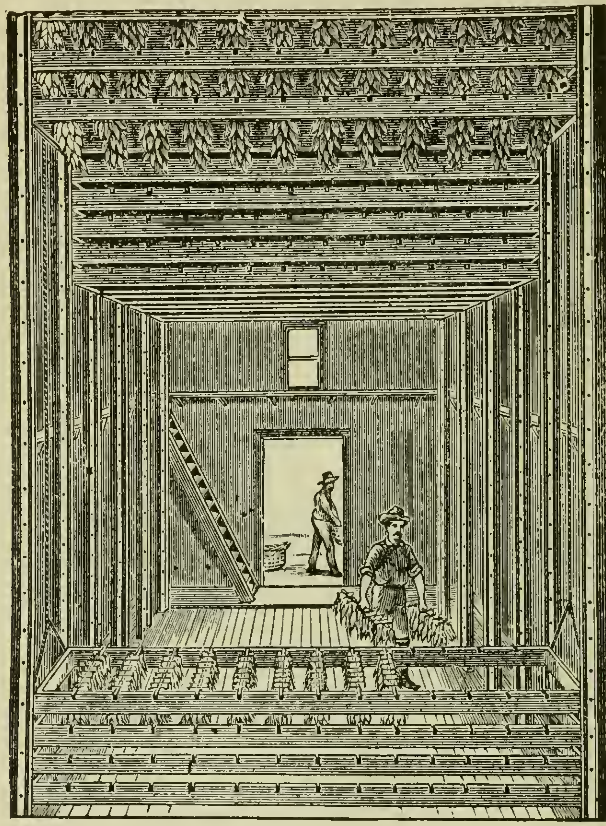

FIG. 45. INTERIOR OF SNOW BARN.

ing fine tobacco, as it is exposed very much to beating rains or drifting snows, and to the damaging effects of winds. The best Burley planters are discarding such barns and are erecting frame barns, like that in Fig. 35, with such conveniences and appliances as will enable them to regulate the curing. In damp weather, it is the practice to give all the ventilation possible by opening all the doors and windows ; in dry weather, close the barn during the day, and open at night. Too much wet weather or too much dry weather is equally hurtful in curing tobacco. It is very necessary that the ventilation of the building should be under perfect control while the process of curing is going on.

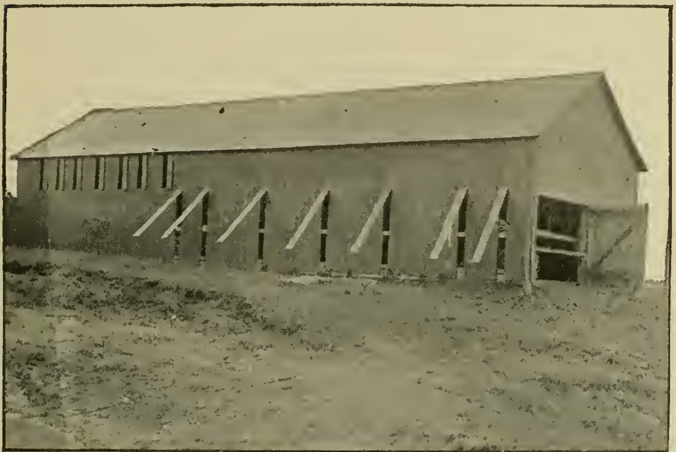

FIG. 46. ONONDAGA TOBACCO BARN.

The tobacco barns in common use for curing yellow tobacco by means of flues are very inexpensive and simple in construction. They are usually built of logs or poles cut from the woods. Sometimes these logs are hewn, but oftener they are put up with the bark on them. It requires about 68 logs, or 17 on a side, to build a barn with four firing tiers in the body. The logs are large enough so that one of them, including the space between the logs, will raise the barn a foot in hight. A barn with four firing tiers will therefore be 17 feet high. When the barn is five firing tiers high it requires 80 logs for its construction.

The first firing tiers are usually put nine feet from the ground, and the remaining tiers about two feet and nine inches apart vertically. Ground tiers are sometimes put below the first firing tiers, for convenience in

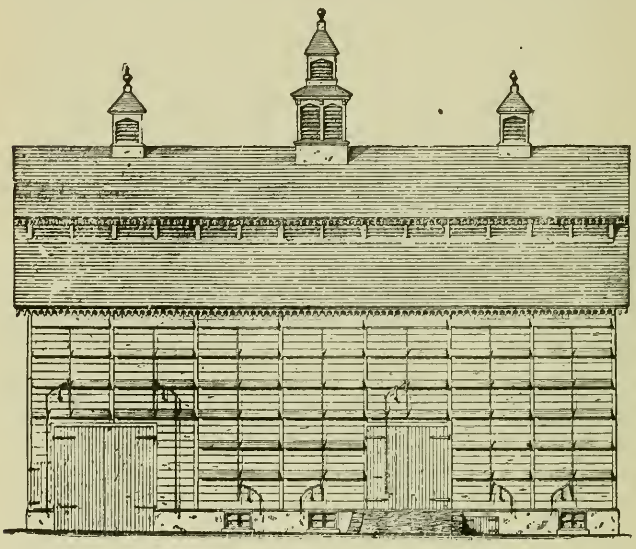

FIG. 47. AN ELABORATE PENNSYLVANIA BARN.

elevating and taking down the tobacco. Usually, there are one or two tiers in the roof. When there are four rooms, or four vertical spaces, between the tier poles, the logs are cut about 17 feet long. When there are five rooms, the length of the logs is 21 feet, and for six rooms 25 feet long. Fig. 36 is a barn with four rooms four tiers high, with ground tiers. Fig. 37 represents a barn five tiers high, with six rooms. Fig. 38 contains five rooms five tiers high.

The most approved barn in size is one with four firing tiers in hight, and the same in width. In the "rooms" next to the walls, tier poles are put which lie against the walls. This is preferable to nailing a strip on the walls to support the ends of the sticks holding the tobacco plants.

The barns are not always square. It is necessary that one of the inside dimensions, or rather the width of the barn on the inside, should be some multiplier of four in feet, so as to accommodate the width of the rooms to the length of the sticks, but the length of the tier poles need not be so restricted. Some barns are therefore constructed 16, 20 or 24 feet in width in the

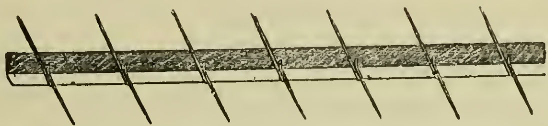

FIG. 48. HANGER FOR LEAVES IN SNOW BARN.

interior, but they may be of any reasonable length in the direction in which the tier poles run. Many planters prefer barns five tiers wide and five high and of equal width and length, with the door on the side and the furnaces and smoke escape pipe on the end.

Barns built of round logs are chinked and daubed with mud. If the logs are hewn, after the cracks are chinked they are usually pointed with a mortar made of lime and sand. This latter manner of closing the spaces between the logs, while much neater in appearance, is not so effective in making the structures tight as when the cracks are closed with mud.

A square barn containing four firing tiers and four rooms in the body, will hold 500 sticks of tobacco, or 3000 plants. One with five firing tiers and five rooms will hold between 700 and 800 sticks, or from 4200 to 4800 plants.

Flues are variously arranged. The illustration given in Fig. 39 shows the arrangement most commonly used. Two holes are cut in one end of the barn, 36 inches wide and some three feet high. These openings must be 18 to 20 inches from the side walls of the barn, as at *e e e e* in Fig. 39. Brick or stone is used for the furnaces, which are built with walls 18 inches apart, 20 inches in hight at the openings, *a a*, and arched. The spaces above the arches are closed with brick and

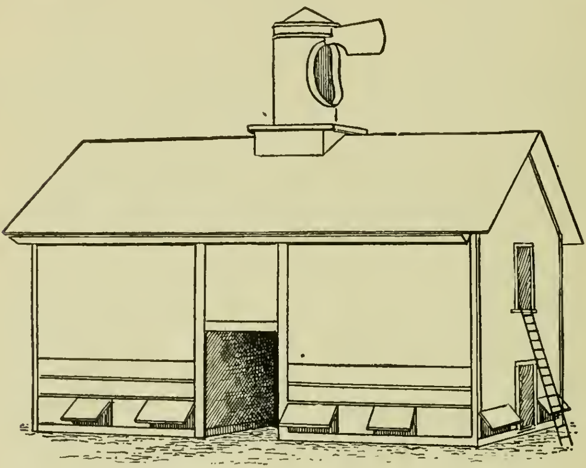

FIG. 49. PATENT VENTILATED BARN, WISCONSIN.

mortar. These furnaces project on the outside 18 inches, and are extended on the inside some three feet. The lateral walls of the furnaces should be extended around from *b* to *c* and covered with sheet iron. At *c c*, flues made of iron pipe 10 to 12 inches in diameter are inserted, with a gentle inclination upward, so as to insure draught. They come out of the barn two feet higher at *d d* than they are at *c c*. No. 16 sheet iron should be used for covering the brick flues for a short distance, and then No. 18 or 20 will suffice.

Recently the flues have been greatly simplified and are now made of iron pipe from 10 to 15 inches in diameter. The flues run continuously from *b* to *c* and from *c* to *d*, coming out on the side of the barn where the furnaces are fed and some three feet higher than the furnaces. Sometimes there is only one pipe for conveying the smoke outside the barn. In this case, the gap between *c* and *c* is filled with a flue pipe, into which a single pipe for the escape of the smoke is inserted. Or

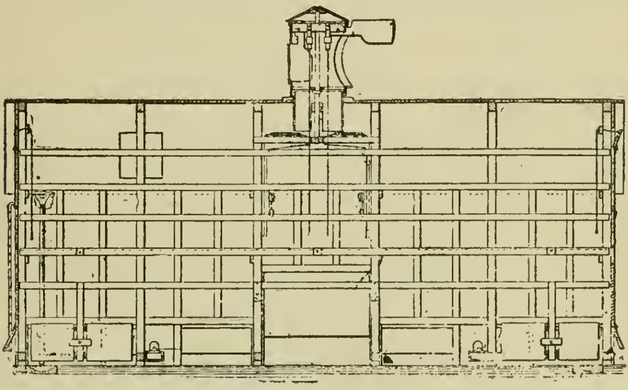

FIG. 50. VERTICAL LENGTHWISE SECTION OF FIG. 49.

the two pipes, *c d* and *c d*, may be united near the exit into one discharge pipe.

Cheaper flues are made by digging ditches in the floor of the barn, from 15 to 18 inches wide and about an equal depth, and covering them with sheet iron. A pipe for conveying the smoke outside must be inserted.

Mud walls are sometimes built by packing moist clay between two boards and beating it down. These mud walls are from 12 to 18 inches apart, and some 10 to 12 inches high. When covered with sheet iron, and the boards burned away, the hardened clay walls will stand a long time, if the clay is suitable for making brick.

The inquiry is often made why the barns for curing yellow tobacco are made so small. The reason is that unless the barn is filled with tobacco within the period of twelve hours and the firing begun, it is impossible to cure it of uniform color. For a portion of the tobacco in the barn to remain for twenty-four hours longer than the rest will so impair its quality as to seriously diminish its value. Another reason why small, inexpensive

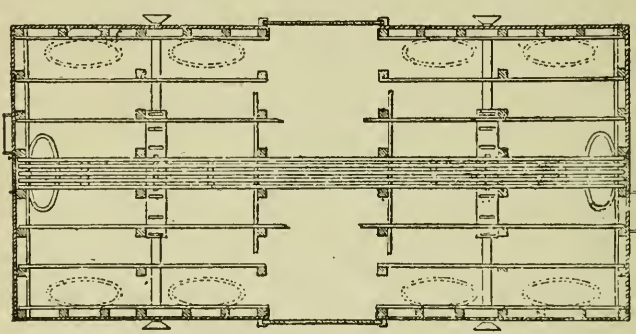

FIG. 51. SECTIONAL PLAN OF HOUSE IN FIG. 49.
Showing inspection walk, ventilating funnels, and distributers of the fresh air directly upon the leaf.

barns for curing are preferred is the danger from fire. The loss by fire of a barn which contains the growth of one acre, is not so disastrous as the loss of one containing a large portion, or, possibly, all the crop. The tobacco in a small barn cures more rapidly, more uniformly and more perfectly, and may be removed to the packing room within a week, and the barn refilled.

The Snow Barn.—Capt. W. H. Snow, of North Carolina, has recently patented a barn with flues, or stoves, for curing yellow tobacco. Like many other attempts to patent methods of hanging or curing tobacco, the patentee's claims are ignored or disputed by many, though Mr. Snow stoutly maintains their validity. Figs. 44 and 45 will give a good idea of the structure. In the Snow barn the leaves only are cured after having been stripped green from the growing stalk. The leaves are brought to the barn in baskets, and strung on the points, Fig. 48, about the width of a finger apart. As the sticks are filled, they are put on a movable rack, shown in Fig. 45, which, by a simple device, is lifted to its proper place in the building.

Captain Snow claims for his process of housing tobacco the following advantages: 1. The planter can begin to house his crop from two to four weeks earlier, as the bottom leaves, which ripen first, can be taken off and cured as soon as they are ripe. 2. As the lower leaves are pulled off, those left on the stalk ripen more rapidly, which enables the planter to get in his crop earlier in the season. 3. The tobacco can be stored in a much smaller space, and with no risk of losing color or molding when bulked down. 4. Tobacco can be cured with a more uniform color. 5. Less fuel will be required, and the risk of setting fire to the barn will be greatly lessened.

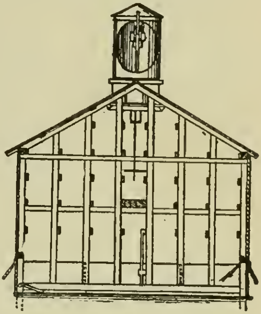

FIG. 52. END VIEW OF FRAME OF FIG. 49.

A hillside, with a slope of two and one-half inches to the foot, should be selected for the site of the barn. The most convenient size for the barn is 16x20 feet, and an excavation should be in the hillside of these dimensions. The upper side of the excavation will be some four feet above the surface. A trench is then dug around the four sides of the excavation on the inside, one foot wide and deep. The trench should be filled with coarse gravel, which acts as a drain, and also as the foundation for the barn. An eight-inch wall of stone or brick is built with strong cement upon the gravel foundation. This wall is built about five and one-half feet high, which makes a basement. A door should be left on the lower side of the wall and in the center of it.

On each side of the space left for the door, two other openings should be left, three inches from the ground and 22 inches from the side wall, through which

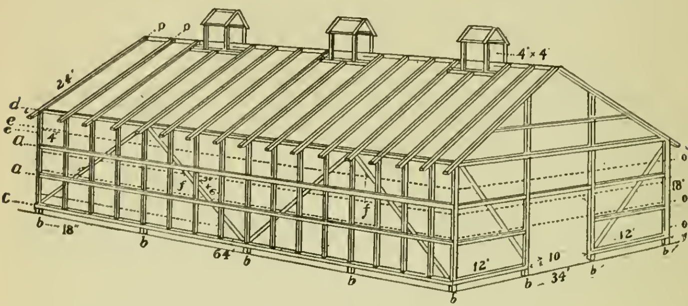

FIG. 53. BALLOON FRAME TOBACCO BARN.

The sill is on stone posts 18 inches above ground, with an 18-inch door lengthwise, as shown in Fig. 40. The sill, *c*, is 6x6 inches, the plate 2x6, *d*, the studding 18 feet high of 2x4 set four feet apart, and flush with sill and plate on *inside*, firmly nailed at bottom and spiked through plate at top. Then nail on sides two strips of 2x6 flat, *a a*, which will come flush with *outside* of sill and plate; upon these four surfaces nail the weather boarding, or covering. Brace across each side and end, by nailing on 2x6 flat *inside*, as shown in the cut. A barn 34 feet wide allows a 10-foot driveway and bays on each side 12 feet deep. The poles, *o*, for holding the lath on which plants are hung are also 2x4 stuff, every four feet, beginning even with the plate; the next three tiers below are each four feet apart; this brings the bottom permanent tier 7½ feet from the ground, or high enough not to interfere with driving in a loaded team. Another tier four feet below this will allow 3½ feet for hanging plants. A tier may be put in the roof also, nailed to rafters. Rafters, *p*, are 24 feet long.

the ends of the stoves should come to within the distance of four inches of the outside face of the wall. The doors of the stoves open outwards. The stoves (Fig. 43) are elevated three inches above the ground floor of the basement, and are covered with brick arches, with an air space of six inches between the arches and the stoves, forming jackets, but the rear ends of the jackets are left open. The arches, however, are extended two feet beyond the ends of the stoves. Openings are left above the crown of the arches and immediately above the stove doors, to admit fresh air between the arches and the stoves. These openings are closed with coverings when not needed. Conduits are provided, also, for admitting cool air to the basement.

For the superstructure, sills are set in the walls four by six inches, the four-inch sides resting on the walls.

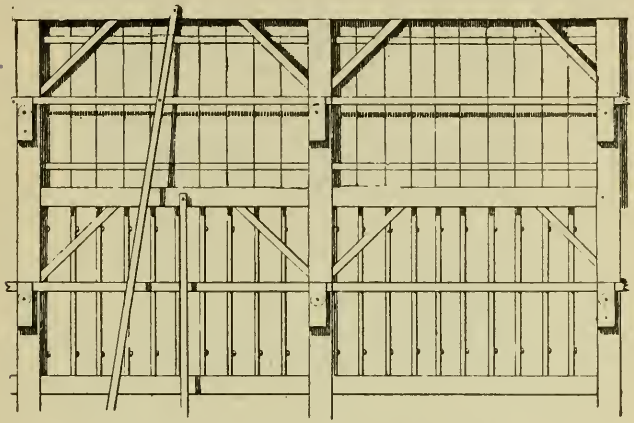

FIG. 54. SIDE VIEW OF GERMAN FRAME.

Joists are put in, on which a slatted floor is laid, with spaces one and one-fourth inches wide between three and one-half inch slats. This slatted floor extends only to within two feet of the walls on two sides and one end. The remainder is closely laid, except on the end containing the door, which is laid in strips. The studding is placed 18 inches apart. The roof is one-third pitch. The sheeting is composed of square-edge boards, or planks, one inch in thickness. Shingles are used for roofing. A ventilator 15 feet long and eight inches wide, is placed on the crest of the roof.

Sheeting paper is nailed on the studding, and the whole barn is ceiled and weatherboarded. Collar or wind beams are put in the roof. The first set of scaffold beams is set about seven feet from the floor on two sides and one end of the building; the next set, six feet above the first. Windows are put at each end with 12 lights of 10x12 glass.

In the barn of the size given, five pieces two by eight inches are placed upright, three and one-half feet

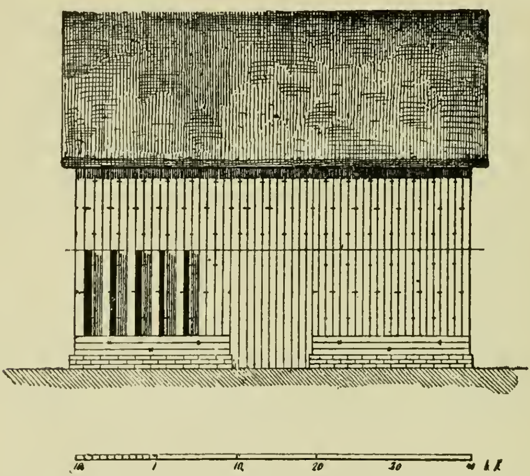

FIG. 55. SIDE ELEVATION, GERMAN BARN.

apart, and extending from bottom to top of the barn. In the center of each two by eight piece is nailed a piece one and one-half by two inches, which makes a groove on each side of the original piece for confining the racks as they slide up and down, as shown in Fig. 45. The racks, shown in the same illustration, are light frames 14 feet long, and, taking their places in the grooves, make five complete stanchions, or rooms, in the barn, of nearly four feet width each. Each rack has 14 notches on the sides, for holding 14 of the wired, or Snow sticks (Fig. 48). The sticks are one inch square, with holes six inches apart bored through the center. Through these holes pointed wires, nine inches long, are put and doubled over at right angles to the stick, making 12 points to the stick, upon which the leaves are strung for curing.

BARNS FOR CURING CIGAR LEAF TOBACCO.

This operation, at the North, is somewhat different from that in the heavy leaf sections of the South. Considerable controversy has arisen, as to what is the best pattern of a barn for cigar leaf, but the one first described is the type in general use throughout the Connecticut valley and New York state, while it is but slightly modified in Pennsylvania, Ohio and Wisconsin. The location should be on slightly elevated ground, well drained, convenient to the field, and sufficiently removed from other buildings to allow a free circulation of the air, from all directions. As a rule, the barn should stand east and west, for it will thus have the benefit of the drying and dampening winds, which, coming from the south, will draw through the barn, with the best effect. In this position, it will be less liable to be blown over, for the strongest winds, or gales, come from the west, and would, therefore, only strike the end of the barn. This may vary, however, in different localities.

A barn 30 feet by 45 feet long, three tiers high, will hold an acre of heavy Havana seed cigar-leaf tobacco, or nearly an acre and a half of seedleaf. Three tiers is now considered high enough, though the cost of a like capacity is a little greater than in a four-tier barn. The expense of hanging and taking down tobacco each year from the fourth tier would soon amount to more than the extra expense of the building. Moreover, the fourth, or higher tiers, do not cure as well as the lower ones, the colors are not as good or uniform, and the leaf is more liable to have white veins. The illustration, Fig. 40, is an outside view of a barn, 30x45 feet, three tiers high, or 17 feet from the sill to the plate. Fig. 41 gives the cross section of the end of the barn, with the boards removed. Fig. 42 is a sectional view, lengthwise, through the middle of the barn, showing the posts through the center, and the girders on which the poles rest. A width of 30 feet is very convenient for a three-tier barn, and a building so constructed is easily and thoroughly aired. The first tier of poles, as shown in Fig. 41, *b b*, should be 7 feet from the ground, which will allow of free ventilation from beneath, after the plants are hung, thereby lessening the liability to stem rot, pole or cold sweat, or injury from moisture arising from the ground. The two tiers above the first one should be five feet apart, which will bring the second tier 12 feet from the ground, and the third 17 feet. About a foot or two before the second tier, *c c*, at each end of the barn, and at each bent, a stout tie girder, 5x5 inches in size, should extend across the barn, which will strengthen it very much; some, however, think that no tie girders are necessary on the ends of the barn. This tie girder is shown in Fig. 41, *a a*. The middle girders, lengthwise of the barn (Fig. 42, *a a*), should also be of 6x6 timber. They are sometimes made smaller, but the great weight on them, when the barn is full of tobacco, requires this size, at least. The upper girders should be braced, but the lower ones need not be; the latter can be made to take out at will, when it is called a slip girder. The posts, plates and beams should be 7x7 inches, and the outside girders, on which the boards are nailed, should be 4x6 inches. Sometimes 4x4 inch timber is used for these, but it is too small and will be likely to spring,

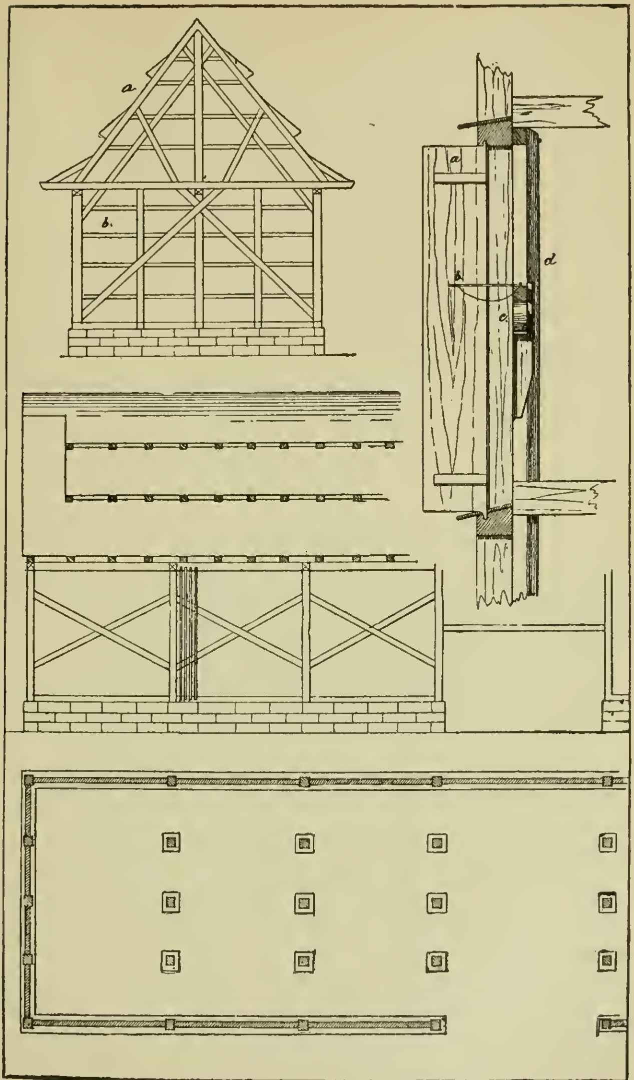

FIG. 56. GERMAN TOBACCO BARNS.

thus weakening the barn. It is better to use timbers of good size, and build a substantial structure at a somewhat increased cost, than to erect a frail structure that the first big wind might blow down.

The poles on which the tobacco is hung by tying should be 2½x5 inches, of good timber; spruce is the best. These are cheaper in the end than round poles, even if the latter cost nothing, if the plants are to be tied to them; when laths are used, however, the round poles are just as good. In a barn 30 feet wide, the 15-foot poles should be placed crosswise of the barn, one end resting on the middle girder, and the other end on the outside girder near the boarding. Roof tiers, if there are any, should be hung lengthwise of the barn. When tobacco is hung on slats, the bents should be 16 feet long, so as to take four lengths of four-feet slats. This would make a three-bent barn 48 feet long.

The covering should be of good boards, of uniform width. They should be lined, so that the barn can be made tight. Every other board should be hung for a door and left as long as will swing under the eaves. These may be hung in two ways; either on two hinges, to open outward in the usual way, at *b* (as shown in Fig. 40), or the door may have one hinge at the top and open outward at the bottom, as seen at *a*, Fig. 40. The latter door will keep the sun and rain off the tobacco hanging next to the boarding, but the two-hinged door is generally preferred, as giving the least trouble and better circulation of air. The eaves should extend two feet over the outside of the barn, so that the water will fall clear of the boards, and thus be prevented from trickling through upon the tobacco. Many pounds of fine leaf are every year damaged by the barn being faulty in this particular. The end of the barn needs doors for ventilation only at the top, where four are all that are necessary, as shown in Fig. 40. Some growers advocate giving as much ventilation as possible at the top by a ventilator. The sill should be about one foot from the ground, resting on a good-sized stone at each post. On this, boards about a foot wide should be hung, to turn up and let air under the tobacco after it is nearly cured, and the long doors are closed, as shown in the side view of Fig. 40. A four-tier barn may be constructed on the same plan. It should be 36 or 39 feet wide, to use poles 12 or 13 feet long, there being three lengths of poles across the barn, instead of two lengths, as in the three-tier barn (Fig. 40). The middle girders need not be braced and all the lower ones should be slip girders. Upon the lower tier the middle bent should be left unhung, to admit of better ventilation. Above the sill there should be a row of doors, three or four feet long, to ventilate with after the long doors above have been closed, or before that, if necessary.

Jacob Zimmer, an authority on this crop in the Miami valley, Ohio, says a better plan is to have the barn, even for cigar-leaf tobacco, as air-tight as possible, by nailing strips over all cracks, except to cut away six inches lengthwise at bottom, to admit fresh air, and leave an open space at top, under the eaves, thus providing constant circulation of air. Screen space at bottom with wire netting to keep out vermin. Fig. 29 shows such a space under the eaves, and Fig. 40 shows the open space alongside at bottom.

In Pennsylvania, barns are of all sizes, from 20 feet square to 40x150 feet, and a width of 36 feet is generally preferred. Fig. 47 shows an elaborate affair, 41x184 feet. There is a cellar nine feet high in the clear, under the whole of it, containing a dampening room, into which the tobacco is lowered through trap doors in the floor, where it is bulked after being stripped. A smaller room is used for stripping; around its four sides are permanent tables or counters, with a raised wooden floor immediately behind them, on which stand the men when stripping. The barn is 29 feet high from floor to plate, with room for seven tiers of tobacco. Ventilation is provided at the sides, at the gables and at the roof. At intervals of four feet, there are horizontal openings along the entire sides of the whole building, as shown in the illustration, Fig. 40, each opening just where the tier of tobacco begins. These openings are about a foot wide, the doors being operated by levers. This ornate affair cost $4,000 about 20 years ago, and is far more expensive than necessary.

In the rest of the Northern cigar-leaf growing sections, barns are generally constructed on the principle above described. The Snow barn was used in Suffield, Ct., for one season, but H. Austin, under whose auspices the trial was made, says: "It cured our cigar leaf too quickly, and left the stem hard and woody, the leaf was of poor color, and had a smoky smell, which spoiled it for cigar leaf." Although this single test is no criterion for judging the method, it should be said that it is yet a serious question to what extent artificial heat can safely be applied to the curing of cigar-leaf tobacco.

In Florida, barns for cigar leaf are made like those in the Connecticut valley, but plants must not be hung on the bottom tier, as the leaf might mold in wet weather. Instead of single board doors for ventilation, windows are made every 8 feet, 2½ or 3 feet wide and 10 feet long, hung by a hinge at the top. This is necessary to admit air more freely at night, being closed every dry day. The balloon frame tobacco barn is more preferred in Florida. As matters of interest for comparison, views are given of the tobacco barns used in Germany.

A Wisconsin barn that has been patented is shown at Figs. 49, 50, and 51. This building is 60x33½ feet, divided into two sections of 24 feet each, and these cut into two divisions of 12 feet each. It is four stories high and has four tiers four feet in width each side of the center walk, making eight tiers in all. In the center, between the two sections, is a driveway of 12 feet. Midway between the second and third stories is an inspection walk, 18 inches wide, the length of the building, with a door at each end, which enables one to inspect the condition of the upper tiers. The building is perfectly air-tight, with no ventilating doors, but ventilation is furnished by the air shafts between the hanging tobacco; by the vertical air shaft in center of building its whole length; by the air distributers in each section, with pipes connecting them with funnels outside of the house; a rotary turret on the roof, with double vanes for upward or downward draft; arrestors to be hung in the center if each section to force an upward draft, and by outside ventilating doors at the bottom, to admit air. Arrangements are made for ventilating the different rooms independent of each other. We believe only one such barn was ever constructed, but there are some suggestive features about it.

A Balloon Frame Tobacco Barn is shown and described at Fig. 53, that can be put together with simply a hammer and saw, no mortising is required, and yet it will stand the severest cyclone. Long, narrow windows along the bottom, just above the sills, are advised by Mr. Chapman, also a big window in each gable and three cupolas, 4x4, with slats to keep out rain and inside shutters to exclude air when necessary. This barn, 34x64, will hold about three acres, requires 22,000 shingles and 17,000 feet of lumber. It has no loose poles inside to be lost, or to expose men to bad falls by a misstep when hanging tobacco.

CHAPTER X.

ON CURING TOBACCO.

This is one of the most delicate and important operations, but the method of doing it varies with the kind of leaf grown, and the object for which it is to be used. The object is to cure the leaf to the desired state without sacrifice of its good qualities, and yet to avoid or get rid of bad qualities. But this involves far more than merely drying the leaf, for (says Frear) a marked loss of dry matter occurs during the process, as well as a loss of water. "If the leaf be killed by chloroform or frost, the changes ordinarily observed to result from curing do not occur. Curing, then, is probably a life process, due chiefly (if not wholly) to the activity of the cells of the leaf."

The process of curing is, therefore, much influenced by the structure of leaf, and by conditions of temperature and moisture. Nor does it appear that the same method of curing can by any means be applied, with safety, to different types of tobacco. Cigar leaf is practically ruined by the quick-curing process used for yellow tobacco. Pole burn and white veins also appear under apparently or somewhat different conditions in different classes of leaf, and even with the same variety in different years. All these matters are now being scientifically investigated, but we must confine our attention to such practical details as have thus far been proven to give the best results. We are confident, however, that science and practice together will greatly improve upon these methods.

CURING THE YELLOW TOBACCO.

Probably in no other tobacco region in the world are so much experience and good judgment required in the curing of the crop as in the yellow-tobacco States. Barns are purposely built small in order that they may be filled quickly. A difference of one day in cutting the plants will be hazardous in the curing of the tobacco a uniform color. Every plant, if possible, should be put in the barn the same day, and heat applied before it is wilted.

Very minute directions have been given as to the regulation of the heat at varying intervals of time, and these directions, though valuable, are rarely ever applicable as a whole to the curing of a barn full of tobacco. They require to be modified to suit the change of conditions. Tobacco cut full of sap, superinduced by a rainy season, requires a different formula for curing to that cut after a season of dry weather. The sole object, in curing, is to expel the sap in such a way as to make the desired colors, and to prevent the exudation of the juices, which give flavor and suppleness, by improper or too rapid curing, or in drying preceded or accompanied by fermentation. The cells of the leaf must not be broken so that the contents are dissipated. This is done in tobacco that is house burned or pole sweated. Nor must the process of curing be so rapid as to destroy the colors.

Mr. R. L. Ragland, of Virginia, first laid down a plan to be followed in curing yellow tobacco, and this has been the basis of all subsequent formulas. The agent for curing is dry, artificial heat. The heat is either made by having heaps of charcoal on the floors underneath the tobacco, or by means of flues running around three sides of the barn and heated by wood fed from the outside in a furnace (see Fig. 58). A thermometer is put inside the barn, so as to determine and regulate the degree of heat required at the various stages of the curing process. The Snow barn principle is preferred by the North Carolina experiment station, because it enables temperature and moisture to be more closely regulated than in old-fashioned barns. Approximately, a pound of water for each plant must be driven out in about 100 hours. According to Mr. Ragland's methods, there are four stages in the operation :

1. The yellowing process, requiring 90° of heat and lasting from 24 to 30 hours.

2. Fixing the color, requiring from 16 to 20 hours at a temperature ranging from 100° F. at the beginning, to 120° at the close.

3. The curing process, requiring for 48 hours a temperature of 120° to 125°.

4. The curing of the stalk and stem, which requires from nine to ten hours with a heat of 125° to 175°, increased at the rate of 5° an hour.

Mr. Ragland himself subsequently modified these regulations, by advising the heat to be put under the tobacco as soon as cut, and the temperature put at 90° for three hours and then advanced rapidly to 125°, or as high as the tobacco will bear without scalding, letting the heat remain at this high temperature for only a few minutes, and then allowing the temperature to descend to 90° again. This process he calls "sapping." The sap cells are opened, the water comes to the surface of the leaves, and the yellowing process is hastened, requiring only from four to eight hours, instead of from 24 to 30 hours by the old formula.

Mr. George L. Wimberly, a successful tobacco grower of Edgecombe county, lying in the Champaign district of North Carolina, gives some information which is appended. Mr. Wimberly strips the leaves from the stalk in harvesting, and the method of curing is varied somewhat from that used in curing tobacco on the stalk.

He says: "Our barns are simple structures, 20 feet square, 16 feet from the ground to the plate, with a roof not too sharp, a moderately flat roof being, in the opinion of experienced tobacco farmers, the best. In curing, we generally start at 95°, and consume from 24 to 30 hours between that heat and 110°. From this point, advance two and one-half degrees per hour until 120° is reached, where that degree of heat is retained for about four hours. Then it is advanced to 125°, where it remains about the same length of time. From that point, the heat is advanced slowly to 135°, where it remains until the leaf is thoroughly cured. When this is done, the critical point is past, and the heat can be moved up five degrees an hour until it reaches 170°, where it should remain until the stem is cured so perfectly that it will break like a dead twig. The fire is then drawn, the door opened, and in 24 hours the tobacco is ready to come out of the barn and go to the pack house. It takes four days to cure a barn of tobacco, and in a 20-foot barn there will be about 800 pounds."

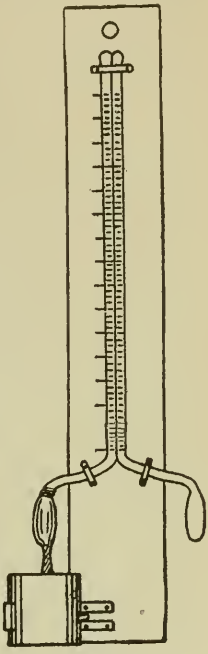

FIG. 57.
*PSYCHROMETER.

Mr. R. B. Davis, who raises yellow tobacco very successfully in the Piedmont district of North Carolina,

*The instrument consists of two accurately graduated thermometers, of which the bulbs are placed at some distance apart. The bulb of one is surrounded by thin muslin, which is connected by a wick of clean cotton to a cup hung a short distance below, and which, while the instrument is in use, should contain more or less of distilled, or clean, rain water. The water from this cup is drawn upward through the wick to the muslin that surrounds one of the bulbs, and thus the surface of this bulb is kept constantly moist, while that of the other bulb is dry. Now, the water on the surface of this wet bulb will evaporate into the air about it more or less rapidly, according as the air says that the yellowing process should be done at 90° (80° if the weather is cool), and should last from 18 to 30 hours, until the desired color is obtained. The drying, or curing, is then effected by regulating the temperature so as to have 95° for two hours, 100° for two hours, 105° for two hours, 110° for two hours, 115° for two hours, 120° for six hours, 130° for two hours, 140° for two hours, 150° for two hours and 160° for 24 hours, the last temperature being kept up until the stalks and stems are cured.

A very interesting case was reported by the *Border Review*. A barn 18 feet square, four firing tiers high, and containing 450 sticks, or 3150 plants, was successfully cured by the following process: The tobacco was of old-field growth, long leaf, but thin and light. The temperature was run up to 90° in six hours, then to 100° in six hours, then 110° in six hours. The leaf was thoroughly yellowed at the expiration of 18 hours. The temperature was then advanced 120° in six hours; to 125° in six more; to 130° in six hours; to 140° in three hours, where it was allowed to remain for six hours. At the end of this time the leaf was cured. Then the temperature was run up to 150° for three hours and held at that point for three hours, then to 170° in 12 hours, where it stood for 12 hours, until the stalk was

already contains more or less of moisture,—the more moisture the air contains, the less rapid will be the evaporation, and vice versa. Since water, in evaporating, absorbs heat, the temperature of the wet bulb is lowered more or less, according as the evaporation is more or less rapid. Hence, by noting the difference in the temperature registered by the two thermometers, we form an idea of the moisture of the air, —the greater the difference registered, the dryer the air, and vice versa. When the two thermometers register alike, the air in contact with the wet bulb is saturated with moisture, so that it can hold no more, and hence evaporation has ceased. In dry, summer weather, the difference registered by the two thermometers may amount to fifteen or more degrees. By using prepared tables, the absolute relative humidity of the air may be determined by the psychrometer, but for our present purpose, the depression of the wet bulb is all that is necessary to use. The tobacco leaves while in process of curing being moist, the evaporation from them will follow the same law as from the wet bulb, hence a psychrometer hung among the plants in the curing house will give an indication at any time of the rate at which the moisture is passing off from the tobacco.

dry. The result was a perfect cure of a lemon color requiring only 75 hours.

Another modification of the process was made by Mr. T. C. Anderson, of the Champaign district of North Carolina, which he says will always give good results if the tobacco yellows well and is allowed to remain on the hill until it is thoroughly ripe. His instructions are, that it must be cut and put in the barn as soon as possible, from five to seven plants on a stick, arranging the sticks in the barn ten inches apart in warm weather and eight inches in cool weather. Start the fires at once. In warm weather run the temperature up to 100°; in cool weather to 75°. Keep the heat to this point for six hours; raise to 105°, hold at this point for five or six hours; raise to 110°, at which point hold for 10 or 12 hours, until the tobacco is yellow enough to commence drying the leaf; then raise to 118° or 120°. When this temperature is reached, throw the doors open and reduce the heat to 105°; then run the heat up to 120°; open the doors and let the temperature fall back to 105°. Repeat this four or five times. This dries off the sweat that causes trouble at this stage of curing. Close the doors then and hold the heat at 120° for three hours, or until the leaves on the bottom tier are about half cured, then raise the heat to 128°. Open the doors and reduce the heat to 115°; then close the doors and elevate the temperature to 130° in three hours; then to 135° in five hours, or until the leaves are cured; then to 145° for three hours; then to 150° for two hours; then 155° for three hours; then to 160° for two hours, and so on to 180°, and hold at this until stalk and stems are cured.

It is apparent, from a careful study of these different formulas, that every curer must exercise judgment as to when to increase and when to decrease the heat. He must watch some particular plant and be governed by its condition. The greatest danger to be feared is the reddening, "splotching" or sponging of the leaf during the second stage, when the color is fixed. The sweating of the leaf at this period must be checked, by admission of air to the barn by the opening of all doors and windows, and by opening a space between the logs on the side opposite the door. Mr. Ragland says, just at this point more failures are made than at any other stage of the process. "Five curings are spoiled by forcing too fast, to one from going too slow."

Captain E. M. Pace, of South Carolina, gives the following directions for curing when the leaves are

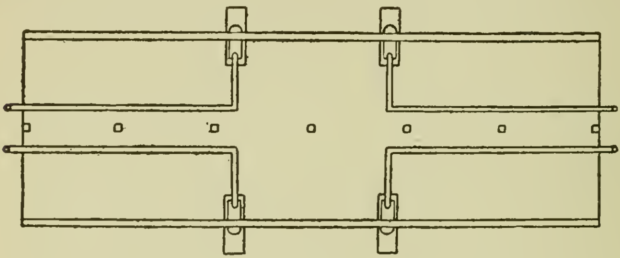

FIG. 58. STOVES AND FLUES FOR CURING SEEDLEAF.

stripped from the stalk. "Take off the thoroughly ripe leaves after a light shower, or early, when the dew is heaviest; string and run the tobacco in the barn before it has time to wilt. In case there is no light shower, use plenty of water around the sides of the barn below the first tiers. Suspend a plank over the main flues, to keep the heat from scalding the tobacco on the lower tiers (these can be removed after the sweating). Use pans filled with water on the flues and furnace. This will assist in producing a moisture, or warm vapor, thereby aiding the leaf to sweat. The entire barn must sweat freely. Heat and water will do it. Stop the use of water on the sides and floor as soon as the leaf begins to sweat. When the leaf begins to sweat, say at 110°, 115° or 120°, as the case may be, stop the fire and hold as long as the leaf will sweat. When the leaf begins to dry off, you know then that you have sweated, or steamed, all the water or foreign matter out. Draw all the fires, open both your doors, ventilators and gable windows and give cold, fresh air. Use such fuel as to be able to draw the fire quickly.

The cold air will "yellow" the barn in, say 30 or 60 minutes, or maybe one and one-half hours, or longer. Watch it closely, and when it is sufficiently yellow, begin a dry heat at once, and advance your heat fast enough to keep it from sponging, but not too fast, to splotch it. Right along here you are the sole judge. Simply apply to the symptoms which are apparent. If not fast enough, the leaf will sponge; if too fast, the leaf will splotch. Always advance as fast as the leaf will bear, and rest a few hours at 130° or 135°. This is immaterial, and is only done as a safeguard, for when you once pass the sponging and not splotching points, you may go ahead and kill out the barn at 150° to 160°. It is a well-established fact that tobacco, at the time it is ripe and ready for curing, contains 80 per cent of water, and that water must come out before the plant can assume an artificial yellow. You cannot cure green tobacco by this method; it will coddle and turn black before it will sweat. By this process it requires from 24 to 30 hours, and maybe a little longer, to cure a barn.

The object should be to make as little green tobacco as possible. Curing tobacco yellow is now regarded as an art, which demands the closest attention, the best judgment and the most painstaking experience to attain the perfect results. No novice can succeed without undergoing an apprenticeship, however minute in details the instructions he may receive.

Curing in Leaf vs. Stalk.—On this point the North

Carolina station conducted an elaborate experiment, and concluded:

1. "If the first priming leaves upon the tobacco stalk be saved, they can be cured at a considerable saving. The remaining leaves upon the stalk ripen at different times, commencing from below, and if these leaves be cured separately the experiment would indicate that it can be done advantageously and remuneratively. Curing by the leaf process, the plant will require at least three separate curings in the barn, whereas only one curing is required to cure the entire stalk with its leaves still upon it, but the results justify the additional labor. It is believed, also, that by removing the lower leaves the remainder mature more rapidly, and so the danger of being hurt by frost is decreased.

2. "The manipulation in handling the leaves separately is considerably more than in the stalk cure, but the greater part of it is of such a nature that it can profitably be done by children, and at various times during the season.

3. "There is a less consumption of wood for heating by the leaf cure than by the stalk cure. There is apparently no satisfactory cause for consuming wood to drive off 473 pounds of water (or 946 pounds, or 124 gallons, per acre) contained as moisture in the green stalks, when results would indicate that there is no good reason for the outlay."

CURING HEAVY SHIPPING TOBACCO.

If the tobacco has been on the scaffold for four or five days, fires should be kindled under it as soon as the barn is filled. The heat should not be over 90° for 12 hours. After that time, it may be carried up gradually to 150°. The leafy part and one half the stem should be cured in three days and nights. After this, the tobacco should be allowed to come in "order" (that is, to become pliant from the absorption of moisture), and dried out by fires. This alternation should be kept up for two or three weeks; and, indeed, whenever, during the fall months, the tobacco gets very damp, it should be dried out with fires.

When the tobacco is taken directly from the field, it should remain hanging in the barn for four or five days. Slow fires should then be kindled under it, and at the expiration of 24 hours, the heat may be increased, as in the case of tobacco taken directly from the scaffold to the barn.

In the heavy shipping districts, at least 90 per cent of the leaf is cured by open, wood fires. Two logs are

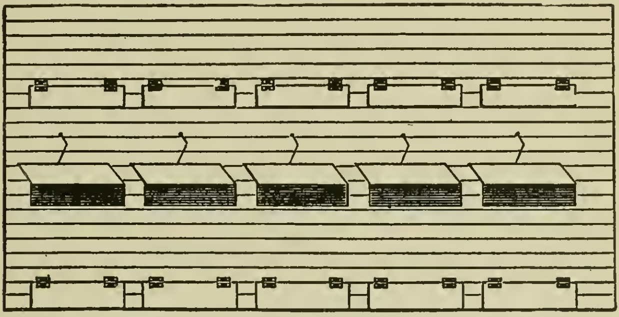

FIG. 59. HORIZONTAL VENTILATORS FOR PROTECTION AGAINST POLE BURN OR POLE SWEAT.

placed side by side and the fires kindled between them. Small sticks of wood are supplied, to lay at the point of contact of the logs, so as to keep them burning. Some flue-cured tobacco is made in the heavy shipping districts, but scarcely enough to make note of. The principle and method of flue curing will be fully discussed under the head of yellow tobacco. Flues may be built, in a barn 20x20 feet, for about $15.00, including chimneys for carrying off the smoke.

It should never be forgotten that the object in curing is not so much to dry the leaf as to fix, as far as possible, the qualities of the leaf as to color, strength, elasticity and flavor. Even the texture may be improved by judicious management in curing. To begin the fires too early, makes the leaf starchy and stiff. To make the fire too hot in the beginning, makes a bluish, undesirable color. The desired flexibility and softness of the stem, fiber and tissue of the leaf cannot be secured unless the curing process is made gradual. To make hot fires under the plants, before they have sufficiently yellowed, would be to impair the value of the article fully one half, if not more. Gentle fires for the first 24 hours are positively necessary, to bring about the best qualities in the leaf. To delay firing too long would increase the liability of injury from "house burn." Care should be taken that the fires are managed so as not to emit much blaze, for there is always a danger of setting the dried tobacco on fire. Tobacco cut in wet weather, when full of sap, requires a longer time to cure. The danger from "house burn" is also increased.

Sometimes, after the tobacco has been cured, it is necessary, in humid weather, to keep up fires to prevent a change of color by the running of the sap in the leaves. Piebald or yellow tobacco should be dried out whenever it grows very limp. Otherwise, the color will change to a red, or a reddish-brown, or yellow. When all the stalks and stems are thoroughly cured, the tobacco may be packed down, and in this way all colors may be preserved. Small barns for fire curing are better than large ones, because they can be filled in a short time, and the curing will begin with all the plants simultaneously. The quality of the crop will be made uniform as to color and softness of leaf.

Open fire heat is preferred for all tobacco to be shipped abroad. The pores of the leaf are filled with a carbonaceous matter that has a preservative effect. It has long been known that fire and smoke cured tobacco will withstand an ocean voyage, and go through the sweat, or fermentation, much better than tobacco that is air cured. The firmness and solidity of structure of leaf, as well as its strength, are preserved. The porous system is filled with creosotic compounds, and the absorptive capacity of the leaf is greatly diminished from what it would be by air, sun or flue curing.

In air-cured tobacco, of which there is a considerable amount made in heavy shipping districts, the natural flavor of the leaf is better preserved, and its porous system is greatly developed, so as to absorb and retain a large percentage of the artificial flavorings with which it is tested in the process of manufacturing.

CURING WHITE BURLEY TOBACCO.

As a general rule, no artificial heat is employed in curing White Burley tobacco. From six to eight weeks are required to complete the process, by the ordinary methods of air curing in the barns provided with ample facilities for ventilation. If the weather is very dry, to prevent curing too rapidly, all openings should be closed during the day and opened during the night. During wet weather and when house burn has begun, or is feared, all possible ventilation should be given, by throwing open the doors and windows. Passages through the tobacco hanging in the barn should also be made, in order that the air may find free access to every part. Sometimes, when house burn is threatened, small charcoal fires are built in the barn, during very wet weather, though this is an unusual practice, and is rarely resorted to. If the season should be very dry, during the period of curing, the tobacco will be variable in color; if too wet, the color will be too dark; but after being housed, if the weather is fair, with occasional

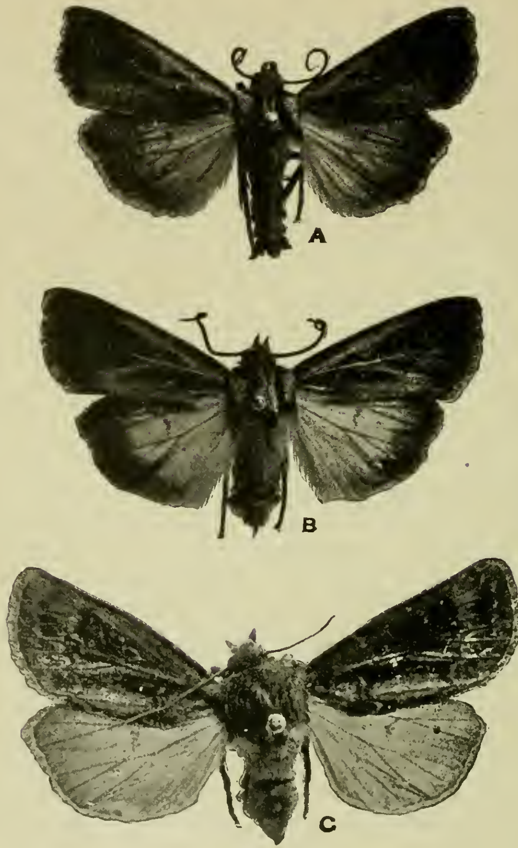

FIG. 60. MOTHS OF CUTWORMS.

A, Moth of dingy cutworm (*Feltia jaculifera*); *B*, another species of dingy cutworm (*Feltia subgothica*), both one and one-half times natural size; *C*, moth of traveling cutworm (*Feltia gladiaria*), two and one-fourth times natural size. Other varieties and species of these moths differ but slightly from these in the eyes of all except the scientist.

showers, the tobacco will cure a beautiful bright, golden-red color. Much the same methods are to be followed in curing Burley as is the case with cigar leaf or seed-leaf.

CURING SEEDLEAF TOBACCO.

The method of curing practiced in the cigar tobacco sections of the United States, also Cuba and Sumatra, is entirely air curing,—it is accomplished by regulating the air and moisture, by opening or closing doors or shutters in the barn. Fire curing, that is, by the aid of artificial heat, or sun curing, by exposure to the direct rays of the sun, is seldom practiced. The modified Snow process has been tried with doubtful results, although at the Pennsylvania experiment station "the general character of the rapidly cured leaf was not inferior to that more slowly cured, and the dangers of disease were removed." The Wisconsin experiment station favors artificial control of temperature and humidity, after two years' experience with it, but does not state how leaf so cured came out of the sweat, or fermentation process, necessary after curing to fit the leaf for cigar making. In the Miami valley, a few planters put small, coal stoves into their barns, with pipe running up through the roof, and keep up a gentle heat during very rainy weather or a long-continued damp spell, admitting cold air at bottom and opening ventilators at top to carry off the hot, moist air. Undoubtedly this same method of artificial control will be perfected to reduce pole sweat, pole burn or white veins.

But the system now in vogue is that which has prevailed for years. It has been improved by greater care in the construction of barns, but it is at best a crude and imperfect method, and one requiring vigilant attention to details, and a nice perception of alterations of temperature and moisture, to properly carry out. Yet so skillful have the growers become, even with this crude process, that a good cure can be expected in the vast majority of cases, unless the crop has been damaged, or improperly grown in the field, and unless excessive fogs and dampness prevail at curing time. It is a phase in the existence of the crop that is looked forward to with great anxiety, and the grower breathes a sigh of relief when the curing is safely over and the crop is stripped and cased without injury.

The first point to avoid is the too rapid drying of the leaf. Drying is not curing, and the terms are in no way synonymous. The change of color and condition in the leaf is largely due to a process of fermentation, which takes place in the hanging tobacco, and for which a certain amount of moisture in the leaf is necessary. If the leaf is dried too rapidly, this fermentation is either prevented altogether, or checked to some extent, thereby affecting the result disastrously. As far as possible, the air in the shed, during the whole curing process, should be kept in such a condition that the tobacco will never become quite dry and brittle ; it should never crumble when handled. To this end, after the first two weeks following the hanging, the sheds should be kept tightly closed during dry weather, and if opened it should be at night, or for a while upon damp and misty days. If the buildings are kept closed, the great amount of moisture evaporated from the tobacco will keep the air sufficiently damp, even in dry weather.

The second principle is to keep the air in the shed from excessive dampness, which, with heat, causes a destructive fermentation or rotting, which is entirely different from the fermentation of the curing process. For this reason, the buildings should be kept well opened and ventilated the first week or two after hanging, that the fresh currents of air may carry off the large amount of moisture evaporating from the tobacco, and also check any tendency to excessive heating. During the whole time of curing, after any protracted time of damp or warm, muggy weather, the sheds should be opened, until the tobacco is partially dried off. To carry out both these principles, the shed should be so constructed as to permit of its being tightly closed and also of its being opened and thoroughly ventilated. Light should be carefully excluded during the curing process, especially in its later stages, as it is found that

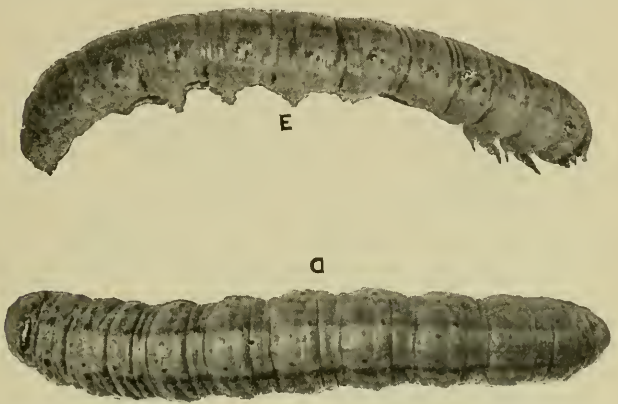

FIG. 61. TRAVELING CUTWORM. One and one-half times natural size.

strong light has an injurious effect upon the color of the leaf.

Even under the most favorable conditions, a successful cure will depend largely upon good management. Tobacco is very rapidly dried out by means of a constant current of air, especially if this air is heated, undergoes very little if any chemical change, and retains to a greater or less degree its green color. Moreover, since the process of fermentation in bulk, accompanied by heat, depends upon and must be preceded by the changes in the leaf produced by gradual curing, it follows that tobacco that has been too rapidly dried loses, to a large extent, its ability to pass through the subsequent sweating process, and the tobacco remains permanently of a greenish color. If the tobacco is cured in a current of air, care being taken not to drive the moisture out too rapidly, a change takes place in the interior of the leaf that changes the color from green to brown. Finally, if tobacco is hung too closely, so as to prevent the free access of air, the color still changes from green to brown, but by a different process of fermentation, the leaf loses its tenacity and elasticity, becomes subject to pole burn and is more or less spoiled by rot.

The time required for "curing down" tobacco varies very greatly from year to year. Some seasons it progresses very rapidly,—so much so that a cure is completed in from six to eight weeks; again, it is slower, and three or four months are required. As a rule, quick curing is the best. It can only be accomplished when all the conditions are favorable. The seasons of 1891 and 1892 were remarkable for the rapid cures, and the result of the cures in these years was unusually satisfactory. Some years, however, the conditions are abnormally bad, such as was the case in 1872, when dense, heavy fogs settled over the Connecticut valley during the curing season, and the crop rotted on the poles, in spite of all that could be done to save it. This has gone down in the legends of the tobacco growers as the "bad year of '72." It is thus seen that very much depends upon the temperature and moisture of the outside atmosphere, although these conditions can be controlled to some extent, and often to a sufficient extent to effect a cure. But even with the best of care and the most favorable management, atmospheric conditions may prevail that render any curing abortive.

Goff has shown that in Wisconsin green seedleaf tobacco loses about 71 per cent of its weight during the curing process. The rate at which the water passes off gradually increases from the time the leaves are well wilted until they assume the brown color. The water appears to be set free by the leaves, rather than extracted from them by drying. The changes in color of tobacco leaves during the curing process are not the result of drying, but of certain changes within the leaves themselves. Riper tobacco yields a lighter color of cured leaf than that which is less mature. Leaves

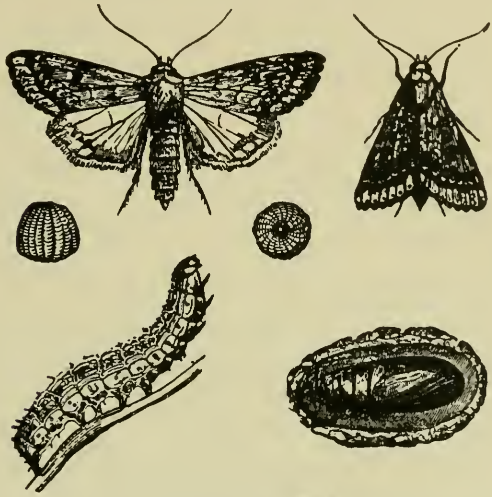

FIG. 62. BUD WORM (*Heliothis armiger*).
The eggs enlarged; the worm, or larva; the pupa in its cell underground; male and female moths.

that become spotted with yellow before cutting, will produce a cured leaf that is mottled with varying shades of brown. The lower leaves on the plant usually cure lighter than the upper ones, because they are riper.

The period of most rapid escape of water from curing tobacco is in the browning stage, i. e., while the color is changing from yellow to brown, while with tobacco that is well wilted at the time it is hung, the escape of water from the leaves is at first comparatively slow. Goff thinks this "furnishes a warrant for the practice of many intelligent tobacco growers, who hold that it is better to keep the curing house nearly closed for a time after the tobacco is hung, and that it should be gradually opened as the curing proceeds," but of course this point depends to some extent upon atmospheric conditions, if the leaf is to be cured naturally.

Artificial Curing.—Frear modified the yellow curing process for seedleaf at the Pennsylvania station (referred to heretofore), as follows, getting a complete cure in about 16 days:

Period.	Hours.	Advancement of Curing.	Temperature. Deg. F.	Humidity. Per cent.
A	42	To first yellowing,	76-91	69-85
B	28	To first browning,	91-96	78-86
C	24	To development of tobacco odor,	96-97	85-93
D	72	To end of sweating,	93-99	92-96
E	216	To completion of cure,	98-108	95-41
	318			

In this work, no great difference in yield of cured leaf was found in artificial over natural curing. But the former gave a leaf tissue and veins as thin as the slow air-curing process does. The final thickness seems chiefly determined by the conditions under which the plant was grown.

Wisconsin Experiments.—Two years' work at the Wisconsin experiment station, by E. S. Goff, have brought out the following valuable points.

Moist air is lighter than dryer air at a given temperature, and hence tends to rise. Comparatively dry air entering the curing house near the ground and coming in contact with tobacco that is giving off moisture, as it absorbs this water will gradually rise through the building, absorbing more and more moisture in its course, until it reaches the roof. It is important, therefore, not only that the curing house shall contain ventilators through the roof or in the gables, but that these be so made that they can be opened and closed at will, because these furnish an efficient means for controlling the humidity, providing the weatherboarding of the building is tight, as it should be. In ordinary weather, it is probably better to use only the ventilating doors near the ground, and the roof ventilators, leaving the higher side doors closed, except as an emergency seems to require special ventilation, and the control may be mainly exercised by the roof ventilators, since by opening or closing these more or less, the air, as it rises between the hanging tobacco plants, may be compelled to rise more or less rapidly, as desirable. But it should be remembered, that when the external air is very moist, as in rainy

FIG. 63. TREE CRICKET (*Œcanthus niveus*).
The plate at right is the male, viewed from above. At the left, female, side view.

weather, this upward current of air will largely cease, because the absorption of water from the tobacco will be greatly checked. At such times, the temperature of the air between the plants must be raised, to restore normal absorption, and the only way to do this is to provide artificial heat. Placing lighted lamps beneath the roof ventilators will help to produce an upward current of air, as was proved in our experiments, but this will not avail to prevent pole burn if the air that enters the building is already on the verge of saturation.

The curing house should be enclosed in such a manner that the amount of external air that enters it is under control, and should be provided with some kind of heating apparatus that renders it possible to reduce the humidity of the air in wet weather. To ascertain whether the air is too humid, hang a psychrometer (Fig. 57) between the plants in a central part of the barn. The wet bulb in this instrument should show a depression below the dry bulb of not less than one and one-half or more than two degrees. If the wet bulb shows a greater depression, it indicates that the air is so nearly saturated with moisture that it can no longer take up the water given off by the leaves. This is the condition that induces pole burn. Now apply artificial heat to dry the air, opening the upper ventilators to carry off the heated moist air, and the danger will be averted. Keep up the heat until the psychrometer gets back to the desired standard—wet bulb not less than one or more than two degrees below dry bulb.

From these Wisconsin experiments, the conclusion seems warrantable, that with a temperature within the curing house of not exceeding 75° F., a degree of atmospheric humidity represented by a wet bulb depression of one and one-half degrees, when the psychrometer is between the plants, and is not exposed to unusual air currents, does not endanger the tobacco to pole burn, and that an occasional variation to one degree is safe, at least if not prolonged. But a wet bulb depression of less than one degree is dangerous, and if prolonged, is almost sure to result in pole burn. It will be wise to make one and one-half degrees of depression for the wet bulb the minimum, rather than one degree, not because one degree is dangerous, but because it provides too little margin between the safety and danger limits. The atmosphere throughout the curing house cannot be changed immediately by starting the fires, and if these are started as soon as the wet bulb depression becomes less than one and one-half degrees, if the weather is becoming rapidly damper, it might sometimes be difficult to prevent the atmosphere within from becoming so damp as to register less than one degree of depression for the wet bulb before the fires could prevent it.

After two seasons' trial of this, what may be called scientific, method of curing, Goff feels warranted "in commending it to the attention of all who aim to pro-

FIG. 64. LEAF INJURED BY RED-LEGGED GRASSHOPPER.

duce the first quality of air-cured cigar tobacco. It has the advantage of curing the crop under the best known conditions, and hence, of developing the highest possible quality. It demands a somewhat more expensive building, and a greater amount of care and intelligence than the average Wisconsin tobacco grower has been accustomed to devote to his crop. But 'what is worth doing at all is worth doing well,' and as a rule, a business will prove most profitable when conducted in the best manner."

On a single morning during the curing season, a very perceptible odor of pole burn pervaded the building, and the wet bulb depression was considerably less than one degree. But fire was immediately started, and in twenty-four hours the ominous odor was almost entirely dispelled, while the psychrometer registered a fraction over one degree. A very slight amount of pole-burned tobacco was found in the crop, but not more than is usually found in dry seasons, while the general quality, so far as the curing was concerned, was pronounced superior.

The heating apparatus for this purpose may be like that used in the Snow barn (see Fig. 43), or in the Yellow tobacco barn (Fig. 39). Another arrangement is that suggested by Goff, as shown in Fig. 58, which is especially adapted to tobacco barns now in use. It can be put in at a first cost of $25 to $75, according to the size of the house. The increased value of a single crop saved from a severe attack of pole burn by this system would more than repay the cost, and if, by being able to exclude hot and dry winds, the crop may be cured slowly in dry seasons, the apparatus may be made to pay for itself every year. We are not aware that the experiment has ever been tried in this country, but it would be feasible to provide pans, or tubs, of water on the floor of the tobacco house, which, by evaporating, would furnish the necessary humidity during a hot and dry period that otherwise might cure the tobacco too quickly. With the heating apparatus, tobacco may be hung a little closer than would otherwise be prudent, thus permitting a somewhat smaller building for a given acreage.

If a new curing house is to be provided with the heating apparatus, it would be well to build it two feet higher than the needs of the tobacco alone would require, to provide more room for the pipes beneath the lower tier. Goff thinks a curing house 100 feet long would be sufficiently warmed with four 36-inch box stoves, carrying seven-inch pipe, placed as shown in Fig. 58. The stove should be let into a little basement, bricked or stoned up beneath the sills. The pipes should start from the ground level, and rise eight or ten inches to the rod. If they come in the way of hanging tobacco, remove a sufficient number of plants to make room. They may be supported on temporary brick piers, or suspended by wires from the poles carrying the tobacco. That portion of the pipes extending outside of the building will be more durable if made of galvanized iron, and should be capped with spark arresters, but the remainder may be of common sheet iron. No difficulty is experienced in securing a good draft, and if the tobacco is not hung too thickly, the humidity of the air in a tight tobacco barn will be found to respond readily to the heat from the stoves, even where a very little fire is used. After the curing is completed, the pipes are taken down and stored for use next year.

Curing Leaf Alone vs. Curing on Stalk.—The bulk of the cigar leaf grown in the United States is cured on the stalk,—that is, the plant is cut up at the bottom, allowed to wilt, and then the entire plant is hung in the barn, as described in the chapter on cigar leaf. In Florida, however, the crop is largely harvested leaf by leaf, as described in the chapter on Florida tobacco. The cost of handling each leaf separately was about one-third higher than by the stalk system, at the Pennsylvania station, and was quite as large at the North Carolina station (see Page 216). Wagner declares that "if the leaf is picked before it is ripe, it needs a process of subsequent ripening to give it a good quality. This is impossible if the leaf is separated from the stalk, but it takes place to perfection under the American method" (the leaves cured while still attached to the stalk); but if the leaf process is used, the leaf would certainly not be picked before it is ripe. German authorities maintain that the weight of tobacco leaves cured on the stalk is 15 per cent greater than that of leaves cured separate from the stalk, due to the translocation of matter from stalk to leaf during ripening after the harvest. Behrens, however, has shown that the current of solids is from leaf to vein, thence to rib, and thence to stalk, and not the reverse. Frear found nothing to indicate any marked gain in weight as the result of slow ripening or curing on the stalk. Results by Carpenter, in North Carolina, on yellow leaf, point in the same direction. Nessler long ago pointed out that the leaf cured on the stalk, and separate from it, showed no appreciable difference in weight. At the Pennsylvania station, 1000 leaves cured on the stalk weighed, when stemmed, 116 ounces; 1000 leaves harvested more nearly ripe, and cured leaf by leaf, yielded 151 ounces of stemmed leaf, the precise gain varying with the ripeness of the leaves.

It will be seen, therefore, that opinions are widely divergent, among both practical tobacco growers and scientists, concerning the good and bad points of the single leaf system. Yet the fact that it is but little employed in the seedleaf sections is no argument against it. Frear found that the ripest of the stalk-cured leaves were thinner than the less mature leaves harvested separately.

CHAPTER XI.

PESTS OF TOBACCO—DISEASES, INSECTS, THE ELEMENTS.

Following the chapter on curing, we will first discuss the troubles or diseases that are met with in curing tobacco. Chief among these is pole burn. "This trouble," says E. S. Goff, "appears as dark spots near the midrib or vein; under favorable conditions it spreads rapidly, discoloring and rotting the whole leaf, and often destroying the entire crop in 24 to 36 hours. It is caused by two fungous enemies: First, a sort of mold, which attacks the outside of the leaf and lays the interior open to the invasion of bacteria, which (second) then develop rapidly, causing the principal mischief. The development of the disease is chiefly controlled by atmospheric conditions, being most probable in rather warm, very humid air. A nearly cured, dry leaf is not liable to attack. A temperature above 100° F., or below 40°, greatly retards its activity; but one of 70°-90° is most favorable. If we can control moisture and temperature conditions, we can prevent injury from this otherwise menacing enemy." Examination shows that the leaves have changed from a greenish-yellow to a dark brown or almost black color, that the fine texture has disappeared, and that instead of being tough and elastic, the whole leaf is wet and soggy, and tears almost with a touch, falling of its own weight from the stalk.

Something has been done at the Wisconsin experiment station to combat this disease (as described in the preceding chapter), and considerable has been accomplished at the Connecticut station by Dr. W. C. Sturgis.

It appears from his work, as well as from the experience of practical growers, that a crop is very seldom cured at the North without showing some traces of disease. Even during the most favorable seasons, the disease makes its appearance in the center of the curing barn, where the temperature is higher, and the moisture more retained in and about the leaves, whereas, in unfavorable seasons, the loss often amounts to practically the entire crop. Nor is it confined to the seedleaf sections, being common in the heavy shipping and yellow districts. It is not the mold (*Cladisporium*) that does the mischief so much as the bacteria, which cause the rapid decay. Sturgis found that warmth as well as moisture is conducive to pole burn, and this fact emphasizes the necessity of securing good circulation of air in the curing barn, and especially when artificial heat is employed. All attempts to inoculate thoroughly cured tobacco with bacteria of pole burn were failures. Sturgis regards this as partial confirmation of the generally expressed view, that when tobacco has cured to a certain degree, the period varying from ten days to three weeks after hanging, there is very little danger of pole burn.

The remedy for pole burn has already been described in the chapter on curing. It is to get rid of the excess of warmth and moisture, which can only be done by a complete system of ventilation. For this purpose, Sturgis strongly endorses horizontal ventilators near the ground, a similar row for each tier of tobacco and one or more large ventilators along the ridgepole. The ventilators in the walls should open horizontally at intervals of about four feet, as shown in Fig. 59. They should be from five to ten feet long, one foot high, hung from the upper edge by strap hinges, so as to be raised and hooked up, and occupying the full length of the building. When these are all open, the air will enter freely, not only near the ground, but also just below each tier of tobacco. Free ventilation in the roof is absolutely essential to allow of the escape of warm, moist air, any of the systems outlined in the chapter on barns being available for this purpose.

"White Vein" or "Stem Rot" appears in the latter stages of curing cigar leaf, in the form of white, velvety patches of long-piled mold, first affecting stalk and rib, and later destroying the tissue near the veins and ribs and causing the peculiar white veins. This disease is also due to a fungus (*Botrytis longibrachiata*) that thrives upon drying vegetation. "The fungus seldom reaches maturity on the curing stalks," says Sturgis, "for it requires some days and considerable moisture for

FIG. 65. RED-LEGGED GRASSHOPPER (*Pezotettix femur-rubrum*). Enlarged one-fourth.

its complete development, hence by the time its vegetative threads are ready to produce the fruiting branches, the stalks are too far dried to afford the requisite nutriment. After the curing process is completed, however, the tobacco is taken down, and the stalks and leaves most seriously affected with stem rot are thrown down on the floor with the refuse which always remains after the curing of a crop of tobacco. Here on the damp, earth floors and in company with decaying stalks and leaves, the stem rot fungus finds all the conditions favorable to its further development. The fungus spreads among the refuse, and produces its spores in enormous quantities. It is not unusual upon entering a barn, even during this process of curing, to find the floor partially covered with the refuse of the previous year's crop, the latter often looking as though a fall of snow had whitened it, so densely is it covered with the mold and spores of this fungus. The slightest current of air serves to separate the spores from their attachment, and carry them through the barn, some finding lodgment upon and at once infecting the curing stems and leaves, others being deposited on the beams or walls of the barn and there remaining to propagate the disease another year.

"Against such a pest, absolute cleanliness is the best and simplest precaution. After the crop is cured, all the diseased stems and leaves should be carefully collected and at once burned, before the fungus has reached maturity. All the refuse remaining on the floor of the barn should then be thoroughly gathered together and burned, and the floor should be liberally sprinkled with a mixture consisting of equal parts of dry, air-slaked lime and sulphur. If the floor is of earth, covering it to the depth of an inch with clean, dry earth would prevent the dissemination of the spores through the air. A more effectual method of reaching the spores in all parts of the barn would be fumigation by means of sulphur, kept boiling for two or three hours in any iron vessel over a small kerosene stove. In the larger barns it would be advisable to have three or four such stoves, and keep the sulphur boiling simultaneously in different parts of the barn ; of course during the process of fumigation the building must be kept tightly closed, so that the fumes may thoroughly penetrate every part. If this were done once, after the removal of the cured tobacco, and again the following season, a fortnight before the tobacco is harvested, the danger from stem rot or white vein would be largely decreased, if not entirely obviated."

White veins, as a disease, is confined to the seed-leaf and Havana-seed varieties, and is much dreaded, because it greatly impairs the value of the tobacco in which it occurs. White veins in the districts growing yellow tobacco are desired, because they add to the beauty and value of the yellow product.

Leprosy is the common name applied to a greenish fungous growth that attacks curing tobacco in the lower

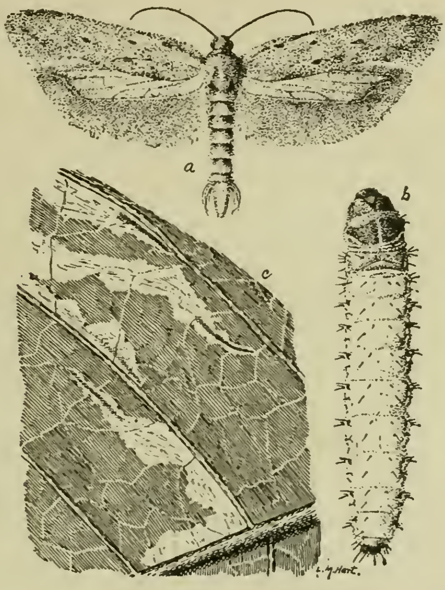

FIG. 66. TOBACCO MINER.

a, Adult moth; *b*, worm; and *c*, part of leaf damaged by this worm.

Ohio districts of Kentucky. The fungi increase with amazing rapidity, and they extend even to sound, dry tobacco in proximity, seriously damaging it. This is a disease that is doubtless propagated from spores, which find congenial lodgment in badly kept barns or tobacco sheds, or packing houses. All old trash left in such places should be either hauled out and spread upon the fields, or burned, while the disinfecting of barns as just described for stem rot or white vein, is also advised.

DISEASES OF THE GROWING PLANTS.

There is probably no crop produced of the same magnitude that suffers so little from disease as does tobacco, and nearly all these diseases may be avoided by proper care in the selection of the soils, in the judicious application of manure, and in the cultivation of the crop. The greatest number of diseases to which the tobacco is liable, come from a want of drainage in the soil. The diseases rarely affect more than a fraction of one per cent of the plants in a field. These diseases are largely of a fungous nature, and are now being tardily studied by scientific experts. Their efforts will ultimately give us a scientific explanation of the form or cause of the various diseases, but this book being mainly of a practical nature, for popular use, we content ourselves with a popular rather than a mycological and physiological treatment of the subject.

Rust or Fire Blight.—The most common disease of tobacco is known as "Brown rust" or "Red field fire." This arises from three causes, viz: First, overripeness in the plant; second, a deprivation of moisture while the plant is in vigorous growth, making the leaf perish in spots for want of sustenance, and, third, the use of too much heating manure applied in the hills, with supervening dry weather.

Another field fire called "Black fire," which is totally different from the red field fire, is caused by excessive humidity, and occurs only after continued rains of several days' duration, with hot weather. This black fire is much more to be dreaded than the brown rust or red field fire, for it attacks the plant while immature, involving all the leaves, and necessitates the

FIG. 67. FIELD OF TOBACCO DESTROYED BY TOBACCO HORN WORMS (Kentucky).

cutting of it before it is ripe. Sometimes this disease will spread over a field in two or three days and ruin the crop, making black, deadened spots as large as a silver dollar, but this rarely happens. Good drainage and a sufficient depth of soil to carry off all superfluous rain water, are the only safeguards against the blighting effects of this disease.

Spotted Leaf.—There is another disease, similar to the last, called "Frog eye" or "White speck," often occurring in tobacco thoroughly ripe. It is sometimes caused by too much potash in the soil, and sometimes from the taproot of the plant coming in contact with an impervious water plane. This disease is most frequently seen in the tobacco grown in Florida. It was once regarded as a sure indication of the fineness of texture in the leaf. Forty years ago the Florida wrappers affected with this blemish commanded the highest price with the manufacturers of domestic cigars. A similar trouble at the North causes what are called "calico plants," in cigar tobacco.

Frenching (from the French word *friser*, to curl) attacks tobacco grown upon old, clayey lands inclined to be wet, that have been much compacted by the tramping of stock, or through other means. Rainy weather is also a predisposing cause to this disease, and it sometimes manifests itself over a considerable area, but if the tobacco is closely plowed and a vigorous pull is given to the plants so as to break the taproots, a large majority of them will recover, if treated before the disease has gone too far. The first appearance of the disease is seen in the buds of the plants, which turn to a honey-yellow color. As the leaves expand, they become thick and fleshy, growing in long, irregular, narrow strips with ragged outlines, the leaves often cupping downward. When cut and cured, such leaves are lifeless, with a dingy, dead color, and are very light in weight.

"Frenched" tobacco is worthless for any purpose except as a substitute.

Walloon or Waterloon, is a disease that affects the appearance of the plant and causes the leaves, instead of curving in graceful outlines, to stick up like "foxes' ears," by which name the disease is known in some localities. This disease, though akin to Frenching, does not injure the tobacco to the same extent, though it reduces the weight of the cured product and impairs its quality and color. It results probably from deficient drainage.

Hollow Stalk.—The overflowing of any part of a tobacco field, though the water may stand on it for only a few hours, will produce "Hollow stalk" and "Sore shin." Some careful observers think hollow stalk results from the attack of the wireworm or the cutworm; others think it arises from the bruising of the young plant or of injury done to the epidermis, so that the sap is not able to ascend in full force. It most probably arises from the absorption by the pith of an undue amount of water, while partially overflowed, and the effects of the subsequent exposure to the hot sun. The disease is rarely seen upon a well-drained or porous soil. The plants attacked with it should be cut at once, for they will never grow or improve in any respect thereafter.

A New Disease of tobacco is described by J. Van Breda de Haan (in *Med.'s Lands Plantentuin*, No. 15, pp. 107, pl. 1.). It has appeared in Java. The leaves become dark spotted and greatly depreciate in value. The cause is attributed to the fungus, *Phytophora nicotiana n. sp.* A study of the biology of the parasite has been made and various attempts undertaken for the repression of the disease. The author thinks it can be prevented from spreading, by careful attention to, and frequent change of, the plant beds, and by spraying the

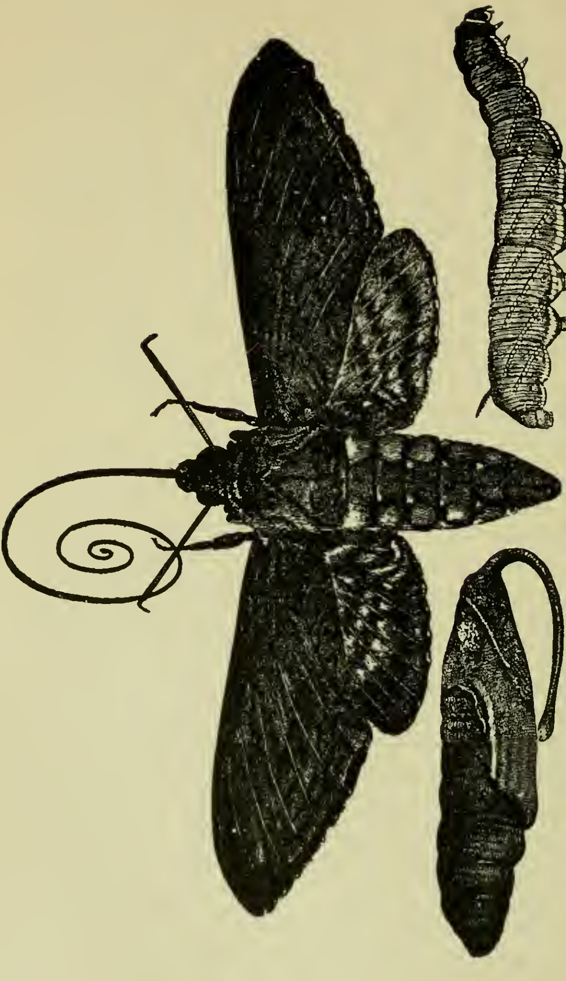

FIG. 68. TOBACCO WORM OF THE NORTH (*Phlegethontius celeus*, life size). The Sphinx moth, adult insect. At left, the Jug-handled pupa. At right, the worm.

plants with Bordeaux mixture, otherwise the disease threatens to become a serious enemy to tobacco culture.

2.—INSECTS.

The tobacco plant, from the period of its germination until it is cured, is preyed upon by a variety of insects, and the utmost diligence and watchfulness are required by the grower to guard against their depredations. The first of these to make their appearance are the so-called "Snow fleas," which are peculiar to the seedleaf districts of the North, and are rarely seen south of the Ohio and Potomac rivers. The snow flea has a large head and a small abdomen, without any segmental divisions. It is known to entomologists as *Smynthurus hortensis* or "Springtails." The antennæ are three-fourths as long as the body. It is called springtail because of a forked member, which lies folded up against the underside of the abdomen near its end, which gives the insect its great leaping power. Its power of rapid locomotion resides in this spring tail. These insects can stand very cold weather and are the first to feed upon the tobacco plant, beginning when the two first tiny leaves appear above the surface of the ground. Applications of the flour of sulphur are said to have the effect of driving them away. They are rarely ever seen upon beds that have been well burned.

The Flea Beetle is far more destructive to the young tobacco plant, and its ravages extend through every part of the United States where tobacco is grown. It belongs to the genus *Epitrix,* family *Halticidæ.* Two species are described that attack tobacco, —*Epitrix cucumeris,* and *Epitrix pubescens.* The first is black, with the exception of the feet and antennæ. The second is more oblong in form, but is otherwise about the same in size and of a dull black color. The feet and antennæ are of a honey-yellow color, as well as the upper part of the body, except a portion of the wing covers, which are black. The upper and lower parts of the whole body, with the exception of the thorax, are covered with a slight down, from whence it takes its specific name of *pubescens*. These insects are from one-sixteenth to one-tenth of an inch in length. This latter species is especially fond of the young tobacco plant, though it will feed upon young cotton, cabbage and potato plants, and the tender leaves of all leguminous plants. When disturbed, the flea beetle will leap from

FIG. 69.
TOBACCO WORM OF THE SOUTH (*Phlegethontius Carolina*), reduced one-fourth.

It differs from *P. celeus* mainly in not having so long a tongue, while its "jug handle" is not so long or so arched as in *P. celeus*.

the plant and hide itself among the clods and in the dry dirt. Frequently the plants will be seen covered with them and the depredations are made rapidly, a whole seed bed being often destroyed within a few days.

The only certain protection to the young plants against this destructive insect is to cover the bed closely with canvas as soon as the seed is sown, and close up all openings between the canvas and the ground. Plants in beds are also sprinkled with powdered lime moistened with turpentine, or soot, wood ashes or fine road dust may be used instead of lime. A decoction of tobacco stems, heated to 125° F., will kill all the fleas it touches, without injuring the plants. Until the practice of using canvas coverings was adopted, this beetle was more dreaded even than the horn worm. The flea beetle at the North is frequently as destructive to half-grown tobacco as to the potato plant, the little holes it eats into the leaves ruining their quality, if not killing them outright. The potato crop is protected against this pest by spraying with Bordeaux mixture,* and in bad attacks the same remedy may be sprayed upon tobacco.

Cutworms (Fig. 60) are occasionally troublesome to seed beds when they are made near old land infested with them. Canvas covering is no protection against them under such conditions. Prevention in this case, by preparing the beds on new land some distance from the old, is the best remedy. But cutworms are sometimes very destructive to the plants after they are set out in the fields. They sever the stalks of the plants beneath the surface. Their work is performed at night, or in the cool of the morning, before the sun begins to shine upon the ground, or late in the evening, after the sun has set. They take refuge beneath the surface of the ground when the sun is shining, where they may be easily found lying in a coil. When grown, they are from one and one-quarter to one and one-half inches long, plump and greasy looking. The common, white grub is familiar to all, and the traveling cutworm, Fig. 61, may be even more destructive.

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*Bordeaux mixture is made by combining six pounds of copper sulphate and four pounds of quicklime, with water to make fifty gallons. The copper sulphate is dissolved in water (hot, if prompt action is desired) and diluted to about twenty-five gallons. The fresh lime is slaked in water, diluted to twenty-five gallons, and strained into the copper solution, after which the whole is thoroughly stirred with a paddle. Both the copper and the lime mixtures may be kept in strong solution as stock mixtures, but when combined should be promptly used, as the Bordeaux mixture deteriorates on standing.

Burning the trash from the fields before plowing, and breaking the land in the fall of the year, are both very destructive to the cutworms. Clean culture, leaving nothing to harbor worms during the winter, is important. When they are found in the soil, however, there is no better remedy than to hunt them out about each hill of plants, and destroy them. Cutworms disappear upon the advent of hot weather. Enclosing plants with stiff collars of brown paper, stuck well into the earth, is effective, but involves much labor. Cutworms may be caught by putting on each hill, or every few hills, at night, a bit of clover, cabbage or other tender green stuff the worms relish, first covering the same with a mixture of Paris green, one part to flour twenty parts, or dipped in a pail of water containing a tablespoonful of the poison; the poison sickens the worms so they won't eat, or kills them outright. Birds, chickens, turkeys and pigs are very fond of cutworms, and may, under some circumstances, be utilized for their destruction. The common bluebird is known to have a special fondness for them, and will do valuable service in field and garden if left unmolested. Examination of the contents of the stomachs of the bluebird shot in Tennessee during February, showed that 30 per cent of the food consisted of cutworms. During March, also, its food has been found to contain a large percentage of these insects.

Like the chinch bug, cutworms are subject to diseases, which appear to be caused by attacks of bacteria and other parasitic enemies. The Kentucky experiment station reports that those affected with the trouble would often go into the ground as if to change to pupæ, but instead died, becoming flaccid and discolored, and when recently dead were filled with a clear, yellowish fluid, in which were large numbers of bacilli, some of them in active motion. It is hoped that practical means may be found for spreading the disease among cutworms, and thus kill them by the wholesale.

Wireworms, the larvæ of the "Click beetle" or "Snapping bug" (*Elateridæ*), sometimes bore into the stalks of the plants, but they never attack the leaves.

The "Bud Worm" (*Heliothis armigera*), Fig. 62, attacks the bud and tender leaves at the top of the tobacco plant before they are unfolded, and sometimes work the greatest injury. One of these worms may ruin a dozen young leaves in a few days. Hand picking is the only remedy for tobacco, though carefully spraying with Paris green is suggested. These worms are always most destructive in cloudy weather. This is the dreadful bollworm of the cotton planter and corn worm of the North. The tobacco bud worm has been observed on weeds belonging to the same family as tobacco, but has not been generally accounted a tobacco insect. At the Kentucky station, worms left tobacco and went into the ground August 10, and adult moths came out August 24 and 25. Since their original food plant was probably some one of the weeds known as ground cherry and horse nettle, it would be well always to destroy such plants when growing about tobacco.

Crickets.—There is a greenish tree cricket (*Œcanthus niveus*), Fig. 63, that occasionally does much injury to the leaves of tobacco, by eating round holes in them. It does not kill the leaf or arrest the growth, but the small holes increase in size longitudinally, as the leaves grow in length. This insect begins its depredations in July in the southern tobacco regions, and in August in Pennsylvania. Tobacco planted near trees suffers most from its depredations. This pest infests blackberry and raspberry canes, and tobacco should not be set near them.

Grasshoppers.—The meadow grasshopper (*Orchelimum vulgare*) is sometimes very destructive on the tobacco plants when first set out, and before they have become established in the ground. One part of Paris green mixed with twenty parts of wheat flour and a small quantity dusted on the plants while the dew is on them, will destroy these pests. Frequent workings of the land will also drive them from the field. All weeds and other unnecessary growth likely to harbor these pests during the early part of the season, should be destroyed as a precaution against late summer injury.

Several species of grasshoppers are likely to be so starved for forage that in July or early in August they are often forced to attack tobacco, but in Kentucky the greater part of the holes gnawed in leaves (Fig. 64) is the work of the red-legged grasshopper, shown in Fig. 65.

To kill the grasshoppers, the mixture of Paris green above mentioned is put in a bag made of thin cloth, which is tied to the end of a pole four or five feet long. Walking between the rows when the dew is on the plants, the bag is held over each and a slight tap given to the stick. A portion of the mixture falls upon each plant, and adheres to the surface of the leaves. This application is said to destroy the grasshoppers completely. Too much of this mixture should not be put on a plant, not enough to make it whitish.

Sucking Bugs.—In Pennsylvania, and other seed-leaf growing districts of the North, there is a class of hemipterous insects that puncture the leaves of the tobacco plant and suck out the juices. One of these is a small, gray insect or bug, about a quarter of an inch long, known among entomologists as *Phytocoris linearis.* In Tennessee, and other southern States, this species feeds upon the parsnip, the tomato and the cabbage plant, but rarely on the tobacco plant. A larger insect, belonging to the family *Scutelleridæ,* known as the *Euschistus puncticeps,* preys upon mullens, thistles and other weeds as well as upon the tobacco plant, but its injuries do not seem to be so decided as the first named. These bugs make very small holes in the leaf, but the damage resulting from them is inconsiderable.

The Tobacco Miner is a new pest that attacked tobacco for the first time in 1896, being noticed in three townships in one county in North Carolina. The caterpillar is about half an inch long, and greenish, with a dark brown head. It makes an irregular or blotch mine by eating the green matter between the two sides of the leaf, leaving the skins intact and the leaf transparent. The caterpillar is extremely voracious and as several usually mine one leaf, the leaf is soon rendered worthless, and it is feared that the pest may be widely prevalent. It has been carefully studied by Gerald McCarthy, botanist North Carolina experiment station, and the facts and illustrations (Fig. 66) are from its bulletin 133.

The insect is a native whose common food plant has been the perennial weed, *Solanum Carolinense,* commonly called horse or bull nettle. This weed is rather common on dry, sandy soil from Connecticut southward along the coast to Florida, and westward to the Mississippi. The range of the insect is co-extensive with its host plant, and includes nearly the entire tobacco-growing area of the United States. It is well known to economic entomologists that the natural increase of any insect is chiefly regulated by the abundance of its food plants. Insects which subsist upon a few species of weeds of waste ground must necessarily lead a very precarious existence, and do well if they hold their number from year to year. When such an insect changes its wild food plant for a cultivated species, the relatively almost infinite abundance of the latter causes a parallel increase of the insect, which, soon overflowing its natural boundaries, or the range it occupied before, spreads into all regions where the new host plant is cultivated. This has been the history of the Colorado potato beetle, which originally subsisted upon another solanaceous weed.

Description of the Tobacco Miner.—Gelechia picipellis, Zett. General color, yellowish gray. Head and thorax paler than wings, inclining to cream color. Palpi simple, not exceeding the vertex. Primaries variegated, with a few smoky streaks and a marginal row of minute black spots at base of cilia. Wing expanse 0.45 to 0.50 inch. Length 0.20 inch. (After Miss M. Murtfeldt, 1881.) The insect belongs to the natural order Lepidoptera, sub-order of moths. Family

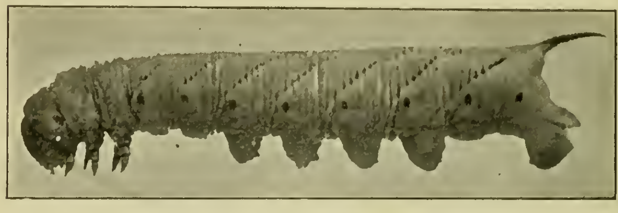

FIG. 70. TOBACCO WORM, LIFE SIZE.

of Teneids, of which the more important are the clothes and fur moths, and the Angoumois grain moth or "Fly weevil" (*Gelechia—Sitotroga—cerealella*), so destructive to corn and grains in the crib. The latter species is very closely related to and greatly resembles our tobacco miner.

Remedies.—None have been tried as yet. From the nature of the case, the treatment must be preventive. The parent moth deposits her eggs within the substance of the leaf or stem of the plant. The resulting caterpillar eats the green matter of the leaf, leaving both epidermes intact. These surfaces, in the case of tobacco, are oily and will readily shed any liquid, and they also prevent any powder from penetrating or touching the insect within. It is within these mines that the caterpillar appears to pass its whole larval and pupal life, issuing as a winged moth to lay eggs as before. The number of annual generations is yet unknown, but is probably not less than three. The insect is believed to hibernate in the imago or winged state, though it may also lie dormant, either as caterpillar or pupa, hidden in the stumps of tobacco or the roots of the bull nettle. The most promising remedy at present is the extirpation of the bull nettle in all tobacco-growing sections, and the prompt plowing under or removal of tobacco stumps as soon as the crop has been gathered. Watch for leaves showing the miner's transparent blotches, and when found, remove and burn them.

The Tobacco Worm.—This is the great arch enemy of the tobacco plant and absolutely sets a limit to the culture of tobacco. It reduces the acreage fully one-half. But for its destructive power six acres might easily be cared for by one man. There is no remedy for them, but to search every leaf and destroy them. The worming of the crop, when they are numerous, is the most disagreeable and tedious work attending tobacco growing. Some seasons there are comparatively few, again, they seem to infest every leaf. Worming has been done so persistently in many places in the Connecticut valley that this pest is well-nigh exterminated. But under more careless methods at the South, immense injury is done by the tobacco worm, as may be inferred from the photograph in Fig. 67, of an entire crop utterly destroyed by this pest. Fields of tobacco that give promise of making the finest wrappers may be totally ruined for that purpose through a week's neglect in catching the worms. It matters but little how rich the soil may be, or how well cultivated, the crop will be a total failure unless these worms are destroyed. So important is this work regarded by the successful tobacco planter, that he will neglect every other duty on the farm and pay three or four times the ordinary prices for farm hands in order to fight this pest, for the profits of tobacco culture will be, other things being equal, proportioned to the ability to destroy this inveterate and insatiable enemy.

The fruitful mother of the devouring and destructive tobacco worm is a *lepidopterous* insect of the hawk moth or *Sphingidæ* family, also called the Sphinx moth. It derives the name Sphinx from the attitude which the caterpillar assumes in raising the fore part of the body, and remaining in this state of immobility for hours together. In this the lively imagination of Linnæus perceived a resemblance to the sphinx of the Egyptians. There are two species of these moths—the tobacco worm of the North—*Phlegethontius celeus*, shown in Fig. 68, and the tobacco worm of the South—*Phlegethontius Carolina*, Fig. 69. Both species may occur in the Middle South, and for the purpose of the practical planter may be considered as one, though entomologists have had a dispute over their proper names, the one above adopted having by far the weight of evidence and authority in its favor.

The worm enters immediately upon its work of destruction, making a small hole in the leaf, and gradually enlarging this, confining itself to the under surface of the leaf if the weather is clear. About the seventh day it passes through another change, doffing its old skin and putting on the habiliments of maturity. While this change is going on, the caterpillar loses its appetite, but in a day or two it recovers and becomes endowed with greater vigor, activity and voraciousness, passing readily from leaf to leaf, or from plant to plant, growing in size and its capacity for eating, until it will consume half a large leaf within twenty-four hours. As it approaches its full growth, it takes refuge, during the heat of noontide, among the ruffles of the plants, or screens itself from the ardent rays of the sun by pene-

FIG. 71. LEAF ATTACKED BY TOBACCO WORM.

trating the soft earth under the plant. At this stage of its growth (Fig. 68, better shown in the engraving from a photograph, Fig. 70) it is a hideous looking creature, between two and three inches long, and as large as the little finger. It has a dark, green color, with a sharp, pointed spikelet upon its tail resembling the sting of a bee. This is often called a "horn," hence the name horn worm. Oblique, whitish, dotted stripes point downward and backward, and ornament its sides. It has twelve segments or rings; six true legs, coming out from the second, third and fourth rings, and four double, fleshy suction protuberances from the seventh, eighth, ninth and tenth segments, with a prop leg on the twelfth. The fifth, sixth and eleventh segments have no legs. When touched, the worm manifests its irritability by throwing its head from side to side, ejecting from its mouth a stream of masticated tobacco, and chafing its mandibles, emitting a sound like the chattering of teeth. Though threatening in appearance, it is perfectly harmless, and can be handled with impunity.

This moth rarely makes its appearance in the day until about sunset, when it may be seen with its long tongue probing the deep corollas of the petunia, evening primrose, and of the jimson or Jamestown, weed, at which time it is easily caught. This moth (Fig. 68) measures across the wings from four to five inches, has a gray color, variegated with wavy black lines across the wings, and fine orange colored spots on each side of the abdomen. The tongue is five or six inches long, and when not in use is coiled up spirally, like a watch spring. Its first appearance is about the middle of May. From this time, the number increases until the last of August. From their large size, the manner of their flight and method of feeding, they are often mistaken for humming birds and are called "Humming bird moths" and "Horn flowers."

The eggs, about the size of a mustard seed, and of a pea-green color, are deposited both upon the upper and under surface of the tobacco leaf, being kept in place by a viscid fluid resembling glue. The moth, in depositing the eggs, flies rapidly from plant to plant, giving each leaf upon which it deposits an egg, an audible tap. This is done usually at twilight, and after, in clear weather. The eggs gradually change their color to a milky white, and even before the tiny worm breaks from the shell, its spiral form is distinctly visible through the transparent encasement. When first hatched, it is of a delicate cream color, with a white, thornlike appendage. When it has attained its full growth, which occupies the period of about twenty days, it descends into the ground, when its body contracts and shortens, the skin meanwhile changing from a dark green to a brown color and increasing in hardness; within a week or two it will assume the chrysalis state, with a long tongue case bent over circularly from the head and touching the breast, making a complete loop (Fig. 68), hence they are sometimes called "Jug handle grubs."

Entomologists usually concur in the belief that in this condition it remains in the ground, below the freezes, through the winter. Many practical, observant farmers, however, are of the opinion that this is true only as applied to those that appear later in the season, just before, or after, the appearance of frost. It is believed that those coming to maturity in June and July throw off the chrysalis state in August and September, and appear as moths. In this way only can the large number of worms that appear in these months be accounted for.

There is another moth, the *Sphinx quinque-maculata*, that resembles the latter so much that an ordinary observer will scarcely distinguish the difference. This is another species of the same family, and the larvæ of the moth prefer the tomato vine, especially in the Southern States, but they are very destructive to the tobacco plant in higher latitudes.

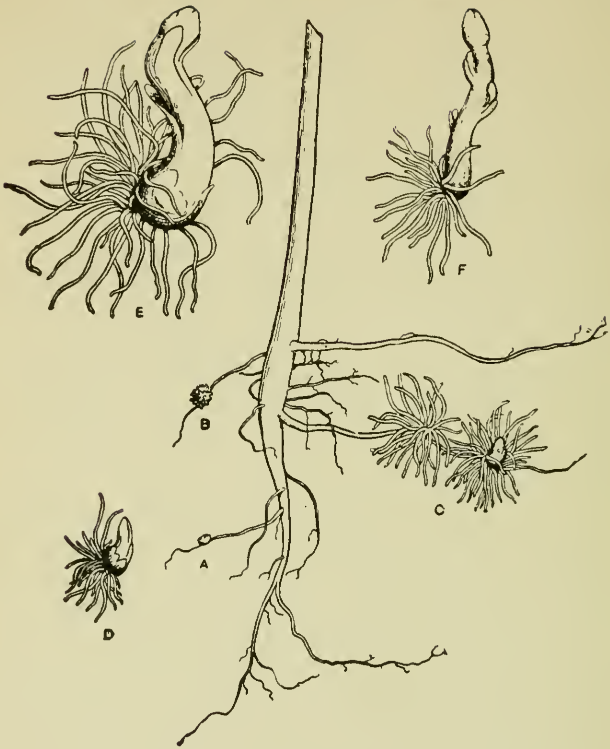

FIG. 72. DEVELOPMENT OF YOUNG BROOM RAPE. Three-fourths natural size.

a, A plant which is just beginning to put out the stalk bud and the fibrous roots; *b*, a later stage when the closely placed fibrous roots form conspicuous prominences which conceal most of the surface; *c*, two parasites at a still later stage, the right one turned so as to show the bud, now of considerable size; *d*, a still later stage, with a short stem and bracts; *e*, a well-grown young parasite as it pushes through the ground at the surface, its long, fibrous roots not yet attached to those of the host plant; *f*, a young plant which was grown in packed soil, with several lateral buds which would have produced branches.

Worms having cocoons attached to them, resembling grains of rice, should not be killed, as these cocoons belong to a family of parasites called *Microgaster congregata*, which destroy the horn worms in great numbers.

Catching the moths in traps, or poisoning the blossoms of petunia and Jamestown weeds with a sweetened solution of cobalt (water one pint, molasses or honey one-fourth pint, cobalt one ounce), diminishes the number of worms, but there will always be left enough to be troublesome. A drove of turkeys kept in the tobacco field will destroy a great number of the worms, but the only safety is in going over the field at least once a week, or oftener, picking off the worms and destroying them. The worms usually stay on the underside of the leaf; if a hole is seen in the leaf, no matter how small, a worm will usually be the cause of it. The work cannot be done too carefully, for if one or two worms remain on a plant, they will completely riddle it in a very short time. If they are well cleaned out when they first appear, much time and labor would be saved.

Spraying tobacco with Paris green to destroy the tobacco horn worm has engaged the special attention of the Kentucky experiment station. The proportion used was one pound green to 160 gallons of water. Plants were thoroughly sprayed July 27 and August 3. There were fewer worms on sprayed than on unsprayed plants. As to the amount of arsenic, only one-third of one grain of arsenious oxide per pound of tobacco was the largest quantity recovered by careful chemical examination. Only four per cent of the arsenic originally applied was recovered. As two to three grains of arsenic are required for a fatal dose for an adult man, the station officials see no harm in making these sprayings during a dry season.

There are usually what farmers call two "showers" of these worms, one coming about the last of June and the other about the middle of August, or, rather, during the light of the moon in August, at which time the moth is most industrious in depositing its eggs on the plants. The first influx is easily destroyed, for the tobacco is then small and there are but few hiding places for the worms, until the suckers begin to put out. It is the second influx that is to be dreaded. The large size of the tobacco leaves at this time, the presence of the suckers and the disposition of the worms, as they grow older, to shift their places, all makes it very difficult to rid the tobacco of this devouring and destructive enemy late in the season.

3. OTHER TROUBLES WITH THE CROP.

Broom Rape.—In central Kentucky, there is a parasitic flowering plant called broom rape, that attaches itself to the roots of hemp and tobacco and derives its nutriment from that source. It is known to botanists as *Phelipæa ramosa,* and grows to the hight of about ten inches. As described by the botanist of the Kentucky experiment station, "The stems are thick, whitish, fleshy, pubescent, generally branched and bear small scale like bracts, in place of leaves, which, when old, turn brown at the tips. The flowers are white with a faint purplish tinge; sometimes of a decidedly purple color. They are borne in loose spikes in the axiles of the bracts. The flowers are all perfect, and as many as forty are produced on a single branch." A section through a young plant and the root to which it is attached, shows that they are very closely united. The young broom rape pushes an elongated cell into the root of the host plant, and soon spreads out into a fibrous bundle, robbing the host plant of the nutritive elements which it derives from the soil and atmosphere. The result is an enfeeblement of the infested plants, shown in retarded growth, weakness of the stems, and reduced yield and quality of leaf.

When the land is badly infested with broom rape, the director of the Kentucky station thinks that a rotation with crops which are not attacked by it is the best means of avoiding injury. The seeds of the broom rape are very small, far smaller, indeed, than tobacco seeds, and they seem to possess great vitality, remaining several years in the ground without losing their power of germination, which appears only to take place when brought near the host plant. This parasite cannot be removed by hand, for its roots are so intimately intertwined with the roots of the host plant, that one may not be pulled up without pulling up the other. It is said that an application of gas lime to the soil will sometimes prove successful in destroying the seed of the noxious plants. The lime looses this property after being exposed to the air for some time. The application should be made to the land in the fall of the year, at the rate of two tons per acre, and plowed, or harrowed, into the ground. A stimulating manure applied to the land will aid the hemp or tobacco plant in resisting the onslaught of the broom rape. The station does not recommend stable manure, however, for this purpose. Whatever renders the soil friable, stimulates the broom rape to greater activity, when its host plant is present. It does not push its way readily through a closely compacted soil. The danger to tobacco on infested land is greatly increased when the soil is loose and porous. Rolling the land with a heavy roller is recommended when the land is infested with the broom rape. This should be done immediately before setting out the tobacco plants.

Hail is a much dreaded enemy from which there is no escape, as it is not practicable to cover a field so that a hail storm would not cut the leaves. The best plan is for growers to mutually insure against damage by hail or wind, through a coöperative insurance company

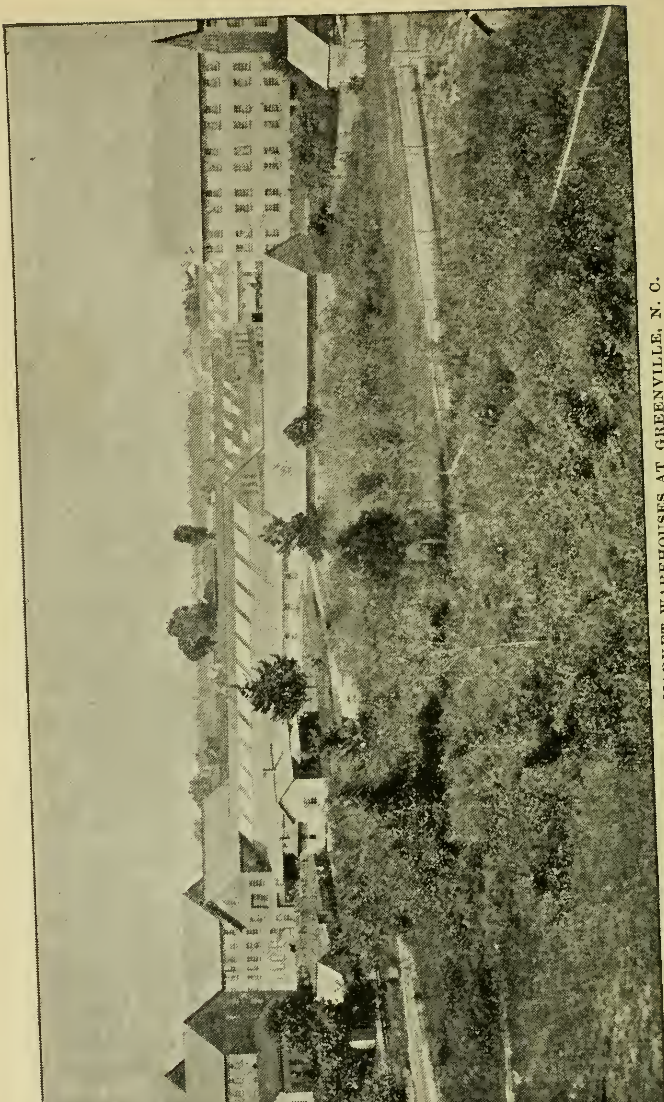

FIG. 73. TOBACCO MARKET WAREHOUSES AT GREENVILLE, N. C.

organized for this special purpose. Such insurance is usually cheap, and is limited to the actual loss incurred. After a hail or wind storm, it is well to go through the field and prop up all plants that have been beaten down, removing the leaves that are most badly cut and stained with earth. Make the most of a bad situation and save all that can be saved.

Wind whipped tobacco is much injured. It can only be insured against as just stated. But where severe wind storms are common, a hedge, or some tall and close crop, to break the wind's force, is advisable next to the tobacco field.

Early Frost.—Since the perfect quality of the tobacco depends upon curing it at proper maturity, and since such maturity may not be reached until danger of frost, it is highly important to guard against this contingency. Even the slightest frost will destroy the intrinsic quality and market value of an otherwise perfect crop. The more valuable the crop and the greater the risk of frost, the more effort and expense may be safely put into means of protecting against frosts. A famous California orange grove is equipped with a system of iron pipes, through which water is conducted to nozzles at frequent intervals, the idea being that the spray will ward off light frosts. Barrels of tar and rubbish, in different parts of the orchard, are available for making a smudge of smoke, which is the most practicable means yet devised. In the case of a freeze, neither of these methods is of much avail. Smoke is good against all light frosts, and is easily obtained. Strawy manure, leaves, rubbish, etc., should be piled in the lowest places and about the sides, and covered with hay caps, or ducking (previously painted with two coats of linseed oil, and dried), so as to be always dry. Have a barrel of kerosene oil handy, some cans, and torches. When frost threatens, set a night watch to inspect thermometers placed on stakes in various parts of the field, especially in the most exposed places. If the mercury drops to 35° by one or two in the morning, it is likely to mean a frost of more or less severity before sunrise. Then call up the folks, light the torches, and let each person take torch and oil can (previously filled) and set fire to the row of rubbish heaps previously assigned him. If the wind blows the smoke away from the field, carry some rubbish over to that side, so the smoke will be blown on to instead of off from the field. If the danger never comes, no expense worth mentioning has been incurred, as the piles can be scattered and plowed under for manure, or burned, the ashes making excellent fertilizer. No prudent person thinks of leaving his buildings uninsured against fire. Certainly it is just as important to insure against frosts, so far as it can be done, by such simple means as smoke coverings, or water. Mr. E. P. Powell, a successful and brainy horticulturist in western New York writes: "The very best preventive against frost is not fires, but thorough spraying with water during the evening and night. When this can be done, we can overcome the danger from a fall of two or three degrees. This will often save our whole crop. This last spring I lost my grapes by a margin of not more than two degrees, but on a preceding night anticipated the frost by deluging the trellises with water." The same plan will work equally well on tobacco.

CHAPTER XII.

ON THE MARKETING OF TOBACCO.

In the cigar-leaf growing States there is not, as yet, any organized system of marketing tobacco, such as has been developed so admirably in the heavy leaf, Burley and yellow districts of the South. Numerous attempts have been made by cigar-leaf growers in the New England and Middle States to organize coöperative exchanges for the sale of their crops, but so far without success. The method followed at present, and for years, is for the planter to wait for the buyer to come to his farm.

Buyers usually inspect the crop very carefully while it is growing, and under unusual conditions may even contract for the growing crop. Such contracts are usually verbal, and are a frequent cause of dissatisfaction and complaint. The buyer agrees to pay a certain price for the crop delivered to him in good condition, but if the market goes down before the leaf is delivered, he will claim that it is not of the quality represented, and he will not pay the stated price for it. On the other hand, should the market advance, the buyer of a crop contracted for in the fields will insist upon having the leaf delivered. If such contracts are made at all, they should be in writing, with all the conditions plainly set forth, so that there can be no mistake, and 10 per cent of the amount should be paid to bind the bargain. This caution also applies to tobacco sold on the poles before stripping.

The great bulk of the cigar leaf, however, is sold after being stripped and put in the bundle. The buyer comes to the farmer's barns, inspects the crop, and a price is agreed upon for the crop delivered at the buyer's local warehouse, or shipped to his headquarters. Some farmers, however, when dissatisfied with offers made by traveling or local buyers, case the crop themselves and hold it for higher prices.

These buyers of the cigar-leaf crop may be traveling agents sent out by dealers in New York, Chicago, or other cities, or they may be the representatives of cigar manufacturers. Very often, too, some enterprising planter and business man combines the assorting and sale of his own crop with purchases of his neighbors' crops. Buyers usually prefer to take the crop in the

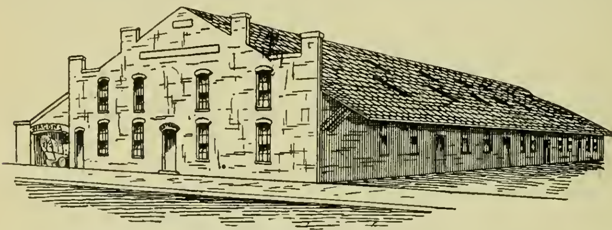

FIG. 74. NORTH CAROLINA TOBACCO WAREHOUSE.

bundle and assort it themselves, to suit their special trade.

It will be seen that, by this system, there is very little competition for the crop on the part of buyers, except in seasons of scarcity or excitement. The tobacco grower is largely at the mercy of the buyer, especially as many sales are kept secret because made on so-called "private terms." Indeed, it is quite difficult to accurately report the price at which cigar-leaf growers sell their crops, as buyers make every effort to keep the high prices secret, while the grower is equally anxious not to have it known if he has accepted a low price. The whole system is mischievous, illogical, unjust, unbusinesslike, expensive. It is apt to rob the farmer, it sometimes operates to the disadvantage of the buyer, and at best, it maintains an unnecessary number of middlemen.

If public warehouses for the sale of the crop, according to the system so successful in the South, could be provided at central points in the cigar-leaf sections, and carefully regulated by law, that system could not fail to revolutionize the old method, and greatly to the satisfaction of all concerned. A large quantity of tobacco, divided into established grades or descriptions, offered at certain established dates, could not fail to attract large numbers of buyers. Each crop would thus have the benefit of competitive sales at auction, and would thus get the best price the market affords. Such warehouses would also provide for sales other than by auction. It is singular that the North, usually so enterprising, should be so lacking in a businesslike method for selling its tobacco crop, since the South has brought the method to such a high state of perfection.

The Warehouse System.—By this system in the South, warehouses are erected at a point that is the center of a large tobacco-growing district. There is much strife among towns to secure the location of tobacco warehouses, because the large daily sales of leaf during the season distribute immense sums of money to the planters in the vicinity, and the town's general business is greatly benefited thereby. This warehouse system is building up many towns in the South. Within the past ten years, eight markets for the sale of tobacco have been established in as many different towns in the ten counties constituting the "new golden belt" of North Carolina. These towns contain 20 warehouses of spacious size. They engage from 60 to 80 large prize houses, ranging from 80 to 120 feet in length and 30 to 50 feet in width, three to four stories in hight, each equipped with all the best methods of keeping and re-

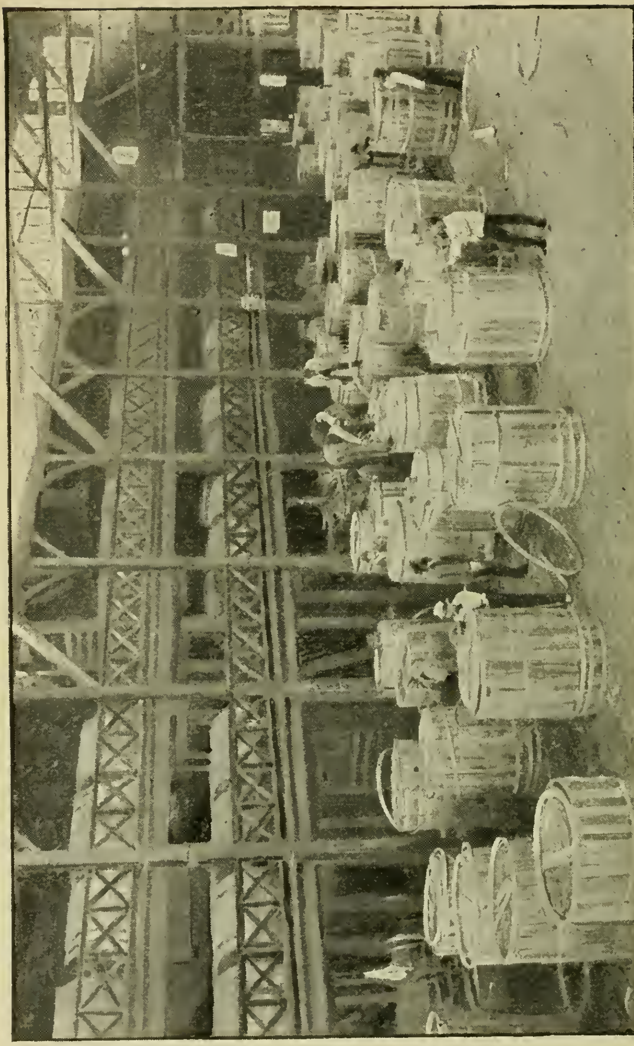

FIG. 75. STRIPPING THE CASKS, OR HOGSHEADS, FROM HEAVY TOBACCO, PREPARATORY TO INSPECTION, SAMPLING AND SELLING, CINCINNATI AND LOUISVILLE.

prizing tobacco. Upon the floor of each of these warehouses may be seen daily from 15,000 to 50,000 pounds of bright tobacco. Fig. 73 is from a photograph of the warehouses in the section referred to, that are building up the prosperous town of Greenville. In the older and heavy shipping districts, the warehouse system has attained still larger dimensions, involving great warehouses, tobacco boards of trade, banking facilities, and all the appurtenances to a large commerce. Clarksville, Tenn., is an example of a town being rapidly developed, because it is a center for tobacco sales by the warehouse method, while Danville, Va., has long had a national reputation in this respect. Much of the vast commerce of Cincinnati and Louisville is due to these cities being great tobacco markets.

Selling "Loose" Tobacco.—In the heavy leaf districts, large quantities of tobacco are sold loose, the other method very generally employed being that of selling the leaf in hogsheads under inspection regulated by law. Heavy shipping and manufacturing tobacco, when sold loose, usually changes ownership after it has been examined by purchaser in growers' barns, and price is usually fixed according to weight, with the condition that the amount of lugs must not exceed a certain agreed percentage. In other words, a fixed price is paid for the good grades, and another set figure for the lugs. Warehouses for the sale of loose tobacco are now established in Virginia and North Carolina, but no such provision for sales is made in the Mississippi valley. The warehouses for the transfer of loose tobacco are quite different in construction and arrangement from those where prized tobacco is sold.

An important requisite, in the construction of a warehouse for the sale of loose tobacco, is plenty of floor space, and plenty of light from above and also from all sides. Attached to one side of the warehouse is a cheaply

FIG. 76. INSPECTOR DRAWING SAMPLES OF HEAVY LEAF.

constructed shed, into which wagons with the loose tobacco are first driven. The floor of this shed is about three feet lower than the floor of the warehouse. The tobacco is taken from the wagon and placed in long piles on trucks, with the heads outward and the tails in the center. This loaded truck is then wheeled upon the platform scales and weighed, after which it is taken to an open floor space to which it is assigned, and the tobacco skilfully dumped. A card bearing the warehouse number, weight of the pile and name of owner is fastened in the cleft of a stick, which, in turn, is fixed in the top of the pile of tobacco. As far as possible, the various grades are kept separate. The tobacco is then ready for the auction, and the owner, if bid prices are not satisfactory, reserves the option of rejecting these, and may subsequently sell privately or offer his tobacco at another time at the same place publicly.

The charges for handling loose tobacco in this character are not burdensome. That for weighing each pile is 10 to 15 cents; the auction fee is at the rate of 10 to 15 cents per 100 pounds, and if the pile weighs more than 100 pounds, a set figure of 25 cents. Finally, there is a commission of two and one-half per cent on the amount of sale, which goes to the warehouse. Immediately following the sale the tobacco is removed in large, flat-bottom baskets, each holding 200 to 300 pounds.

Sales of Prized or Inspected Leaf.—Licensed warehouses for the sale of tobacco prized in hogsheads are numerous throughout the heavy shipping and manufacturing districts, and are governed by certain wise restrictions under State laws. These are generally very rigid, and properly require that everything shall be done by the warehouseman to insure fair dealing between buyers and sellers. It is the purpose of the law that these regulations will so cover every case as to make it unnecessary to carry disagreements to the courts. Provision is

FIG. 77. SELLING HOGSHEAD TOBACCO AT AUCTION BY SAMPLE.

made that no warehouseman, or any one of his employees, is allowed to participate in the profits or losses from the purchase or sale of any tobacco in the warehouse with which he may be connected.

The inspectors of tobacco are either appointed by some State authority, or elected by a tobacco board of trade. In Tennessee, the warehousemen are created inspectors by law, but they may appoint inspectors, or samplers, for whose acts the warehousemen are held responsible, by the regulations of the tobacco board of trade. These deputy inspectors are elected by the vote of the warehousemen and buyers, who have an equal voice in their selection. In cases where differences and claims arise, these are settled by an arbitration committee. The latter consists usually of three persons, who are appointed by a committee of the board of trade, one member of which is a warehouseman and another a buyer, these two selecting a third to complete this committee. Provision is also made for a committee of appeal, which has the power to confirm or reject the decision of the committee of arbitration. The warehouseman is obliged to keep his house in good condition and repair, the floors fitted with platforms, or skids, which will elevate the hogsheads at least four inches.

Drawing Samples.—In order to secure fair average samples from a cask of tobacco, the top head is first taken out, the cask then turned bottom upward and lifted from the closely packed tobacco, as illustrated in Fig. 76, this leaving the entire contents of the cask in a solid column exposed to view on all sides. The tobacco, by means of an iron lever supported by an adjustable fulcrum, is divided in at least four places. At each "break" four or more bundles from different courses are drawn by the inspector (Fig. 77), so as to get a fair idea of the quality and condition of the leaf. These bundles are tied in one sample, to which is affixed a tag,

FIG. 78. BUYERS FROM ALL OVER EUROPE AND AMERICA AT A SALE OF SHIPPING TOBACCO CLARKSVILLE, TENN.

or label, bearing the name of the warehouse, the seller, the warehouse number, the gross weight, date of inspection and the name of the inspector. This tag is affixed by tape and sealing wax, to prevent tampering. If a hogshead is resampled, it must also be reweighed. The tag bears the date of original inspection, and later and last date of reinspection, with the new gross weight. The tobacco "note," or manifest, as it is called, also shows the date of inspection or reinspection, of old and new weights, and passes from buyer to seller without endorsement or further marks of identity.

This note bears also the name of warehouse, planter's private marks and numbers, and is signed by the proprietor. When required by the buyer, the private initial or brand must be interpreted, revealing the packer if not the owner. This tobacco manifest, or receipt, is negotiable, representing, as it does, an individual and identified package of tobacco. When the tobacco "note" is taken by the warehouse as a receipt for the delivery of the tobacco, the receiver or owner is required to properly endorse same. Sometimes tobacco is placed in storage, the owner not wishing, for the time being, any inspection. The warehouse issues a special receipt for this, inserting in it the description of each package in the way of private marks and weight, and also the name of the owner, the paper bearing the statement that the tobacco is delivered to the holder of the note or his order through proper endorsement. The warehouse charges are $1.50 per hogshead from the date of inspection to the end of the first four months. Subsequent to this, storage is charged at the rate of ten cents per month. After two years' storage has accumulated, the tobacco is liable to be sold for storage charges, but is rarely ever thus disposed of under three or four years.

Storage and Auction Fees.—In addition to the inspection fee of 25 cents for each package, the owner of

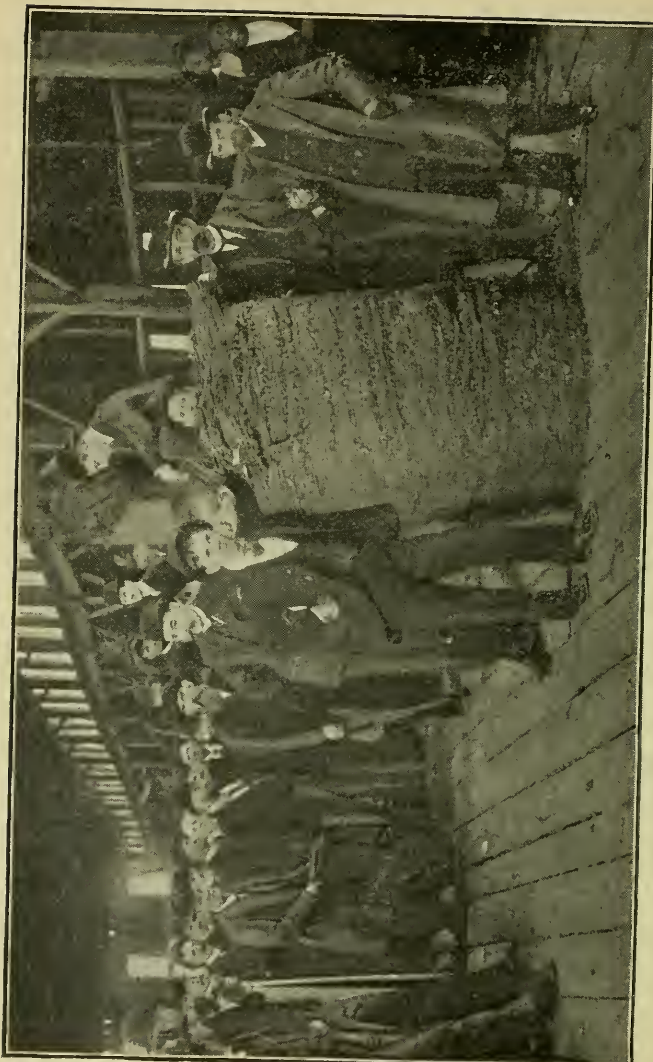

FIG. 79. TOBACCO SALE AT CLARKSVILLE. A HOGSHEAD IN THE FOREGROUND STRIPPED OF ITS CASK FOR SAMPLING.

the tobacco pays through his commission merchant, or directly, a sampling fee of 75 cents, which includes cooperage and nails, making an expense of $1 on each hogshead of 500 pounds net, to any weight merchantable up to 2200 pounds, and over. Insurance is at the risk of owner, unless otherwise stipulated. The fee of the tobacco auctioneer ranges from 12½ to 25 cents per sample sold, and is paid by the seller. Auctioneers of loose tobacco are paid arbitrary fees and salary by warehousemen, while the warehouses themselves charge graded prices to the planter by the pile. Commission merchants' fees for selling tobacco loose, or in hogsheads, are two and one-half per cent on gross sales, one-half per cent tax, one-half per cent insurance, beside freight, grading and inspection, if same has been previously paid out; also auction fees if the sample is put up at auction.

Marketing and Selling.—If sound leaf tobacco, well assorted and in good keeping order, the sample is marked A, for Admitted. All lugs, trash and tobacco in bad keeping condition is marked R, for Refused. Damaged tobacco is Insecure. Casks in poor condition are replaced at the cost of the owner. If hogsheads are fraudulently packed, with intention to deceive, the inspectors are required to give information to the grand jury when called upon. False packing is an indictable offense in most of the heavy-tobacco-growing states. The samples are placed on top of the hogshead from which they are drawn. During the sale (Fig. 78), the auctioneer stands near the hogshead which he is selling, and every buyer may see the condition of the tobacco. Bids are taken at auctions at an advance of 10 cents per 100 pounds up to $6; after this price is reached, 25 cents is the minimum bid recognized up to $25, when 50 cents increase per 100 pounds is the lowest bid taken. After being sold, the cask is replaced over the uncovered tobacco, coopered and weighed. Planters have the au-

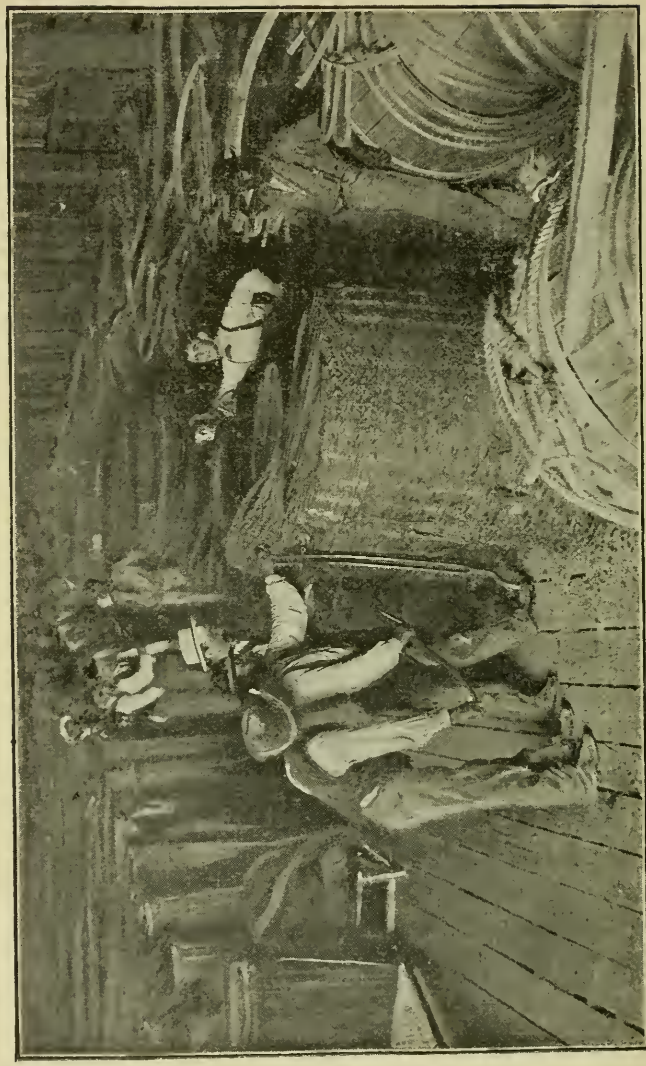

FIG. 80. INSPECTING AND SAMPLING TOBACCO AT CLARKSVILLE.

thority by law to reject any bid offered, but in such cases they are charged with the fees. A lien is usually given on the tobacco for warehouse charges and fees.

Buyers may make reclamations on the inspectors, when the tobacco in the hogshead is inferior to the samples by which it is sold. Each inspector, before entering upon his duties, is required to give bonds for the faithful performance of his duties, and for prompt payment of all reclamations granted. Inspection fees range at 40 cents to $1 per hogshead. At the larger centers of the warehouse system the "breaks," or sales, are attended by buyers from all parts of Europe, and the principal cities of America, interested in the export trade, as shown in the illustration, Fig. 79. The methods of conducting these sales are practically the same at other markets, at Cincinnati and Louisville, as may be seen from Figs. 80 and 81.

Ordinarily, there is keen competition for the better grades of leaf. Sometimes there is a fancy demand for the first of the new crop, or for some special mark, or for some special purpose. An instance in point was the public sale by Mr. S. P. Carr, at the Richmond tobacco exposition of 1888, of a fine hogshead of Kentucky White Burley for the remarkable price of $4,555.90, or at the rate of $3.10 per pound.

In the Yellow Tobacco Districts of North Carolina and Virginia, the bundles of leaf after stripping are put on sticks and hung in the barn until taken to market, but much leaf goes to market directly from the stripping room. Most growers, however, prefer to wait until spring, when the tobacco is ordered and either packed in wagon beds, and thus taken to market, or, what is regarded as much better, is packed in tierces (as in east Tennessee) about four feet high, three feet in diameter at the smaller head, and three feet two inches at the larger. In such tierces the tobacco is packed loosely,

FIG. 81. YELLOW TOBACCO "BREAK," OR AUCTION SALE, IN NORTH CAROLINA.
At the sale illustrated, the tobacco break was about one-third medium grade cutters for cigarettes, some lemon wrappers for plugs, twenty per cent nice English strips and cutters, balance medium grade and nondescript.

and carried to market. The weight of such a tierce, packed, is about 250 pounds. Larger tierces are used in Virginia and North Carolina, which hold from 400 to 600 pounds of loosely packed tobacco.

The day it is offered for sale, the larger head is taken out and the tierce inverted. The tobacco slips out and stands without support on the floor of the warehouse. If two different grades are put in the same tierce, some strips of paper are laid between them. Each grade is placed in a separate pile on the floor of the warehouse, with a card showing the owner, weight, warehouse, number, etc. The leaf is sold according to the farmer's grades, and just as he directs. The principal markets, however, prefer to have the leaf carefully assorted in grades of a specified character, established by the rules of the board of trade. No receipt is given a farmer if he comes in a wagon and delivers his tobacco, attending to the sale himself. But if shipped in hogsheads, tierces, or open crates, by freight, the farmer sends to the warehouse his bill of lading. The warehouse then pays the freight, deducting it from his sales account.

On auction days, these warehouses are filled with a crowd of buyers and curiosity seekers. The auctioneer stands on a box set on wheels, which admits of its being easily moved from pile to pile. At each one he solicits bids; that is, you are told, if you are a stranger, that he is doing so. At all events, he is using his tongue, his hands, and his body to the best advantage. His jargon is unintelligible to all but the initiated. Meanwhile, the buyers are pulling the piles apart, and examining the character of the tobacco, as the bids are made and cried by the auctioneer. As fast as a pile is sold, a clerk takes down the price and puts upon the card the name of the buyer. The hired employees of each buyer take up the piles as they are sold, in large, square baskets, four feet long and wide and six inches deep, and carry them away. Everything is cleaned up at once, so as to leave the floor space empty for the next sale. All is activity and motion, some 150 piles being sold in an hour. The same thing is repeated, until the contents of the warehouse have all been disposed of at auction, to

FIG. 82. WEIGHING TOBACCO HOGSHEADS PREVIOUS TO SAMPLING.

the highest bidder. The engraving in Fig. 82 is from a photograph of a typical scene at a sale of yellow tobacco.

Five hundred sales in a warehouse in a morning is not an uncommon occurrence. Generally, the first sale is followed by other sales at other warehouses, the crowd going from one to the other. Latterly, the system has been adopted of letting the owner withdraw his tobacco after the sale, if the price does not suit him. This is done to prevent effective combines between the buyers, or to beat the trusts. A certain hour is fixed at which the bids must be cashed. Failure to comply with this rule puts the buyer on the black list, and his purchasing ability is at an end. The farmer goes to the office in the building, gets his money, less the handling and selling commission, and goes where he pleases.

The piles rest on warehouse baskets made for the purpose, and are circular in shape and pyramidal in form, the hands being laid in a circle and in layers, the butts out. These piles vary in size from a few pounds to hundreds. After the sale is over, the floor is cleaned, and the work of filling it for the next sale begins. Immediately after the sale, bills are made out by clerks and an account of the sale given, or sent, to the owner, generally the same day. The buyers at these sales are both manufacturers and speculators. The manufacturers prefer to get their stock direct from planters' hands. It is then not bruised or broken by handling, and is not stuck together when prizing in the hogsheads. The warehouse sales are fair and open, where the farmer gets cash and where the article is always sold to the highest bidder. The warehouse charges are as follows, with two per cent commission additional: One to 50 pounds, 20 cents; 50 to 100 pounds, 25 cents; 100 to 200 pounds, 50 cents; 200 to 300 pounds, 75 cents; 300 to 600 pounds, $1; 600 to 1000 pounds, $1.50, and 1000 pounds and upward, $2. These sale warehouses are well lighted from the roof, so that the colors of the tobacco may be easily seen. The proprietor of the warehouse receives a commission on each sale for the use of his warehouse, and coöperative warehouses are also feasible.

The Export Trade.—Numerous concerns, individual or corporate, are engaged in buying and shipping yellow tobacco, for both the home and foreign trade. After buying it, the hogsheads are replaced on the tobacco and it is conveyed to the dealers' warehouse, from which it is shipped to domestic manufacturers as ordered, or exported to tobacco factors in foreign countries. When resold in the dealers' warehouse, it may be again inspected and is always reweighed, as shown in Fig. 82. Some dealers take pride in carrying a large and varied stock, so as to be able to supply an order for

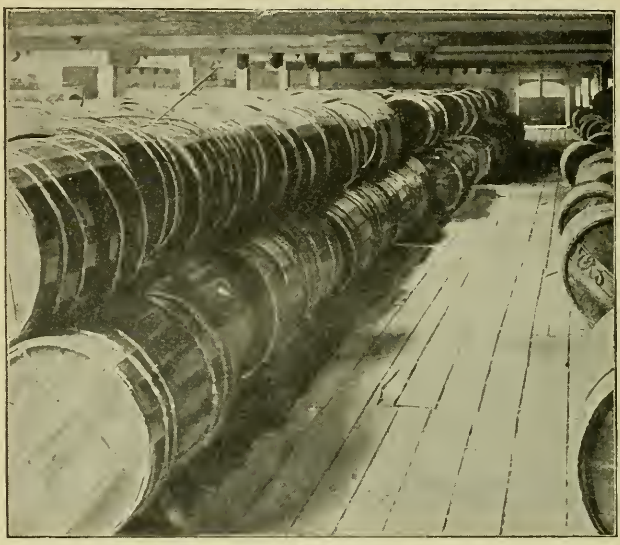

FIG. 83.

VIEW OF TOBACCO IN STORAGE READY FOR SHIPMENT TO ANY PART OF THE WORLD.

This engraving, and Fig. 82, from photographs of the extensive establishment of S. P. Carr & Co at Richmond.

any quality or quantity of leaf. Fig. 81 affords a glimpse at the interior of such a dealer's storage house for tobacco.

Stemmeries and Strips.—Strips are made by removing the midrib from the leaf. They are then tied up in large bundles and hung in the drying room, completely dried out, and then re-ordered. They are rarely taken down from the racks before the last of May or the first of June, when no mistake can be made as to the amount of moisture they contain. They should be in a dry condition, barely pliable enough to prevent injury in handling and prizing. When in this condition, they are put in bulks and afterwards packed and prized in casks, 1200 to 1300 pounds in each. Before packing, the bundles are untied and the strips laid in regular layers in the hogshead and pressure from screws brought to bear upon them.

The work in stemmeries goes on from November, when the new tobacco begins to come into market, until June, and consists of stemming and ordering the stock. For the remainder of the season, the employees are kept busy in putting the tobacco in bulk and prizing in casks for the English market.

The method pursued in recent years in ordering strips is much more effectual and safe. The strips are either hung up in a drying house or put in broad, flat trays made of laths, and exposed to a drying heat of 160° for eight to ten hours. When the tobacco is thoroughly dry, the windows of the drying room are opened and the tobacco cools off. The windows are then closed and steam is turned into the room through pipes that are perforated, which soon puts the tobacco into a condition to be handled without breaking. It is then taken down and "cooped," or shingled, on the floor, but the sticks are not withdrawn. Enough of one grade is put in a coop to fill a tierce, or hogshead. After remaining in the coops a day or two, it is made ready for packing in the cask by putting a few sticks at a time filled with tobacco in a steam box, where it remains for a minute or two, and is then packed without delay, after untying the bundles and straightening the tobacco.

In making strips, the loss of weight by drying is from eight to 12 per cent; by removal of midrib, or

FIG. 84. STREET SCENE IN THE LOUISVILLE (KY.) TOBACCO MARKET.

stem, 20 to 25 per cent; by waste, five per cent, making a total loss of from 33 to 42 per cent.

The making of strips employs a great number of persons, mostly those of a dependent class, such as women and children. They are paid from 25 cents to 40 cents per hundred pounds of strips made. A good stemmer can make from 200 to 250 pounds of strips a day. Children assist the older persons by untying the bundles and placing the leaves in a convenient position for stemming. Each grade of strips is kept to itself. The making of strips is a distinct branch of business rarely engaged in by tobacco growers. It is regarded as a necessary preparation of the tobacco designed for shipment to the English market, where the duties on tobacco amount to from 12 to 15 times the prices paid to the planter. The British duty is 3s 2d, or about 76 cents per pound. The stem is removed, because it is worthless, or nearly so, though an arrangement has been made with the English government by which the manufacturer may return the stems into the hands of the proper officer for destruction, and so be relieved of the tax.

The strips are made very dry, because every pound of water which they may carry will be chargeable with the same duty paid on the tobacco. Within recent years the English government has taken cognizance of this source of revenue and now requires a duty of 3s 10d, or 92 cents, a pound on tobacco containing less than 10 per cent of water.

Tobacco selected for the making of strips should be capable of absorbing a great deal of water, for all the water it will take after passing through the hands of the excise officers will be so much added to the profit. The dealers in strips, therefore, other things being equal, prefer tobacco that will make the least loss in stemming, that will be a great absorber of moisture, and that will bear the ocean transportation without damage.

Strips are made with all classes and grades of tobacco, the largest percentage from heavy shipping tobacco. The output of strips, however, increases year by year in the White Burley and yellow-tobacco districts. These styles are growing popular in England. Strips are therefore made at nearly every point in North Carolina, Virginia and Tennessee, where the yellow tobacco is grown, as well as in those localities where the White Burley tobacco is sold.

The great strip markets of the United States are Richmond, Petersburg, Lynchburg and Farmville in Virginia; Henderson, Paducah, Louisville and Owensboro in Kentucky; Clarksville, Springfield and Paris in Tennessee, and Evansville in Indiana. There are numerous other places where a few hundred hogsheads of strips are put up irregularly. The industry is rarely carried on at such small places except when the prices of strips are very high. The make of Western strips averages from 28,000 hogsheads to 30,000 hogsheads, and those of Virginia and North Carolina 13,000 hogsheads, of which about 8,000 hogsheads are brights and Burley.

Magnitude of Heavy Leaf Trades.—This does not vary much from year to year, and according to the movement toward primary markets there is room for much further expansion of heavy leaf tobacco growing, providing an adequate market can be found. Aggregate receipts at the big market places are averaging a little heavier than five years ago and more, but not much. Taking a total of the receipts at each of the eight leading markets where heavy tobacco is sold at first hands, we find that about 275,000 hogsheads came into view in 1896. This was a decrease from 1895, but practically the same as in 1894 and 1892, while the aggregate receipts at the eight markets in 1890 were about 250,000 hogsheads. Striking an average, this shows annual receipts covering a period of eight years amounting to 265,000 hogsheads, which fairly represents the available supply of heavy leaf. Louisville is easily the largest primary market, receiving in 1896 about 118,000 hogsheads. Cincinnati followed with 68,000 and Clarksville with 37,000 hogsheads. Among the eight leading primary markets Hopkinsville stands forth in prominence, with 21,000 hogsheads handled in 1896, Paducah 17,000, Mayfield 8,000, St. Louis 5,000 and Nashville 3,000. The beginning of each year, of course, finds more or less stock carried over, but these figures afford a good index of the general movement. The freight rate on heavy leaf, from Louisville as a basis, to New York, is about 35 cents per 100 pounds, to Baltimore 32 cents, to Philadelphia 33 cents, and to Boston 39 cents.

PART II.

Heavy Leaf or Export Tobacco.

FIG. 85. HEAVY SHIPPING LEAF, GREEN RIVER DISTRICT, KENTUCKY.
Grown by Mr. Chris. Denton of Henderson county, on Armour's Black tobacco and White Burley tobacco fertilizer, manufactured by Armour Fertilizer Works, Chicago, Ill.

CHAPTER XIII.

HEAVY SHIPPING TOBACCO.

The export, or heavy shipping, tobacco is so called because by far the largest proportion of it is taken for foreign consumption. With the exception of an inconsiderable quantity used in the manufacture of cheap cigars, cheap plug, snuff, and the making of sheep washes, all may be said to go abroad. Being cured by open fires, the smoky, or creosotic, flavor is not relished by the people of the United States. It is also too strong in nicotine, and it has not the sweetness of taste and delicacy of flavor that the air and sun cured tobacco has. Another reason why our domestic manufacturers do not encourage its use, is its low absorptive capacity for the liquids or sauces used in the manufacture of chewing tobacco. The White Burley has the capacity to absorb nearly three times its weight in water, while the heavy James River or Clarksville tobacco will scarcely absorb one-third as much. This makes the White Burley much more profitable to the manufacturer, for he can produce a much larger amount of the manufactured product from a given quantity of White Burley tobacco, than he can from the heavy shipping styles.

When tobacco is cured by open fires, the pores of the leaves become surcharged with smoky deposits, and the absorptive capacity of the cured product is greatly reduced. Tobacco cured without fires, or cured with flues or by exposure to the sun, is much better suited for the manufacturer's purpose than where cured by smoky fires. On the other hand, the foreign buyers prefer the heavy tobacco because it is strong, and may be adulterated with inferior tobacco grown in other countries without diminishing the quantity of nicotine below a certain standard. The people of Europe have, for generations, been accustomed to using tobacco cured by open fires, and their tastes have been educated to enjoy the smoky flavor.

The Soil for Shipping Tobacco.—The same soil often has the capacity of producing imperfectly all the classes of tobacco, but such versatility in the soil is not favorable for yielding the highest excellence in any one of the classes. There must be a natural adaptation in the soil and climate to the growth of a particular class, in order to reach the highest and best results. There is an endless variety of soils, and there is an endless variety of types and sub-types that pass, by almost imperceptible gradations, from one to the other.

To produce the best shipping leaf, there must be a strong, rich soil, not necessarily deep, but with a large content of potash in its composition. Low river bottoms subject to overflows rarely produce the best qualities of this tobacco. Too much vegetable matter in the soil, imperfectly decomposed, makes a large, rough, harsh tobacco, wanting in all the best qualities of a shipping tobacco. Upland soils are usually better drained than bottom lands, and the humus from such soils, receiving no additions from other than natural sources, is not excessive. For this reason, other things being equal, such soils are preferred for tobacco.

One of the most famous tobacco-growing districts is the Clarksville, embracing the counties of Montgomery, Dickson, Humphreys, Houston, Cheatham, Stewart and Robertson in Tennessee, and Trigg, Christian, Todd, Logan, Simpson, and some areas in the Green River district of Kentucky, where the soil is not deep but fertile, the best soils having a deep, reddish subsoil, in which are mingled rotten masses of flint, or chert, broken into small angular fragments. The latter supplies warmth and drainage, the clayey bed retains and supplies moisture to the growing crop. Upon such soils, the plants will stand long in the field after being apparently ripe, thickening, ripening, and mellowing and storing up oily matter, making the leaf, when cured, as soft and elastic as a kid glove. The best shipping leaf is produced upon manured lots having the characteristic subsoil mentioned. Analysis shows this soil to be rich in potash, while the climate is especially suited to the crop, producing the best tobacco for export now grown in the world.

Western Kentucky and western Tennessee grow shipping tobacco of a lower quality on an ashen-colored soil that is light and friable, containing a large amount of calcareous matter intermixed with a fine, sandy material. Such soils are very easily washed and gullied, and the crop is not grown on them as much as formerly. The Ohio river district in Kentucky comprises the counties of Livingstone, Crittenden, Caldwell, Lyon, Hancock, Breckenridge and Meade. The lower Green River district—the counties of Henderson, Union, Daviess, Webster, Hopkins, McLean and Muhlenberg—has mostly a soil of sandstone and shaly derivation, producing tobacco suitable for English strips, long, wide, heavy and coarse. The upper Green River district—Barren, Warren, Hardin, Grayson, Edmonson, Hart, Green, Larue, Marion, Taylor and Allen counties—has a soil resembling the Clarksville district, yielding tobacco of heavy body, oily face and smooth texture. White Burley is also grown in this district, and a little yellow tobacco in Hart county, on gravelly or sandy soils with calcareous subsoil, giving a fine and silky leaf with light body, but firm and tough and well suited for plug wrappers. Between the upper and lower districts is the

Green River district of Butler and Ohio counties, whose product is not of such good quality.

In the Cumberland River district (embracing the Tennessee counties of Smith, Trousdale, Macon, Clay, Jackson and Putnam, and portions of Sumner and Wilson, and in Kentucky the counties of Metcalfe, Russell, Adair, Clinton, Cumberland, Monroe, Casey, Wayne and Pulaski), tobacco is grown mainly on the low bottom lands and is coarse and bony, wanting in flexibility, deficient in oil, but having a good weight. Heavy tobacco is grown in many parts of Virginia and North Carolina, on dark, rich soils with reddish subsoils, upon which yellow tobacco is never produced. Some shipping tobacco is grown on such dark soils in Maryland and South Carolina. A coarse grade of shipping tobacco, almost destitute of oil, is grown in southern Illinois and Indiana. Some good shipping leaf is grown in the great Kanawha valley and in the counties along the Ohio river in West Virginia, the alluvial soils producing the best leaf. Missouri's production has fallen rapidly, as its leaf has large stems and fiber, being grown generally on rich bottom lands on the North bank of the Missouri river. A little is raised in Arkansas.

FIG. 86. TOPPING THE PLANT.

The Color of the Soil seems to exert a great, but not always a controlling, influence in determining the color of the product. Rich clays of any color will produce a heavy, waxy leaf, if properly manured and planted with a suitable variety,—one that has a tendency to grow thick, leathery and large. Gray, porous soils, made up in part of fine, sandy material, will develop a thinner but finer leaf, particularly if planted with thin varieties that have grown upon such soils for a number of years. Varieties that produce a high quality of tobacco on soils to which they are suited, fail when planted on soils of a different character. The popular varieties known by the names of Yellow Prior and Orinoco, planted upon rich, old lands, highly manured, will yield a strong, dark tobacco full of gummy matter, rich in nicotine, known as "black fat," and eminently fitted for the German market. Planted upon light, new lands, the product of the same varieties is yellow, mottled or piebald, fine-flavored, sweet and fragrant. If the same variety of tobacco be planted in two fields in situations precisely similar, and soils of like character, one field being freshly cleared from the forest, and the other long cleared, but with its fertility preserved, the product of the first will be brighter in color when cured by artificial heat or by the desiccating influence of the sun and air, finer in texture and sweeter in flavor, and have less nicotine in its composition than that grown on the old land. The first will be in demand for domestic manufacture and consumption, and the latter for shipping purposes. The product of new lands, if properly cured and managed, is for the most part profitable if suited for manufacturing purposes, but if the soils of the new lands are red, and otherwise unsuited to the growth of manufacturing tobacco, the product of the old, highly manured lots makes the most valuable commodity.

Preparation of the Soil.—No crop requires a more careful preparation of the soil for its successful growth, than tobacco of any variety. Most of the cultivation, indeed, should be performed before the plants are set in the ground, and in order to do this the land intended for tobacco, if a clayey loam, should be well and deeply broken in the fall by a turning plow drawn by two or three horses or mules. The land should not be closely plowed, but left in ridges, the advantage of this being that a much larger surface is exposed to the ameliorating effects of the winter freezes. If the depth of the furrow should be eight inches, the ridge would probably be from twelve to fifteen inches high, allowing a portion of

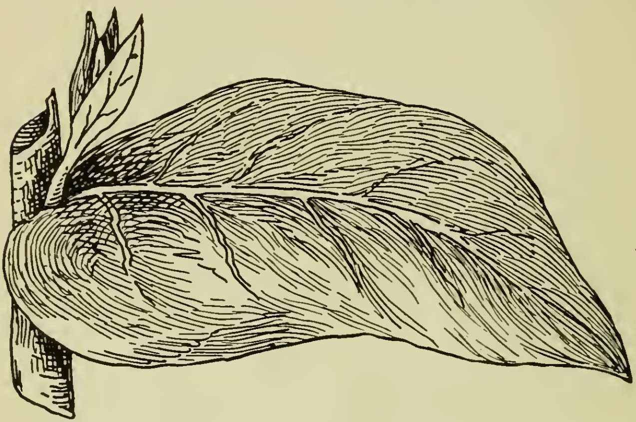

FIG. 87. THE SUCKER, TO BE REMOVED.

the dirt to fall back in the furrow and another portion to be thrown over in the previously run furrow.

If the section of one of these ridges is an equilateral triangle, the surface exposure will be increased one-third, and two-thirds will reap the direct benefit of the freezes. The freezes and thaws alternating will pulverize and mellow the soil and put it in such a fine mechanical condition, that the subsequent rebreaking in the following February or March will put it in prime order for the growth of any crop. Upon land so prepared, the roots of plants have a wide pasture ground, where they may range in search of food without let or hindrance. The air can penetrate such a soil easily, and the capillary attraction induced by such pulverization brings moisture from the subsoil in seasons of the greatest drouth. And not the least of the beneficial effects of such a preparation is the ease with which the superfluous water may be absorbed, for the greatest of all enemies to the tobacco plant is standing water. The first breaking, in the autumn, should take place, if possible, before vegetation is killed by frosts, especially if old meadows, clover pasture or stubble lands are selected for the tobacco crop of the next year. Dead grasses plowed under after midwinter injure the succeeding crop, by rendering the soil too porous and thirsty. Better far, if the breaking up is delayed, to burn off all dead vegetable matter. This burning will, at least, destroy the larvæ of insects and worms, which often prey upon the plants when first set out, not only destroying them, but making it impossible to grow a crop of tobacco that will be uniform in size, color or quality. This second plowing should only be half as deep as the first, unless the furrows are run so close together that the slice cut by the plow will be only half reversed.

Manuring.—Consult Chapters V and VI. Previous to the second breaking in the spring, all the manure which can be gathered from the stables, the barnyards and the poultry yards, and all the trash from the tobacco barns, including the stalks and ashes, should be hauled upon the land, and especially upon those spots that need it the most. It ought to be so distributed that the whole field intended for the tobacco crop should be made, as far as possible, uniformly fertile, in order that the crop may be uniform in size and character. Such crops always command a better price, other things being equal, than one in which there is tobacco of every size, color and quality. A favorite place for growing heavy tobacco is the place where hogs have been fatted the previous autumn. If broken up as soon as the hogs are removed and before the rains have washed the substance from the droppings, a very rich, heavy leaf may be produced. Good farmers keep two places for hog pens, so as to alternate with corn and tobacco.

It is almost impossible for the grower of rich tobacco to use too much manure, if it is well rotted and thoroughly incorporated with the soil. Mistakes are often made, however, in applying large quantities of fresh manure from the stables just before the land is set in tobacco. This almost always results in impairing the

FIG. 88. CUTTING HEAVY TOBACCO.

quality of the tobacco, by causing field fire. It is far better to compost all stable manure with rich dirt, ashes, tobacco stalks, etc., and let the fermentation cease before its application to the tobacco field. Far better results will be obtained. Commercial fertilizers are coming into general use, while planters are more careful to save and compost all possible sources of plant food about the farm.

Laying off the Land.—After the second plowing, the land may be left until the plants are nearly ready to set. When the plants in the seed beds have leaves on them two inches long, the planter should proceed to give the final preparation to his land previous to setting the crop. It should, first of all, be well harrowed until the surface is thoroughly pulverized to the depth of two or three inches. It must then be laid off in rows three and one-half feet each way, and at the points of intersection, a heaping teaspoonful or more of some good guano or superphosphate of lime, or a little well-rotted manure or old ashes, may be dropped at each crossing, and the hill made over the fertilizer with a hand hoe, care being taken to incorporate the fertilizer well with the soil. The hills need not be large or high. The tops should be cut off with the general level of the land, and patted, so as to give the hills compactness enough to retain moisture.

Many farmers lay off their tobacco land three feet by four, which has the merit of giving a few more plants to the acre, and at the same time permits the cultivation of the crop to continue for a longer period with less injury to the plants from the bruising and breaking of the leaves. If the wide rows are run north and south, more of the sunlight reaches the leaves, and matures them more evenly. With wide rows in one direction, the work of worming and suckering is more easily performed, and fewer leaves are torn or broken in working between the rows.

A few years ago, when the "black fat" German styles were in the greatest demand, and at the highest prices, several intelligent farmers tried the experiment of increasing the distance between the plants to four feet each way, believing that increased space would give greater room for development and expansion. While a few were pleased with the results, the practice has been

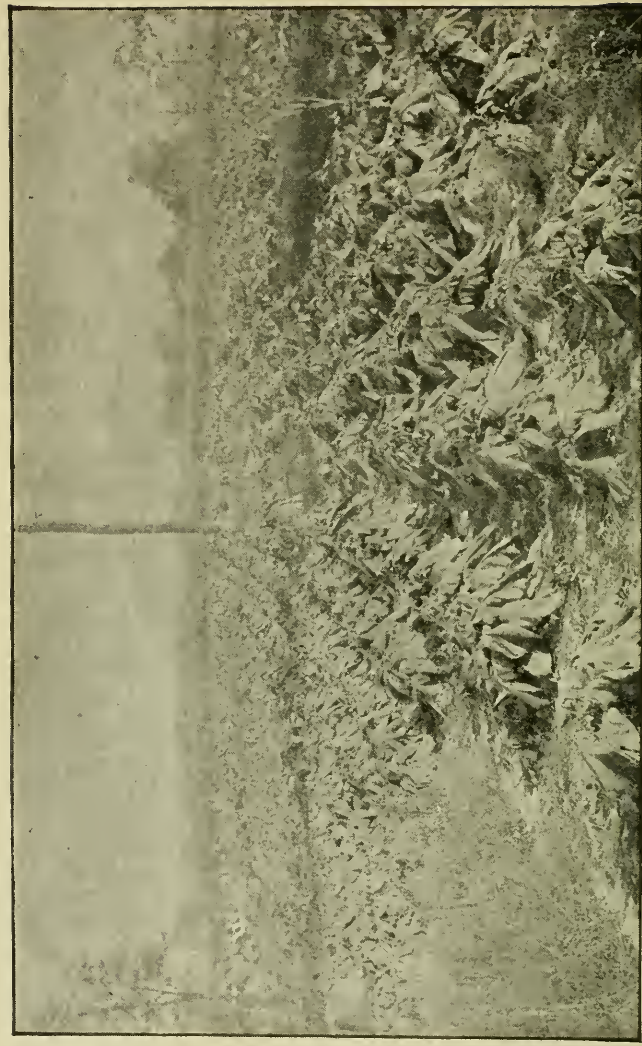

FIG. 89. FIELD OF HEAVY LEAF READY TO BE HUNG.

generally abandoned, not because the quality of the product is not improved, but because there is too much land cultivated for the number of pounds of tobacco made. Planted 3x4 feet, there are 3630 plants to the acre; 3½x3½, 3556, and 4x4, 2725. This made a difference of over 800 plants to the acre, which will not be compensated for by the slightly increased quality of the tobacco produced when planted at the distance of four feet each way.

Now and then a planter will be found who prefers the rows to be laid off 3x3 feet, or 3ft. 3 in.x3 ft. 3 in. This is too close, except for some very small varieties of tobacco. Planted as closely as this, the leaves, being very much shaded, do not secrete the gum and oils necessary to give the product the finish and beauty, the softness and body, the strength of tissue and the amount of gum, so much desired in the shipping leaf. Thin, chaffy tobacco, such as is made in the shipping districts by being planted too closely, by the sterility of the soil, by the bad effects of weeds and grasses growing about the plants, by bad cultivation, or by suffering the suckers to grow to great length, has but one market in all the world, and that is Spain. It never pays to raise heavy shipping tobacco under any of the conditions named.

There is a way of preparing land for tobacco by which it is practically hilled by the plow. It is laid off one way in rows, at whatever distance the planter may desire. The fertilizers or manures are then distributed in the bottom of the row. A turning plow afterwards throws two furrows on this row, making a ridge. The land is then laid off at right angles to the ridges. The tops of the severed ridges are afterwards cut off and patted, and this makes the hills. This plan is preferred by many farmers, because of the great economy in the hoe work. It likewise makes the application of the manure or fertilizer more easy and effective. But this practice will not do, either on rocky or cloddy land, or even on land that has undecomposed, turfy matter or grass on it.

The Preparation of "New Ground" differs mainly in the manner of breaking it. All trees and bushes must be removed, the brush, trash and leaves piled up and burned, making the surface as clean as may be. Remove roots as well as possible, by plowing and harrowing, and then plow close to the stumps with a single horse plow. After another harrowing, the ground is checked off and the hills are made. No weeds or grasses ever trouble the crop in new ground. The sprouts from the stumps, however, are troublesome. The work of preparing new ground for the plant involves a great deal of labor, but the subsequent work in cultivating the crop is much less than upon old land.

For sixty years after the settlement of Kentucky and Tennessee, four-fifths of the tobacco crop was grown upon newly cleared lands, or that which had been in cultivation only one year. The practice among tobacco planters, up to 1860, was to clear a new field every year, plant it in tobacco two, and frequently three, years in succession, and then turn it over to the cultivation of wheat, oats and corn. A few rich lots near the stables, cow barns and hog pens were planted in tobacco in regular rotation with wheat, but the great reliance for the tobacco crop was the fresh lands. Within the past forty years this practice has been reversed, and now four-fifths of all the tobacco grown in the heavy shipping districts of the United States is planted upon old, manured lots. The tobacco is not so well colored as when planted upon new lands, but upon lands well manured it is heavier and richer than when planted upon new lands. It must be conceded, however, that a much larger proportion of inferior lands is now planted than there was forty years ago, and this has caused a perceptible deterioration in the average product.

Seed Beds, Plants, Transplanting.—See Chapters VII and VIII.

Cultivating the Crop.—With suitable weather, it requires about ten days for the plants to establish themselves upon old lands. The first cultivation is then given with a one-horse turning plow, which is run with the bar side next to the plants, throwing the dirt away from the plants to the center of the row. When prop-

FIG. 90. HEAVY SHIPPING TOBACCO ON SCAFFOLD IN FIELD.

erly done, this leaves the plants standing upon a narrow strip of undisturbed soil, which is easily and rapidly cleared of any grass or weeds by the use of the hoe which usually follows the plow. All weeds or grasses between the rows are covered up by the dirt thrown to the middle in plowing, where it forms a ridge. If the land is free from grass, the first plowing is often done with double shovel plows, which pulverize the soil much better than the turning plow. After a few days, the weather continuing favorable, the second cultivation follows, and is precisely like the first, only at right angles to it. All tobacco grown in the heavy shipping districts is planted in checks, and so is worked alternately at right angles, first one way and then the other. No hoe work is necessary with the second plowing, unless the work has been so delayed, or the rains have been so abundant as to allow the weeds to get a start. It frequently occurs that the wheat harvest and the early working of the tobacco crop are coincident. The grasses sometimes get a rank start, but if subsequently eradicated, no damage is suffered other than retarding the early maturity of the plant and adding greatly to the work. Tobacco is a weed, and though drouth may check its growth and noxious weeds and grasses may apparently choke it, yet when rains come and the weeds are exterminated and the grounds sufficiently worked, the most unpromising plants will soon show a wonderful outcome. Of all the crops grown, it suffers least by early neglect. Nevertheless, the more rapidly it is worked, the less work the crop will require.

While the presence of weeds and grass, in the early stages of the growth of the tobacco plant, seem only to delay its period of ripening without doing it any permanent injury, it is undoubtedly true that nothing injures the quality of the product more than competition with other vegetation, after it has been topped. Every spear of grass and every weed, after that time, robs the tobacco of strength and detracts from the quality of the crop.

A third cultivation with a shovel plow, with two furrows to the row and running both ways, should follow in six or eight days from the second cultivation. At the next cultivation the dirt is thrown to the plant. Three or more furrows are run in each row, so as to break out the middles entirely. This gives a wide, generous bed of loose earth about the plant, supplying its increasing demand for food. Just previous to this fourth working, it is the usual practice to pull off from four to five of the lower leaves, so that the earth may enwrap the stalk without hindrance. Some planters affect to believe that the "priming," as this operation is called, induces a bleeding, or waste, of sap, detrimental to the health of the plant. This can hardly be true, as it often occurs that two planters living on adjoining farms will each have a different practice in this particular; but no evidence has ever been adduced that the yield of the crop per acre has been added to or taken from by either practice. The best and only reason for not priming is, that the lower leaves will protect the upper ones from earth burn, and the spattering of dirt during hard rains. This whole question has been often discussed, and no satisfactory reason has been given why the one practice should uniformly prevail, to the exclusion of the other. With all the leaves remaining on the stalk, the plant has more to support. The leaves also afford a refuge for the horn worms. With the lower leaves taken off, a larger proportion of the crop, as housed, will be injured in the way mentioned above.

It was once almost universal to follow this plowing with a hoe, and make a low, flat hill around the plant, but this has been abandoned as unnecessary work. A few planters "lay by" their crop with this plowing, but all experiments have demonstrated that the product will be the heavier and richer with two or more additional plowings. Even where the tobacco is so large that it may not be plowed without great injury from the breaking of leaves, a stirring of the surface of the ground around the plants with hoes, especially if the land be baked after heavy rains, is accompanied with highly beneficial results.

Planters differ as to whether the last plowing should be with a double shovel plow, which leaves the land approximately level, or whether the dirt should be thrown

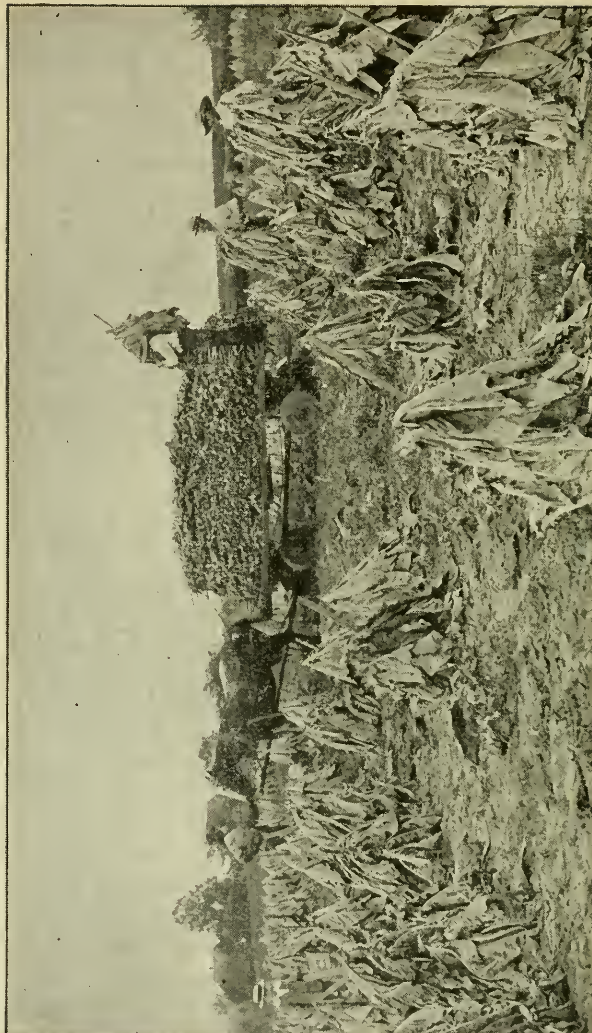

FIG. 91. THE FARMERS' HANDY WAGON FOR HAULING TOBACCO.

It has small wide wheels that specially adapt it to carry heavy loads on soft ground, while its wide platform carries far more tobacco than could possibly be put on a common wagon. It is made by the Farmers' Handy Wagon Co, Saginaw, Mich., and is adapted to a great variety of other uses.

to the plant by a turning plow. The advantage of the last method is that the plants are not so easily blown down during heavy rains, should such rains be accompanied with wind. On the other hand, level culture is the best for dry weather. The truth seems to be that the one or the other is to be preferred, as the season may be dry or wet. A practice recently introduced, which partakes of both, is to run a narrow harrow across the ridges, leaving a square bank of earth about each plant.

In some portions of the heavy-tobacco district in Virginia, no hills are made to receive the plants. After the land has been pulverized by deep harrowing, it is rolled, then checked and planted. The after culture is all level, with but little work with the hoe. On high, rolling, porous lands, this method is probably the best, for level culture retains the moisture and prevents, in some degree, the washing away of the soils in times of excessive rains. In the preparation of the soil, in the planting of the crop, or in the after cultivation of the crop, one caution must be emphasized, that clayey lands must never be stirred when wet. The baking of the soil, which results, often proves disastrous to the healthy growth of the plant.

Topping, Worming and Suckering Tobacco.—Topping, Fig. 86, is not a difficult task, but it requires some skill and practice, and is highly important that it be performed at the proper time. Six weeks from the time the plant is set in new ground, and eight weeks after it is set in old ground, the seed bud should appear in a majority of plants, after good cultivation and seasonable weather. These seed, or terminal buds, are called "buttons." Topping is performed by pinching out these terminal buds, leaving eight, ten or twelve leaves to the plant, as the judgment of the planter may determine. Topping should not be deferred until the plants are in blossom, but should be done just as soon as the required number of leaves can be secured. The leaves coming out from the stalk within six inches of the ground, should not be counted, and they are primed off or left on, as one may be an advocate of priming, or opposed to it. The arrangement of the leaves about the stalk in pairs makes it easy to top without counting. If ten leaves are to be left on each plant, then the upper

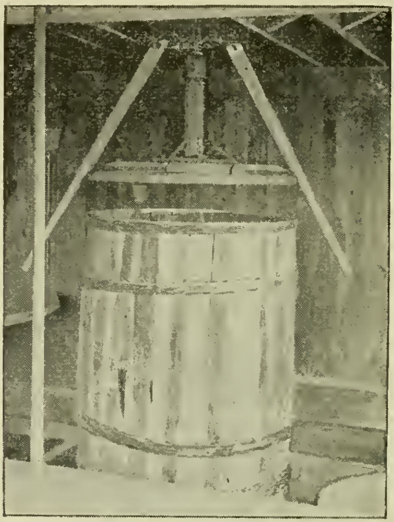

FIG. 92. SCREW PRESS FOR PRIZING TOBACCO, WITH HOGSHEAD IN POSITION.

leaves will hang directly over the lower ones. If eight or twelve are to be left, the top leaves are found nearly at right angles to the lower ones.

The quality of the product is greatly influenced by the number of leaves left upon the plant. The majority of planters of the heavy-tobacco districts have long been of the opinion that not more than ten leaves should be left. A very intelligent minority advocates the leaving of only eight, and some interesting experiments seem to favor this number. It is said that on rich soils the maximum weight and quality will be obtained with eight leaves; that the labor of suckering will be lessened; that the number of leaves to be stripped from the stalk will be reduced one-fifth, and that the high quality and the increase of weight will make the profit proportionately greater. The standard of ten leaves has been generally adopted for the first topping. As the season advances, this number is reduced with each succeeding topping in the same field. Usually, when the plants have not been destroyed by insect enemies or drouth, and the cultivation has been regular and uniform, about one-half the plants come into top at the same time. The second topping takes place about a week after the first, at which time nearly every plant should be topped, unless there is a great inequality in the situation or in the fertility of the soil.

In pinching out the bud, one should be very careful not to injure the tender top leaves. A very slight injury will develop into serious blemishes when the leaf has reached its fullest expansion. An inexperienced man should never be allowed to top tobacco. It is a task that requires the utmost care and the closest attention. Carelessness in topping may greatly impair the value of the crop, for if more leaves are left on one plant than on another, the plants will ripen unevenly and irregularly, which is always an injury. Every plant that is carried to the barn to be cured should, if possible, be of like maturity, in order to secure a uniform quality in the product.

When the seed bud has been removed, the plant makes vigorous efforts to reproduce itself, and every bud at the axils of the leaves begins to produce subsidiary plants, each one of which, if left undisturbed, will blossom and mature seed. These subsidiary plants (Fig. 87) are called "suckers," and must be diligently removed, not only from the axils of the leaves, but from the base of the stalk, otherwise the crop leaves will be dwarfed and robbed of all substance and good qualities.

Worming.—Even before the topping of the plant, the Sphinx moths, or horn worms, begin to feed upon the plant, and until the frosts come they are always present in a greater or less force. See Chapter XI, on Pests of Tobacco. The suckering and worming are carried on at the same time. If the suckers are allowed to grow long, every one becomes a shelter and hiding place for the worms, which find their way back to the plant from the suckers after the latter have been pulled off and thrown on the ground. They thus continue their depredations until the planter goes over his crop again.

Cutting and Housing Tobacco.—From six to eight weeks, in the heavy-tobacco districts, usually elapse from the time of topping until a sufficient number of plants are ripe enough to make the first cutting. This usually occurs from the 1st to the 10th of September. The maturity of the plant is indicated by its general appearance. The leaves droop, the tails of the top leaves sometimes almost touching the ground. They become heavy and thick, mottled with yellowish spots, crisp and tender, breaking easily, especially when the dew is on them. They have an oily, granulated appearance, and their upper surfaces are thick with a gummy substance which is secreted most abundantly during cool nights with heavy dews. Cut when fully matured, the tobacco plant reaches its maximum in weight and in those qualities that commend it to the shippers. If the cutting be deferred too long, round, brown spots will begin to appear on the leaves, which are signals of decay and deterioration. It rarely occurs that all the plants in the field will ripen at once. Several conditions are required, for this to happen—a remarkable uniformity in the fertility of the soil; precisely similar surface exposures; the setting of all the plants of equal hardiness the same day, and the topping of all the plants at the same time, with an equal number of leaves on each. Newly cleared lands will ripen the plants from six to ten days earlier than old land, both originally of the

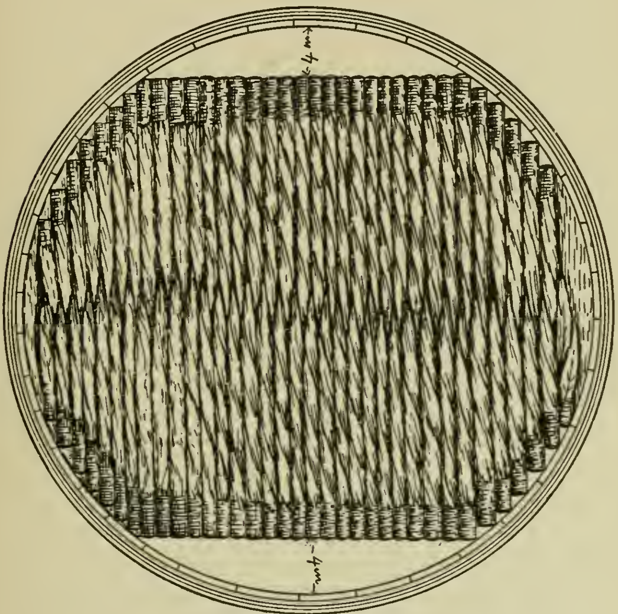

FIG. 93. PACKING THE HANDS IN HOGSHEADS.

same character. A southern exposure, a rocky soil, stimulating manure, an early suspension of the work of cultivation, will all hasten the period of maturity.

As a general thing, the planter is fortunate if one-half the plants in a field are ready for the knife at the first cutting. As the season advances and the danger from frosts begins, the field is cut clean, although there may be some green plants; for a plant cut before maturity is much more valuable than a frosted one. The instrument used for cutting is a butcher knife, with a thin blade about six inches long. The handle of the knife should be well wrapped with old woolen rags, for however hard the hand may be, in housing a large crop of tobacco it will be made sore by the constant pressure on the back of a wooden handle. Another tobacco cutter has been introduced within the past ten years, that does effective work. It is in the shape of a spade, but only about eight inches long. It has a square steel blade two and one-half inches wide, welded to an iron shaft four and one-half inches long, to the end of which a handle an inch in diameter and four inches long is fastened. Many prefer this to a butcher knife. Such an implement is much used in the seed leaf districts of Pennsylvania. A hatchet is also used.

Of two evils, it is better to let tobacco stand a little too long in the field than to cut it green. Thoroughly ripe tobacco has much more weight and thickness, and makes a much better article for shipping purposes, than if cut before it is fully ripe. In about three weeks after tobacco is topped, with seasonable weather, the leaves attain their full expansion. After this they thicken until the plant is ready for the knife, which is shown by the signs of maturity already described. There is as much difference between the flavor of tobacco after it is cured, cut when ripe, and that cut green, as there is between the flavor of a full ripe strawberry and one that is only partially ripe.

If possible to avoid it, tobacco should not be cut immediately after a heavy rain. Rain water dissolves and washes away much of the gummy matter that adds to the weight of the tobacco leaf and gives it body. In three or four days after a rain, the gummy matter will be again secreted, especially if the nights are cool and the dews heavy. If the weather is threatening, so there is a probability that a rain will occur before the tobacco can be carried to the barn, it should not be cut. Nothing injures tobacco more than to be caught in a shower of rain after it has been severed from the ground, and the plants inverted upon the hills. The water deposits mud upon the upturned leaves or spatters them with dirt. The plants also get in a "strut,"—that is, they will not wilt, and if handled in such condition, great breakage of leaves ensues. The bad effects of the dirt that adheres to the leaves will never disappear. The spots covered with mud cure a bad color, and the vitality of the leaf at such places seems to be destroyed.

Nor should tobacco be cut while the sun is very hot, as in that case it will be parched by the heat, thus making permanent green spots, an injury from which it never recovers. The very worst time of all to cut tobacco is in the morning of a hot day while the dew is still on the plant. Cut under such conditions, a great many leaves, owing to their brittleness, will break off from the stalk. The leaves being wet with dew, the dirt will adhere to them when the plants are inverted on the hills, and lastly, the sun is most likely to scorch the plants before they will wilt.

These negative conditions being given, it will be readily inferred that a hazy, not cloudy, day is the best for cutting tobacco, when the heat of the sun is tempered by the haziness of the atmosphere. In the afternoon, between three and five o'clock, is also a good time. It should be cut late enough in the afternoon to prevent sunburn, and early enough to wilt, or fall, before night, so that it may be put in piles.

To cut the tobacco plant with a knife, one should stand over the plant, place the blade of the knife at right angles to the two upper leaves, and split the body of the stalk down to within two or three inches of the lower leaves, Fig. 88. Withdrawing the knife and grasping the stalk about midway with the left hand, the cutter bends it slightly from him, at the same time inserting the knife under the lower leaves, he severs the stalk. The plant is then turned over and set on the hill. In half an hour, unless it is very cool, the plants will have wilted enough to handle without breakage. The tobacco is then put in piles, each pile containing the number of plants required to fill a stick. This number varies from six to twelve, according to the size of the plants.

Each person engaged in making and arranging these piles, takes two rows and puts all the piles on one row with the heads of the plants towards the sun. The next two rows are piled on the row adjacent to the first row of piles. That is to say, four rows of tobacco are piled upon two adjacent rows. The object of piling it in this manner is to give an opening wide enough for a wagon to pass. The stick dropper follows, who places one stick at each pile. These sticks are usually rived from red oak or hickory, and are about 4¼ feet long and about 1x1½ inches thick.

To hang the tobacco, a stick is punched down in the soft hill, making an angle of about 45 to 60 degrees with the surface of the ground, and sloping a little east of north. The object in sloping it in this direction is to give protection to the leaves from the heat of the sun during the hottest parts of the day. The plants are taken up one at a time and straddled over the stick, with the heads to the south or southwest, Fig. 89. When all the plants in the pile are put upon the stick, the tails of the leaves are drawn closely together and tucked under, so as to expose as little surface as possible. When the tobacco has been hung, it is ready to be carried to the curing house or to a scaffold. Some tobacco is still put upon scaffolds in the heavy-tobacco-growing regions, and it is a good practice, if the weather is fair. If tobacco is very heavy and the distance to the curing house is as much as half a mile, much time may be saved by scaffolding in the field for several days. Then double the quantity may be hauled in a load. But if there is a foreshadowing of rain or stormy weather, it is far better to carry it to the barn at once. It does not injure the tobacco much to be caught in a rain while on the scaffolds, unless the rains are long continued. When the rains last a day or two, the tobacco gets very crisp, and it is difficult to handle it without doing a great deal of damage by bruising and breaking the leaves. Scaffolds are nothing but poles arranged four feet apart, and sufficiently high above the ground for the tails of the tobacco to hang clear. These poles may be supported at one end by a bed pole, and at the other by forks. Scaffolds are often made in the corners of the zigzag rail fences that enclose the fields. They are constructed by resting three rails, or poles, on top of the fence, supported at the outer end by forks or other convenient means, so as to make two tiers, upon which the sticks holding the tobacco are arranged. It does not injure the tobacco to crowd it upon an outdoor scaffold. It will yellow the more readily by being so crowded. However closely it may be put, in a day or two the wilting of the plant and the evaporation will make it an easy matter to put the sticks still more closely.

In four or five days it should be taken from the scaffold and arranged for curing in the barns. Tobacco that has been on a scaffold for a few days may be arranged a fourth closer in the barns than that taken to the barns directly from the fields. In the early history of tobacco culture, scaffolds were almost universally used. For a time, within the past twenty years, they were almost universally discarded. More recently, however, this preparatory curing is being adopted by many good farmers, because by this method the plant is completely wilted before it is put in the barns; the texture is softened, the leaf yellows into a clear golden color, and it cures much more easily and, with care, into good colors, the leaves having the toughness and elasticity required in shipping tobacco. Throughout the White

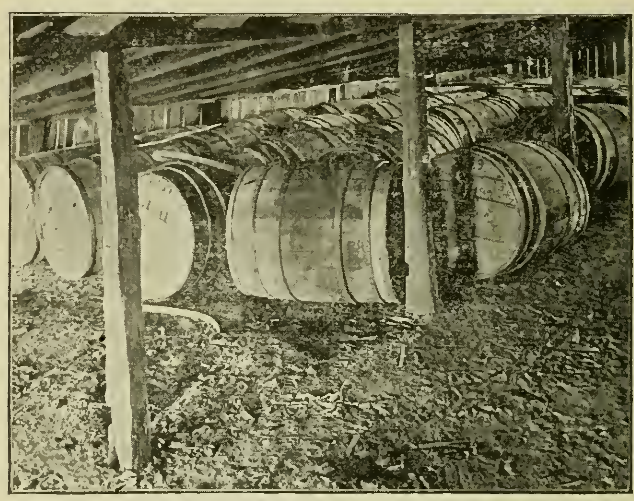

FIG. 94. HEAVY TOBACCO READY TO BE SHIPPED.

Burley districts scaffolding tobacco is an almost universal practice.

If cool nights threaten frost, it sometimes becomes necessary to cut great fields in a single day. When so cut, it is heaped up before it wilts in what are known as "frost piles." The tobacco is heaped around a center. To begin such a heap, two persons take each six or eight plants in their hands, and standing opposite one another, the ends of the tails are put nearly together on the ground, with the heads of the plants leaning towards each person. The heads are then brought together and supported in a position nearly upright by the inclination of each parcel towards the center. It is important that the tails be kept tucked under. Bunches of plants are set up around this center, in the same way, until enough is put together to fill thirty or forty sticks. The heap is then covered with straw, cornstalks, old carpets, or anything to protect it from damage by frost. In a few days the tobacco takes on a golden color, when it is hung and carried to the barn. Continued rains do great damage to the tobacco when so heaped. It not only gets in a "strut," but becomes dirty and breaks easily.

The tobacco is transferred from the fields or scaffolds to the barn by wagons in one of three ways: Either by hanging the sticks containing the tobacco on the upper railings of a long wagon bed, or frame, four feet deep and four feet wide; or the tobacco on the sticks is "cooped" in piles, the heads turned outwards and alternately to one side or the other; or the tobacco is carried on a low frame not more than one foot high, the sticks being hung on the upper railings, with the tails of the plants lying flat in the bottom of the frame, or tucked under. When eight or ten sticks have been so arranged, other sticks filled with tobacco are piled on top, in shingle fashion. The advantage in having a low frame is, that the heads will lean over so as to be nearly flat, and the tobacco piled on this foundation will not be punctured by the butt ends. A larger quantity can be carried in a wagon in this way, than in either of the others. Fig. 91 shows a new style of wagon that is very desirable for this work.

A method of taking tobacco to the curing house once much used, but now generally abandoned, was to have two or more light sleds. Instead of piling the plants in the field, they were piled on the low platforms of the sleds, with the heads outward, as shown in Fig. 36. When a load of sufficient weight was put on the sled for the team, it was hauled to the barn, the team unhitched, and an empty sled taken to the field to be filled in turn. The tobacco was hung from the sleds under the shade of the barn, and immediately elevated to the tier poles. This method saves much handling, and lessens the probability of injury from sunburn or from a shower of rain. Sleds were used because they were cheaply made, and may be built of a hight most convenient for putting on and taking off the plants. Low wagons or carts are more easily drawn and equally as convenient, and the style shown in Fig. 91 is coming into general use.

When taken directly to the barn from the field, a distance of eight inches should intervene between the sticks, when adjusted on the tier poles. Put closer than this would be to invite danger from house burn or pole sweat. When taken from the scaffold, the interval between the sticks need not be greater than six inches. A good day's work for a man, in cutting and housing tobacco, is from 100 to 150 sticks. When the field is cut clean, a third or more may be housed than when the ripest plants only are selected for the first cutting.

Curing Heavy-Shipping Tobacco is fully described in the chapter on curing.

Assorting, Stripping and Preparing Heavy-Shipping Tobacco for Market.—After the crop has been housed and properly cured, and the colors fixed by repeatedly "drying the tobacco out" by artificial heat, it is then ready to be assorted and stripped. Usually the stems and stalks are not sufficiently cured to begin this work until about the middle of November. It is not safe to put the tobacco in bulk before that time. After this time, when the leaves become pliant through the influence of damp weather or a warm rain, the tobacco should be taken down, the sticks withdrawn and plants laid on a platform with heads out, and tails overlapping in the center. Or there may be, by making the bulk wider, several layers in the center. If taken down when the leaf is limp and the stem supple more than half way its length, it is in a safe condition, and will not have to be reordered before it is taken to market. If the tobacco has too much humidity in it, or, as the expression is, "too high in case," it will funk when the weather becomes warm. In such a condition, it is too high either to prize at home or to take loose to market, unless it be to a stemmery, where tobacco high in case is re-

FIG. 95. CARRYING TOBACCO TO MARKET.
Primitive method still in use in North Carolina, Tennessee and Kentucky.

quired. It is the safest plan, therefore, to have the order precisely right, so that it will not be necessary to hang it up a second time.

After the tobacco has been taken down, stripping begins. First of all, the leaves on each plant are assorted by separating the various colors and qualities, and afterwards arranging them into various grades. In the same crop there are often many kinds, as bright and dark, heavy and light, long and short, the result of different plantings, inequality in the fertility of the soils, and of various exposures of the land. It will save much trouble if, in housing the crop, the new-land tobacco is kept separate from that grown on old land, the ripe from the green, and the long from the short. These several classes may be put each in a different part of the same barn.

Upon the same plant there are usually two or more ground leaves, bespattered with dirt, one or more worm-eaten leaves, and several perfect leaves. Sometimes there are also leaves blistered with red spots, or white specks, leaves also that are bruised and sunburned, or house burned. The worst leaves,—the sunburned, the dirty, those most badly worm-eaten,—are first picked from the stalk and tied in bundles of eight or more leaves. This is the lowest grade and is called "Lugs." The leaves that are slightly worm-eaten or injured, the perfect leaves if sunburned or house burned, make a grade called "Low leaf," or "Seconds." These are usually tied in bundles of five or six leaves. The remaining leaves on the stalk are termed "Good." There are various sub-grades of good; for instance, "Medium," which may be short, or poor, or of bad color; "Good leaf," which may be long and poor, or short and rich, or it may be of good color without being either long or rich; "Fine leaf," which has three or more desirable qualities, but is deficient in some other qualities. Fine leaf may be long, rich, fine fiber and gummy, but have a bad color, or lack uniformity in size. "Selections" constitute the highest grade in the heavy tobacco market. These combine every desirable quality in the shipping leaf, as length, richness, fatness, good color, elasticity, small stem and fiber, silkiness, strength and toughness, with uniformity of size.

The best rule to observe for assorting tobacco is not to mismate the leaves in a bundle, and not to mismate the bundles in a bulk or hogshead. Long and short leaves, rich and poor, bright and dark, bruised or worm-eaten and perfect leaves should not be put together.

Assorting and Prizing Tobacco.—The most careful hands only should be allowed to assort tobacco. This work requires undivided attention, good sight and correct judgment as to quality. If, through inattention, a few bad leaves are put with the good, it may depreciate the value of all the tobacco in a hogshead if, by chance, these bad leaves should appear in the sample drawn. Short leaves appearing in a sample of long tobacco, or bright leaves in a sample of dark tobacco, or vice versa, or rich leaves with poor leaves, or perfect leaves with those broken or worm-eaten, all violate the laws of classification and injure the sale of the product.

All leaves of uniform color, twenty-six inches in length and over, should be tied in bundles of not more than five leaves. Such tobacco suits the African market. It is also a first-class "shipper," and is sought for by the stemmer for making the highest grades of strips for the English market. If of uniform color and broad leaf, the buyer of wrappers will want it also. All this competition would be lost if improperly assorted. Nor should the most desirable grades be prized (that is, pressed into the hogsheads) too hard, for the stemmers and buyers of wrappers want tobacco to open freely and not be caked or bruised by hard prizing.

The tobacco is partially stripped in assorting, for to strip tobacco is simply to pull the leaves from the stalk and tie them in bundles. The size of the bundles is an important matter. If the tobacco is intended for a stemmer, and is to be delivered loose in wagons, it may be tied in bundles as large as the arm, care being taken to keep the different grades separate. But if the tobacco is to be prized in hogsheads and after inspection to be sold by sample; or if it is to be sold to a buyer who intends to prize and sell it by inspection, then all the good grades must be tied in bundles containing only five or six leaves. Great neatness should be observed in tying the bundles. The tie leaf should be small. This is taken in the right hand and smoothed out at the tail end, doubled so that the inside surface of the leaf forms the outside of the wrapper. A narrow band is made of the leaf, not more than one inch in width. The band, with the stem downward, is wrapped tightly twice around the butts of the stems, and then the tie is tucked between the leaves. This makes the head an inch long. It differs from the tie of the seedleaf tobacco. The latter is tied, with the butt of the stem an inch or more below the end of the bundle. As each bundle is tied, it should be run through the hands, well straightened and compressed and laid carefully in piles.

During the prevalence of dry winds or cold weather, the exposed portion of tobacco, even when in bulk, becomes so dry that it may not be handled without doing it great injury. To prevent this, blankets, or straw, or a wagon sheet, should be put all around the bulk. This covering, kept damp, will prevent the exposed leaves, or parts of leaves, from drying.

By providing a close room heated by a stove, with a vessel of water on top, stripping may be carried on during very severe cold weather. Otherwise the tobacco will become very dry and harsh and will be damaged by breaking or crumbling.

However good the order of the tobacco when hanging up may apparently be in cold weather, it should not be taken down from the tier poles, for if a warm spell of weather should supervene, it is almost certain to become soured or "funked." Much tobacco is damaged beyond remedy by not observing this caution. Many planters, by taking their product to market in a condition that it will not pass the ordeal of the spring fermentation, lose all their profits. Those who buy it in this condition are compelled to rehandle it. More money is made by properly assorting, handling and "ordering" the tobacco crop than by growing it. When the crop is hurried to market in a condition that it will not keep, the rehandlers of tobacco and the local manufacturers are the only competitors for it. The foreign buyers are excluded by its unsafe condition.

It must not be inferred that it is necessary to bulk the tobacco before it can be stripped. Many successful managers of tobacco prefer to take it down from the tier poles only as it is required for stripping. The leaves are much more readily examined by this method, for they are not pressed together as they are after lying in bulk. Much time is, therefore, saved in assorting. The chief advantages in having it in bulk are: 1. That it is always in condition to be handled, and in bad weather the time may be utilized in stripping, while the tobacco if hanging up would be dry. 2. If taken down in the right condition or order, it need not be rehung on the sticks and tier poles after it is stripped. 3. It is less liable to be weather-beaten, or broken by winds that sometimes find entrance to the barns. Tobacco is also injured by frequent alternations of dryness and humidity, and these changes cannot take place when in bulk.

"Ordering" Heavy Shipping Leaf.—Should it happen that the tobacco, when stripped, is too high in case for prizing, it must be rehung on the sticks. It often occurs that the leafy part is in right order, but the stem is too damp, or the reverse may happen, that the stem is in right condition, but the leafy part is either too dry or too damp. The leafy part should be pliant, but not sufficiently so to show translucent spots when pressed between the finger and thumb. The stems should be pliant, but not limp, and they should break a few inches below the head when the bundle is bent at right angles.

FIG. 96. A TYPICAL NEGRO WAREHOUSE HELPER.
"I'se Jeems Johnson, what 'breaks' tobacco in Carr & Co's warehouse, I is."

Even when it becomes necessary to reorder tobacco, it is not expedient to attempt to do so during the winter months. And it is best not to hang it on the tier poles until spring approaches, for during the winter the snows are apt to beat in upon it. The winds injure it, and if the weather becomes very moist, the heads fall to one side and get into a crooked condition, not easily straightened. When stripped too high, let 16 or 18 bundles be put on a stick, and "shingle" the sticks, filled with tobacco, on an elevated platform, making "coops" four or five feet high. The sticks give ventilation to the interior of the pile, and lessen the danger to be apprehended from funking, even should warm weather ensue.

When the drying winds of spring come, the sticks should be elevated to the tier poles so the tobacco may be "dried out." The first warm rain that comes will put it in suitable condition to take down again. A careful watch should be kept that it does not get too high in case. It should be "struck" down just before it appears to be sufficiently high in case, for the growing humidity continues a while, even after it is taken down. Some of the best "ordering" seasons come without a drop of rain. A warm, South wind surcharged with moisture will do the work of ordering much more uniformly than a rain. A "coming season" only should be utilized, that is to say, when the tobacco goes from a dry to a humid condition. A "going out season" is when it has been too high in case and drying winds bring it seemingly to the proper order or condition. If taken down in a "going out season" it will be found that the stems are too moist for the leaf, and there will be no uniformity in the order.

When the tobacco is rightly ordered after it is stripped, it must be put in a bulk preparatory to prizing and to preserve its right order or condition. A platform, four and one-half feet wide and as long as may be necessary to hold the tobacco to be bulked, is made a foot, or more, above the surface of the ground, unless the stripping room has a plank floor, which will answer for a platform. One man gets on the platform and one or two bundles at a time are handed to him, after being thoroughly straightened and squeezed. A course is run the entire length of the platform with the heads coinciding with its outer edge. Another is similarly run on the opposite side of the platform. Then two courses are run between these, the heads of the bundles resting midway the first course, and the tails overlapping the center line of the bulk. These four courses form one layer, and these layers are repeated until all the tobacco is put in bulk. In laying down the bundles, the man who bulks gets on his knees and packs before him, laying the bundles flat and drawing them closely together. In bulking the heavy-shipping tobacco, the leaves are never permitted to flare out fanlike, but the bundles are kept as nearly as possible in a cylindrical form. When the bulk is finished, it is covered with planks, or tobacco sticks, laid evenly over the top and heavily weighted with logs or rocks. In two or three weeks the tobacco will smell as sweet as a rose and is ready to be put in the hogshead.

The hogsheads for shipping tobacco vary in sizes, but the most approved sizes are 56 inches high and 42 inches in diameter at the head, or 54 inches high and 38 to 44 inches in diameter. In some districts the hogsheads are made 60 inches high, or even 72 inches high by 50 inches in diameter, but these sizes are not popular with buyers.

The casks are usually made of white oak staves rived and drawn, but sometimes they are sawed. Hoops for banding the casks are made of the sap part, with a little of the heart of a young, white oak tree, though small hickory poles divided in halves are frequently used for the same purpose. In Virginia and North Carolina, staves are often made by sawing cuts of the old field pines into the proper dimensions; these make very cheap staves, but they will not bear rough usage. In Kentucky and Tennessee, hogsheads are made of hived oak staves, or sweet oak, or of any other tough, hard wood.

There are several ways of packing tobacco in hogsheads. One is to run two courses across the bottom of the hogshead, the heads of the central bundles in the course being about eight inches from the staves, and the distance of the heads from the staves decreases each way in the course until they come in contact with the staves. Two more courses are run at right angles to the first two, and this is continued until the hogshead is filled, the pressure of the screw, or prize, being put on at intervals. This is called the "square pack," as shown in Fig. 93. Another way is to run two courses, as in the square pack, and then two more courses, the bundles lying in the same directions, but with the heads jammed against the staves of the hogshead. In the leading heavy-shipping districts from 1400 to 1800 pounds of the best grades are put in a hogshead, averaging about 1600 pounds, and from 1800 to 2200 pounds of lugs, though the weights vary from 1000 pounds for fancy to 2500 pounds for black shippers or balers.

NEGRO LABOR.*

The Laborers Chiefly Employed in the heavy-shipping-tobacco districts are negroes, who are exceedingly efficient in the work of cultivating, worming, suckering, housing and preparing the crop for market. Trained

*It may be well to state that Col. Killebrew, the writer of this article, was an extensive slave owner before the war, and since then has been a large employer of negro labor on his plantations.

FIG. 97. A TOBACCO FIELD IN "OLD VIRGINY."

From a photograph taken for this work of Mr. Edgar M. Ward's oil painting, by consent of the painter and kindness of Mr. James D. Gill.

through successive generations in the tobacco fields and directed by highly intelligent managers, the negroes in the tobacco-growing districts of Kentucky, Virginia and Tennessee take naturally to the work and seem to prefer it to any other. They are diligent, careful, patient and faithful, and yield a ready and cheerful obedience to their employers. Their physical vigor gives them the strength to endure and perform the severe labor required in transplanting and housing the crop. Many of them become expert curers, assorters and packers of tobacco. They are peculiarly fitted to withstand the climate of the Southern states. They are scarcely affected in health by the malarial districts. The burning heat of a summer's sun only awakens in them a higher sense of enjoyment. They are children of the sun, and are as much distressed by extreme cold as the Northern laborers are by extreme heat.

They are not only preferred by the planters, but the warehousemen find them most desirable in the work of stripping the casks from the tobacco, and preparing it for sale. Their cheerful faces are seen and their merry laughter is heard in every warehouse of the South, where they are employed in rolling the heavy casks in and out, applying the break lever for the inspectors, reprizing the loose tobacco in the cask and doing all other heavy manual work. They are always good humored, good natured, obliging and respectful to white people, though fond of guying each other in a friendly spirit.

The negro rarely seeks a higher aim in life than a modest living. His earnings are spent with a lavish hand, and however large his wages he rarely makes any provision for old age. He lives for the present, happy, thoughtless, contented. His emotional nature is extreme and hence he enjoys above all things the excitement of a "big meeting," a dance, or a horse race. Social by nature, he will spend every moment of leisure with his companions. He is not given to seclusion, or to thoughtfulness. He is moved by impulse rather than by reason. This social instinct makes him a discontented laborer when working alone, and he will take less wages where he can mingle with a large number of his own race. The negro is liberal to a fault. He will often work a whole week and give his earnings to a church festival on Saturday night, or hire a costly equipage for a drive with his wife and children, or with his sweetheart, on Sunday. He will wear ragged, dirty clothes six days in the week and a costly tailor-made suit when he goes to church, or to a dance, or to spend a holiday. Yet, notwithstanding this want of frugality, it must be said to the credit of the negro that he very seldom leads an idle or vagrant life, and is rarely dissipated. His race indulges in no anarchistic or socialistic ideas. The negro never questions the right of another to take his place when he has been discharged, or when he voluntarily surrenders it. The idea of a boycott is repugnant to his nature. In many respects he is eminently conservative and his greatest weakness is a lack of firmness. Oftentimes he is tempted to do what a firmer judgment would condemn.

The negro farm laborers of the South are probably the most independent laborers in the United States. When one is discharged, unless for some heinous crime, he finds no difficulty in securing employment at once on some neighboring farm. And yet it cannot be said that the negro laborer is wanting in constancy. When he is treated fairly and honestly by his employer and paid promptly, he is averse to a change. Possibly in this particular the negro excels every other nationality, or race, as a laborer. Rarely does he cherish ill will, much less revenge, towards his former employer. He entertains a warm feeling for a generous man, but cordially despises a parsimonious one. Generosity in the employer oftentimes goes further with him than justice.

It is often alleged by Northern writers and statisticians that the wages paid Southern laborers are much less than are paid for the same class in the North. This is more apparent than real. A Northern farm laborer, with a family, has generally to pay rent for his house and garden, purchase his supply of fuel and pay for the pasturage of any stock that he may own. All this is given freely to the negro farm laborers of the South and they are employed throughout the whole twelve months. In the stemming factories many negro women are employed in stemming tobacco. They easily earn from 50 cents to $1.50 per day.

The wages of a Northern man may be $20 to $25 per month, but much of this will be absorbed in buying what the Southern farm laborer has given him, and it rarely happens that he is employed for the whole year at the wages named. The Southern laborer has more money to spend for his pleasures and is rarely oppressed with debt. In the Northwestern States, with the bleak, cheerless climate of that region, the wages of $30 per month to a laborer will not provide near as many of the comforts of life as one-half this amount paid to a Southern laborer. The winters of the Northwest are long and dreary; fuel is expensive and necessary to comfort for at least six months in the year. The character of the clothing also, suitable to such a climate, makes it much more costly than that required by the laborer of the South.

The great and leading difference between the white labor of the North and the colored labor of the South is this: The first has ambitions, calculates possibilities, and looks forward to the future; the latter enjoys the present, is indifferent about what is to come, and is utterly incapable of that self-denial which makes thrift and prosperity possible. The negro laborer never crosses a stream until he reaches it. He is, therefore, contented and happy,—jolly and hilarious oftentimes, when, under precisely similar conditions and circumstances, the white laborer will worry and give way to irritability, or senseless passion. The colored laborer enjoys more happiness and contentment; the white laborer more thrift and prosperity. The one is progressive, the other conservative. Great prosperity springs from the exertions of the one; old customs are perpetuated by the other and scarcely any progress is made by him in the development of accumulated wealth. The negroes occupy a unique, but useful place, in the social structure of the United States. They never indulge in strikes, but they always have profitable employment, and their employers become attached to them and they to their employers. There is less suffering and more contentment among them than among any other laborers in the United States.

CHAPTER XIV.

THE WHITE BURLEY AND MANUFACTURING TOBACCO.

While experiments in growing White Burley have been made in all the tobacco-growing States in the South and several in the North, the district where the quality reaches its greatest excellence has greatly increased its boundaries during the past 15 years. This entire district lies on both sides of the Ohio river. The Kentucky White Burley district embraces an area of a little over 10,000 square miles, and includes 34 counties, or parts of counties, all of which adjoin, except two, Breathitt and Bell, forming an irregular figure bounded by the Ohio river on the North and on the other sides by lines drawn from Louisville, Ky., to Danville, and from Danville to Catlettsburg. Bell and Breathitt together only produced a little over 15,000 pounds of tobacco in 1896, and scarcely deserve to be mentioned.

The largest producing counties, taken in the order of their production as reported by the county assessors, in 1894, are Mason with over 5,000,000 pounds; Shelby, Henry, Woodford and Carroll each between 4,000,000 and 5,000,000 pounds. The following counties between 3,000,000 and 4,000,000 pounds,— Harrison, Hart, Grant, Scott, Nicholas, Fleming, Pendleton, Bracken and Fayette. Boone and Trimble produced each between 2,000,000 and 3,000,000 pounds. The counties of Clark, Bourbon, Owen, Franklin and Gallatin produced over 1,500,000 pounds each, and the counties of Bath, Jessamine, Carter, Mercer and Robertson produced over 1,000,000 each.

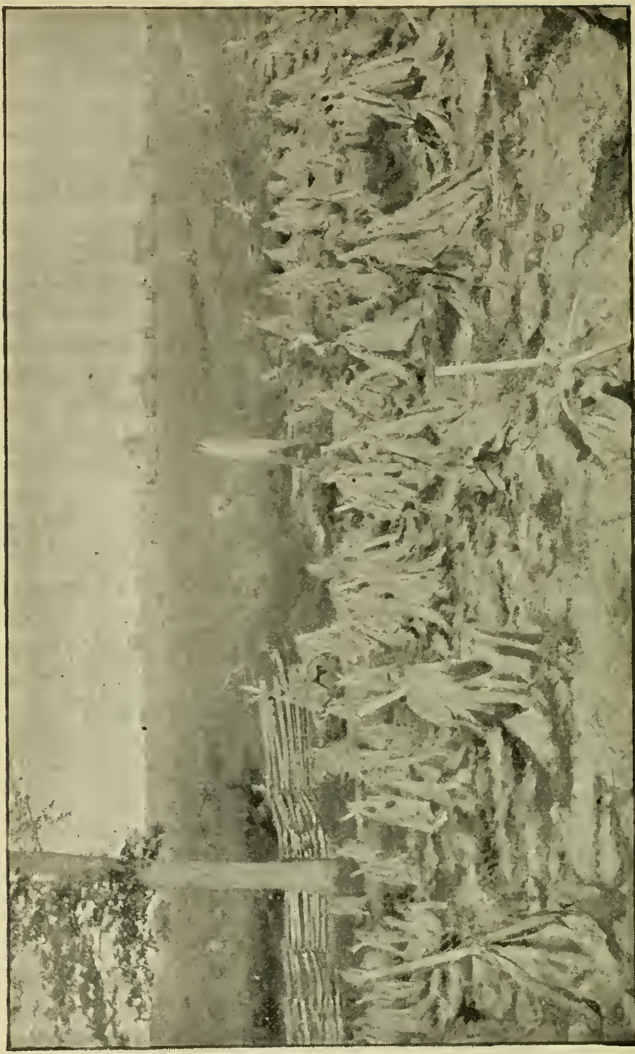

FIG. 98. WHITE BURLEY CUT AND HUNG ON STICKS IN THE FIELD.

The Ohio White Burley district lies just north of the Ohio river and immediately opposite the White Burley district of Kentucky. It embraces the counties of Brown, Adams, Clermont, Butler, Scioto, Hamilton, Highland, Licking and Lawrence. All these counties lie on the Ohio river, except Butler, Highland and Licking. Brown produced in 1894 over 3,700,000 pounds; Adams and Clermont each over 2,000,000. None of the other counties produced as much as 500,000 pounds. These figures are taken from the assessors' returns to the Secretary of State for 1894.

If the figures reported by the assessors are correct, they indicate a considerable falling off in the production of the White Burley crop in Ohio in 1894, as compared with the production in 1889. The counties of Brown, Adams and Clermont reported for that year 14,877,959 pounds, but in 1894 only 8,737,639 pounds, showing a falling off of 41 per cent. A comparison of five of the counties in Kentucky that have the largest production shows about an equal amount for both years. Mason, Shelby, Henry, Woodford and Carroll show a production, both in 1889 and 1894, of over 23,000,000 pounds in the aggregate.

The Soils of the White Burley District are among the most fertile in the United States, and in this respect occupy a position in relation to the growth of product diametrically opposite to the character of the soils best fitted for the growth of yellow tobacco. The latter requires conparatively sterile, sandy soils, while the White Burley must have the most fertile, limestone soils for its proper development. A comparison of chemical elements of the two typical soils will be instructive. Take the analysis of the soil of Mason county, Kentucky, where the finest White Burley tobacco is grown, and an analysis of the soil of Granville county, North

Carolina, where the highest grade of yellow tobacco is grown, and we find the following:

	Mason Co., Ky.	Granville Co., N. C.
Organic and volatile matter,	8.462	1.2050
Alumina,	4.745	2.4965
Oxide of iron,	6.240	0.6275
Lime,	.836	0.2330
Magnesia,	.798	0.0847
Manganese,	.146	0.0417
Phosphoric acid,	.231	0.0379
Sulphuric acid,	.084	0.0140
Potash,	.558	0.5045
Soda,	.160	0.2892
Silica,	78.100	93.5035

The White Burley soil has seven times as much organic and volatile matter in it as the yellow tobacco soil, twice as much alumina, ten times as much oxide of iron, over three and a half times as much lime, nearly ten times as much magnesia, three and a half times as much manganese, nearly seven times as much phosphoric acid, six times as much sulphuric acid, and one-tenth more of potash. The yellow tobacco soil has nearly twice as much soda, and nearly 20 per cent more sand.

The topographical features of the White Burley district in Kentucky are greatly diversified. High, rolling ridges, round, domelike knobs, and sharp hills, with here and there level stretches, are its characteristic features. Many streams pass through the district, and these have carved out deep, winding valleys that are three or four hundred feet below the general surface of the country. The great ridge, known as Dry Ridge, which forms the main axis, or backbone, of the region, runs approximately north and south. Upon this the Cincinnati Southern railroad was built. From this ridge, many transverse and subordinate spurs shoot out, but they are so often dissevered by deep hollows, or gorges, that the region presents for the most part a very irregular series of rounded or flat elevations. The country, except in the principal blue grass counties, is very much broken, and nearly every member of the Lower Silurian formation is exposed at one or more places in the district. This gives within limits a considerable variation in the composition of the soil, but all of it is made fertile by the presence of the carbonate and phosphate of lime. The principal tree growth on the best tobacco soils is hickory, white oak, tulip tree, beech, walnut, hackberry, black locust and ash. All this growth indicates a very fruitful soil. Where the white oak is the prevailing growth the soil is called "oak soil." The soils in every part of the district are exceedingly durable, and where apparently exhausted, if they are abandoned for a few years, fresh plant food will be supplied by the disintegration of the shaly beds and the soft limestones that underlie them. Many of these limestones contain such a large percentage of phosphoric acid as even to make them, when pulverized, valuable as a fertilizer.

The great unevenness of the surface of the country makes tillage difficult. The slopes of the hills, except when kept in grass, soon become scarified with unsightly gullies. Clean culture, such as tobacco requires, soon makes the land unproductive, not, as many suppose, by the amount of fertilizing material extracted from the soil by that crop, but because of the rapidity and ease with which the soil is carried from the hillsides to the valleys. However, the region is fortunate in having a subsoil and rocky strata beneath, which hold in store a large amount of unexpended plant food, which is unavailable until it has been liberated by the crumbling of these underclays and rocky beds through the effects of weathering. Unlike almost any other region not alluvial, the fertility of the soil is renewed by time, as interest gathers upon a fixed capital.

While a few planters prefer the old lands, and especially the old sod lands in the bluegrass districts because the yield is much larger, the greater number of growers prefer the freshly opened lands, where white oak was the original tree growth. The southern and eastern sides of the elevations are usually selected for growing tobacco. In such situations the plant grows into its greatest beauty and most useful qualities, and ripens more evenly and more quickly. Where the soil is derived from the highly calcareous, sandy, blue lime-

FIG. 99. WHITE BURLEY ON SCAFFOLD.

stones and has been kept in bluegrass sod for many years, an excellent manufacturing leaf is grown, not so silky, or so bright in color, or so soft to the touch, or so lustrous, or elastic, or high priced, as that grown on the fresh oak lands, but heavier in body and richer in gummy matter. This old-land product is preferred for manufacturing plug and navy, but not for making cutting tobacco, as the amount of gum present unfits it for that purpose. The old-land product is considered, therefore, a most useful quality of tobacco, and though its color is more red than yellow, it has supplied a want for plug for which the thin, highly colored tobacco grown on fresh soil is not at all suited. It is an ideal filler for plug tobacco, having a large absorptive capacity, mild in its effects upon the nervous system, delicate in its flavor, and withal is very popular with consumers.

The soil is the most potent factor in the growth of the White Burley, as it is in the growth of the yellow tobacco, or the heavy-shipping leaf. Take the soils of one of the typical counties, Owen for instance, and they are classified by the planters according to their timber growth. Plot 1 has a growth of sugar tree, beech, tulip tree, hackberry and butternut, and is first-class bluegrass land; this soil makes the largest number of pounds per acre, but the product is red, heavy and gummy. Plot 2 has a growth of white oak and more clay and less sand in its composition; the tobacco grown on it is thin, bright and silky. Plot 3 resembles an alluvial soil, filled with organic matter; the timber growth is ash, locust, poplar and oak; it grows a rough, heavy tobacco useful, as a general thing, only for fillers and for wrappers in the manufacture of the cheaper grades of plug tobacco.

The White Burley soil in Ohio consists of modified glacial drift, and occupies, beside the Ohio river basin, the fringing spurs, which rise to a hight of 400 to 500 feet above the Ohio river and run back from the basin, uniting at a greater or less distance in a plateau country deeply gashed at intervals by the tributaries of the Ohio and Miami rivers. Many broad areas of level land occur on this plateau, so flat, indeed, that in times of excessive rains, they overflow and form temporary lakes. The drift, or glacial deposits, contributes mainly to the formation of the soils of the district, though there are some small areas where the limestones of the Lower Silurian age come to the surface and yield their characteristic soil. The drift is composed largely of fertile clays, in which limestone gravel is imbedded. Four kinds, or varieties, of soil are found in this district: 1. The native soil formed from the limestones, or bed rocks, of the country. 2. Drift soil of the uplands. 3. Black soil of swampy or peaty areas. 4. The alluvial soil of the river and creek bottoms. The native soil is found on the sloping hills that run down to the stream beds. This soil is dark, friable and fertile and very much resembles the bluegrass soil of Kentucky, and it has the same tree growth. It is preferred for tobacco, though it washes easily. Tobacco is grown on all the other classes of soil mentioned, but the peaty and alluvial soils make a coarse, rough article.

Summarizing the quality of the product as affected by the variety of soils and different exposures in the White Burley districts of Ohio and Kentucky, we find that:

1. Tobacco grown upon new lands, and especially new oak lands, is thin, light, bright golden in color, gumless and rattles, when handled, like dry fodder. This is the very best cutting leaf.

2. On the same land the second year the product will be heavier, a cherry red in color, with more body, but with little gum. This is suitable both for cutters and for the manufacture of plug.

3. Old sod land makes a product of better body, a good absorbent, less light in color, more useful as a plug filler, with a considerable gain in the number of pounds produced on a given area.

4. Alluvial soils produce tobacco dark in color, rough in feel, bony and lacking in softness, and it has a small absorptive capacity.

As to exposures, other things being equal, the east-

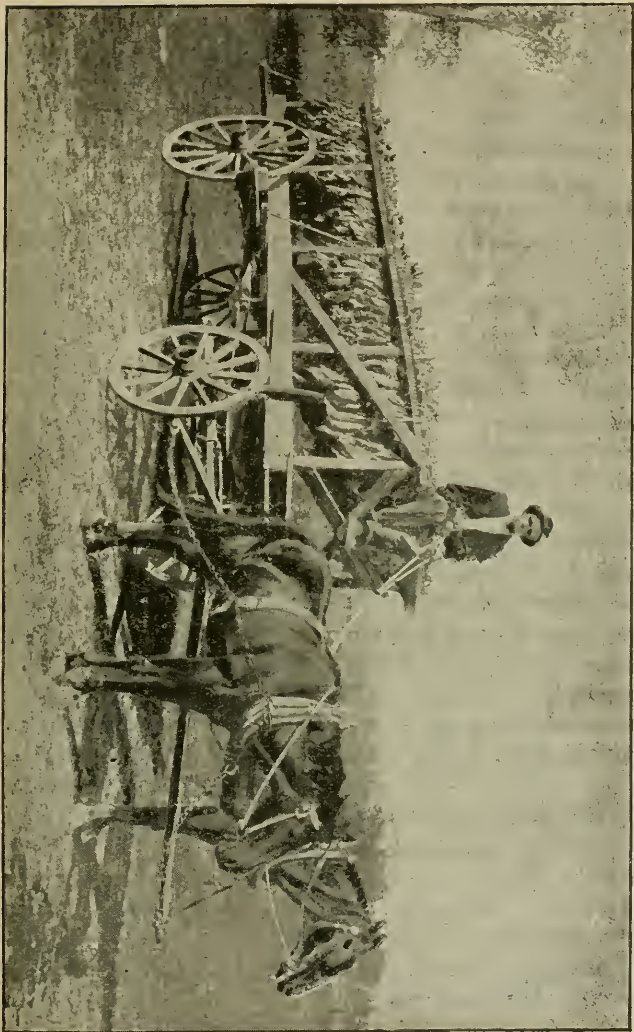

FIG. 100. HAULING WHITE BURLEY TO THE BARN.

ern, or southeastern, is the preference, the southern next, the northern third and the western last.

The White Burley tobacco is planted to some extent in Virginia, Tennessee, Missouri, Maryland, West Virginia, Indiana, Ohio and Arkansas, but it usually fails, when planted outside of the blue limestone soils of its native habitat, to attain the excellence that makes it desirable. The farmers of each district often, after fruitless experiments, return to the cultivation of that type which has made each district famous. Some excellent Burley tobacco is produced on the freestone soils of West Virginia, with pebbly subsoils covered with humus.

The central basin of Tennessee, of which Nashville is the center, by reason of its blue limestone soils, which have the same geological and lithological character as those in the White Burley district of Kentucky, presents the most promising field for the extension of the culture of this most desirable product. Some is already grown in Trousdale, Wilson, Smith, and a part of Mason, in the upper Cumberland river tobacco district, in Tennessee, and in several of the counties in the same tobacco district in Kentucky.

Two Varieties of White Burley.—There are two sub-varieties of White Burley now grown in Kentucky. The old variety (Plate VII, Page 40) has a pale green, or greenish-white color, and the leaves grow very closely together on the stalk. It is also much ruffled, that is, the leaves at the junction with the stalk have a ruffle, which passes sometimes entirely around the stalk.

The other sub-variety (Plate IX, Page 48) is not so pale in color, but it shows the white veins while growing. The leaves are more pointed and do not grow so closely together on the stalk. This sub-variety is more hardy and less easily damaged by weather conditions, either in the field, or after it has been put in the barn.

It furnishes more plug fillers also than the old variety. The new variety has but little ruffle, thus affording fewer hiding places for the worms. It is not so sensitive to the heat of the sun, or to house burn. It will also cure with fewer green leaves or spots.

Preparation of the Land.— In the bluegrass regions of Kentucky, where the White Burley is now very extensively grown, the preparation of the land for the crop is begun in the winter, from January to March. Two methods of breaking are practiced: One with a plow having a "skimmer" attached just in front of the subsoiler. The "skimmer" reverses a slice of sod some ten inches wide and two inches thick, and the subsoiler throws four or five inches of soil on top of the reversed sod. The second way is to turn the sod under with a two-horse plow to the depth of eight inches.

About the middle of April, a revolving disc harrow is run over the land, cutting the sods to pieces. This is followed by a slab drag, which is made of three or four pieces of timber, fastened at intervals of a foot, or more, with chains, so as to be flexible. This slab drag smooths the ground and pulverizes all the clods. The land is then marked off, from three feet eight inches to three feet ten inches, one way only, with an implement made for the purpose, which makes three marks at once. These marks are about three inches wide, and about two or three inches deep. They are made with a piece of scantling two inches thick, the front being armed with a sharpened piece of iron slightly flanged backward. The plants are set on the edge of these marks, at a distance varying from 18 to 27 inches, the less distance being used for growing cutting tobacco. Hills are seldom made in the White Burley district, except by a few Germans, who live in Mason county, Kentucky. In that county, about one-fifth of the area planted in tobacco is fresh land, which makes the very best cutting tobacco.

Fertilization and Rotation.—It is a very rare thing for fertilizers, or manure, to be used anywhere in the White Burley districts. One planter says he never uses manure if he "can possibly avoid it," for the tobacco product is much better when grown without it, having more elasticity and other desirable qualities. Sometimes, though rarely, a little manure is spread over the land before it is harrowed. Tobacco stalks and trash from the barns are preferred to any other fertilizer for tobacco, and impair its qualities less.

The tobacco crop is usually followed by wheat sown in the fall, and upon this timothy is sown immediately, and red clover in the following spring. The land is allowed to remain in timothy and clover for several years before it is planted again in tobacco. The timothy "eats out" the clover in about two years, and the bluegrass takes the timothy in about four years. When well sodded with bluegrass, the soil is again prepared for another crop of tobacco.

On new land, two crops of tobacco are grown in two successive years. After the first crop of tobacco is taken off, the land is sown to rye, which is allowed to grow without pasturing, until the following April. The rye is then turned under with a skimmer and subsoiler, or only with a turning plow, like the bluegrass sod. After the land has produced two crops of tobacco, wheat and timothy are sown immediately after the tobacco is housed, and clover the following spring. After the expiration of three years, another crop of tobacco is grown. After the third crop, the rotation is like that given for old land.

Tobacco plants are usually set after a shower, but if the rains are tardy, or insufficient, the plants are set out in the afternoons and watered. The Bemis planter,

(Fig. 23) is in common use in the bluegrass section, by the large planters. From one and a half to two acres may be set out in an afternoon with three hands—two to drop plants and one to drive the team. A few days after the plants are set out, the ground near them is scraped with hoes. When the plant is established, a bull-tongue cultivator is run six times in the space between the rows. Every week after this the land is plowed with double-shovel cultivators until the period for topping approaches. Some planters plow deep; others shallow, as their judgments may determine. But little difference is observed in the product, whether the plowing is shallow or deep. The work of tillage should be directed to keeping the crop clean. During this period the tobacco is usually hoed twice, a little dirt being drawn to the plants at each hoeing. There are a few small farmers who throw the dirt to the plants with a one-horse turning plow, leaving a deep furrow between the rows. This method of cultivating, however, is almost abandoned.

Care of the Growing Crop.—When the first buttons, or seed buds, appear, the cultivation should cease, and the work of topping begin. From 16 to 20 leaves are left on each plant. White Burley is never primed before topping, and when it is desired to grow a cutting tobacco, the plants are topped much higher than when a filler is to be produced. High topping and close planting produce cutters; low topping and longer distances between the plants make a filler of good body and excellent flavor, and wrappers of great strength of fiber. It is best to top just as soon as there is a sufficient number of leaves on the stalk. It is better, however, to let a few plants bloom, if, by so doing, a large proportion of the plants in the field may be topped at the same time. All plants in the same field should be topped in the same week, even though some of the plants be topped to six leaves. This rule is founded upon the intelligent experience of the best planters in the White Burley district. The tobacco should be wormed at least once a week (see chapter on Pests). If the weather is very wet, the tobacco will have to be

FIG. 101. WHITE BURLEY PLANT NOT PRIMED.

This plant was grown at the Kentucky experiment station, under the same conditions as the typical plant of this variety shown in Plate IX. It was not properly primed, so the bottom leaves rest nearly on the ground and are small in size. The plant was four and one-fourth feet high, with a spread of four feet, being slightly wilted when photographed. The top leaf was 28 inches long and 10 wide, middle leaf 35x11 inches. It will be seen that the leaves are even larger than those in Plate IX, giving a larger weight per acre, but the amount of unmerchantable leaf is much larger, the quality usually not as good, and the tobacco will not sell as well as when the tobacco is properly primed.

suckered three times. The suckers should never be allowed to grow longer than three inches.

Harvesting.—From four to five weeks after topping, the tobacco should be fully ripe. The plants are then cut with a butcher knife, or a tobacco cutter, described in the previous chapter. Each person cutting takes three rows, splits the stalk down below the middle and straddles the plants, as they are cut, over a stick stuck up in the middle row, on the hill of the last plant cut in that row. From five to six plants are put on each stick, according to the size of the plants. In this way the tobacco is cut and housed without coming in contact with the dirt. The sticks are four and one-third feet in length, and when filled with tobacco are taken directly to the curing houses, or barns, and hung 12 inches apart on the tier poles. Very many planters put the tobacco on scaffolds in the field, where it remains for three or four days, and it is then taken to the barns. Trestles, five feet high and very much like those used by plasterers and carpenters, are employed to hold up the tier poles of the scaffold (Fig. 99). The tobacco, when taken from the scaffold, may be arranged on the tier poles in the barns as closely as eight inches. By scaffolding, one-third of the capacity of the barn may be saved. The danger in scaffolding is that the tobacco may be caught in a rain. About one-third of the tobacco planters in the district now scaffold their tobacco before taking it to the barns.

The leaf, after being properly wilted on the stick, or scaffold, is carried to the barn on a frame, made just wide enough to take the sticks conveniently, as shown in Fig. 100.

Assorting and Stuffing.—When fully cured, the tobacco is assorted usually into six grades as follows: 1. Flyings, or sand leaves, called also spod, which constitute about 10 per cent of the crop. 2. Trash, 15 per cent. 3. Lugs, 15 per cent. 4. Bright leaf, 30 per cent. 5. Red leaf, 25 per cent. 6. Tips, or the short top and often greenish leaves, making up the remaining 5 per cent.

The flyings and sand leaves are used mainly for making smokers; the trash and lugs in a fine crop are used for cutters; the bright leaf is used for wrappers, or fine cutters; the red leaf for plug fillers, and the tips for making a low grade of plug for exportation.

All grades are tied in bundles of from 10 to 20 leaves, the smaller number of leaves to the bundle being used in the better grades. A tie an inch in diameter is a better standard and one preferred by the dealers.

Packing for Market.—When White Burley has been assorted and stripped in the fall, each grade is put in a separate bulk. This is prized (pressed into hogheads) at once and is known as the "winter prizing."

For "summer prizing" the tobacco is allowed to remain in bulk until the heated season approaches. It is then hung up in the barn (Fig. 102) for the June sweat, and reordered, so that the stems will crack when bent to the tips of the leaves. Some planters, instead of bulking the tobacco down after stripping, put the bundles on sticks and shingle it on a plank floor until May, and then hang it up in the barn to be properly sweated and ordered. When prized in casks weighing 1100 pounds for the fine grades, and 1200 to 1400 pounds for the inferior grades in good keeping condition after the sweat, it will remain sweet for years.

The largest portion of the crop goes to Louisville, Cincinnati and Richmond, Virginia, and is prized in hogsheads 48 inches in diameter and 60 inches high, made generally of poplar staves five-eighths of an inch thick. It should always be remembered by the grower of tobacco, and especially of the White Burley tobacco, that a good crop badly handled will sell no better than a bad crop well handled. In packing the tobacco in a hogshead, the heads of the bundles are drawn closely together, but the tails are allowed to spread out like a fan. This is different from the packing of heavy-ship-

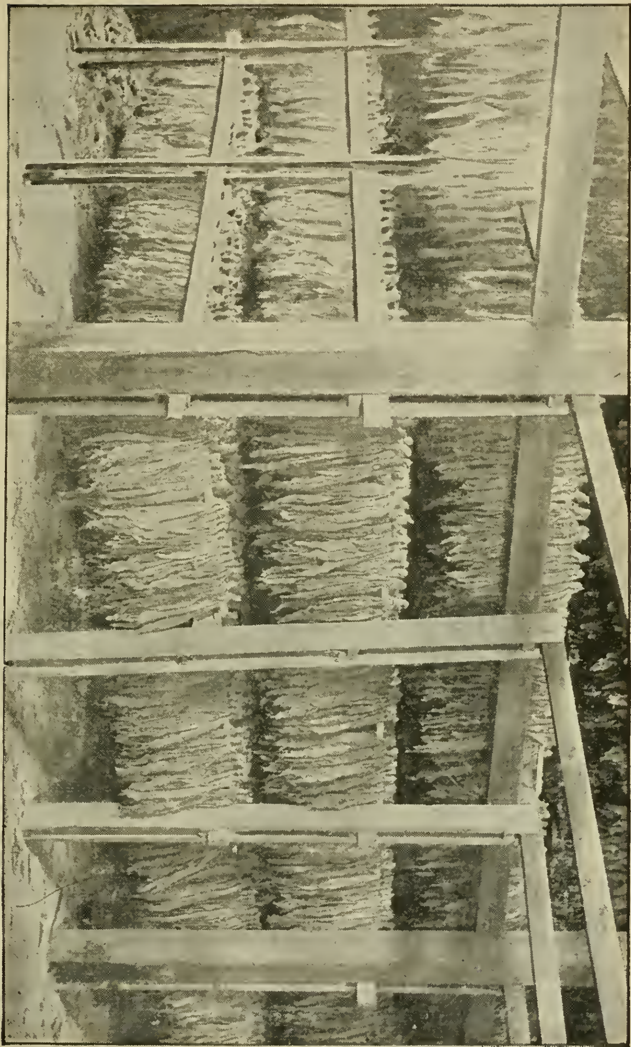

FIG. 102. WHITE BURLEY HUNG IN BARN AFTER BEING STRIPPED FROM THE STALK.

ping tobacco, when every bundle is packed closely to the preceding one throughout its entire length, as shown in Fig. 93.

The best cutting leaf comes from Owen county, Kentucky, and from the hilly land in Clermont and Adams counties in Ohio. It is bright and thin and gumless. Mason and Bracken counties make a plug filler of fine fiber, but of good body. Fayette, and the counties in the bluegrass district, will make a tobacco of as fine fiber as that grown in Bracken and Mason counties, if topped high enough and planted closely enough. If a very wide space is left between the plants, the tobacco will grow too rank, and with large stems, which is not desirable for either plug filler or cutters; such is the product of the alluvial soils in the White Burley counties of Ohio. When well cured, however, such a product makes a very sweet chewing tobacco.

Manufacturing Leaf.—In a few of the counties in Virginia, notably Caroline, Spottsylvania, Hanover and Louisa, sun and air cured fillers for plug tobacco are produced which are said to be the sweetest for chewing purposes grown in the United States. There is no difference in the methods employed in cultivating this and the White Burley, or the shipping leaf. The main difference lies in the method of curing. The tobacco is scaffolded until the leaf is nearly cured in the sun, and it remains on the scaffold from four to seven days. It is then removed to the barn, where it hangs until it is entirely cured. When the weather is unfavorable, the tobacco gets but little sun. In such weather, plenty of space must be left between the sticks so that the plants will not touch each other.

No fire must be used after it is put in the barn, unless in the case of long-continued damp weather. It is then fired gently to keep it from molding. The rich, mahogany wrappers and fillers grown in Henry county, Virginia, and to some extent in one or two of the adjoining counties, are flue-cured in the same manner as yellow tobacco.

Missouri, for many years, grew a large quantity of excellent manufacturing tobacco in the eastern part of the State, on both sides of the Missouri river, but the product has greatly fallen off within recent years. The White Burley is now more extensively used in the United States, for the manufacturing of plug and fine cut, than all other varieties combined. West Virginia is gradually enlarging its area of manufacturing tobacco.

CHAPTER XV.

YELLOW TOBACCO.

The most astonishing fact about the development of this industry, described in Chapter I, is that it has made the abandoned soils in the midland districts of North Carolina and Virginia the most valuable for agricultural purposes. The excellence of yellow leaf seems to depend upon the poverty of the soil, as well as its color.

This leaf grows at all altitudes from 50 to 2500 feet, and under isothermals from 60° down to 54°, from the coast to the western North Carolina mountains, along the French Broad river and beyond in Tennessee, between the Little Pedee, Santee and Wateree rivers in South Carolina, in more than a dozen counties of southern Virginia, also in West Virginia, southern Ohio, a few points in Kentucky, eastern Missouri and Arkansas. Indeed, this tobacco will probably be tried wherever the soil seems adapted. The State experiment stations, or private individuals, are testing this variety in Louisiana, Georgia, Arkansas and elsewhere, and in some cases with promising results, where the soils are most like the typical yellow tobacco soils named below.

The quantity of yellow tobacco produced was erroneously stated by the census of 1890. Mr. W. W. Wood has shown that for 1891, the North Carolina product of tobacco was probably 85,000,000 pounds, while the 1895 crop is returned by the United States department of agriculture as nearly 115,000,000 pounds. The yield per acre, under proper culture, varies from 600 to

900 pounds, and probably 700 pounds per acre is a fair estimate in a good year, this being double the yield reported by the census of 1890.

There is great rivalry between the districts, as to which grows the finest tobacco. For a long time Granville county, North Carolina, stood without a peer as to quality, but Durham, Chatham, Caswell, Person, Nash and Wilson now stand with Granville in the first rank. Warren, Franklin and Pitt are all noted for growing an excellent quality. The western counties of North Carolina make probably the best bright fillers and some very fine wrappers. Eastern North Carolina and South Carolina grow the whitest tobacco. The low, level, sandy areas seem peculiarly adapted to growth of that style of leaf. East Tennessee grows some very fine leaf, but the proportion of green tobacco is large. The southside counties of Virginia have a wider range of product, growing a much larger quantity of inferior tobacco, but some of the very highest grades of the yellow product. Every district has some peculiarity of product, which makes the tobacco easily recognized by dealers.

Wherever produced, this fact stands out with prominence, that the soils upon which it is grown are practically the same in color, in composition, in general texture, in porosity, in physical characteristics and in constituent elements. The opinions of the planters, as to the relative merits of the product grown upon old lands and freshly cleared lands, differ somewhat. New lands are preferred in every locality where this tobacco is grown, except in the midland district and in South Carolina. In these districts the farmers, by judicious use of barnyard manure and fertilizers, make the very highest grades on old lands, though all admit that freshly cleared lands with suitable soils will yield a very fine quality. A peculiarity of some soils is that they will make a very fine yellow wrapper for a year, or two,

FIG. 103. YELLOW TOBACCO (bright type) MECKLENBURG COUNTY, VIRGINIA.

but never afterwards, however much they may be coaxed. This, doubtless, grows out of an increased density, or compactness, of the soil. There seems everywhere to be a reciprocal relation between the color of the soil and the color of the cured product, for no case is reported in which a tobacco, having an orange, or lemon yellow color, has been grown, except on light colored, porous soils. Even the darkening of the color of the soil, by the application of too much stable manure, will change the product from a bright yellow to a mahogany, or mottled leaf.

This must be said, however, of the yellow tobacco product of nearly every region, except that grown on the very poor soils of Virginia, North and South Carolina, that it will blacken under pressure, while the typical yellow wrapper, grown on suitable soils in the last named States, will remain as bright and as stainless under the great pressure of the manufacturer's screw as if made of gold-foil. The poorer the soil upon which the tobacco is grown, the better it will bear this test, and this, to a great extent, is the test of merit and value.

Typical Soils for Yellow Leaf.—In the Champaign or Eastern district of North Carolina, where yellow tobacco is now grown, embracing the counties of Edgecombe, Wilson, Nash, Pitt, Greene, Duplin, Jones, Lenoir, Northampton, Wayne, Warren, Franklin, Johnston, Wake, Sampson and Halifax, the formation consists largely of uncompacted, loose strata of sand, and sandy and gravelly clays, generally resting upon marly beds of half-decomposed shells, a few feet below the surface. These marly beds often come to the surface along the bluffs, or in the bottoms of the stream beds. The country is generally level, or slightly undulating, except where the streams have carved out channels through the spongy strata. The soil is grayish in color, though when first cleared the surface soil has a darkish hue, derived from the presence of vegetable matter. It, however, soons becomes gray when intermixed by cultivation with the subsoil, which is usually yellow, sometimes gray, occasionally red, or brown; in contexture it is a clayey sand, though in certain areas clay predominates and it becomes a sandy clay. The timber growth is long and short leaf pines, with a subordinate growth of oaks of several kinds and hickory, and an underbrush of gum, dogwood, huckleberry, honeysuckle and trailing vines. Oaks predominate on clayey, and pines on sandy soils.

The soils in the Champaign or Tidewater districts of Virginia, North Carolina and South Carolina, suited to the growth of bright, yellow tobacco, have an open, sandy texture and light gray color, with a yellow, clayey, or sandy subsoil, well drained, naturally supporting such tree growth as has been mentioned. These are not considered fertile soils. Indeed, a crop of ten bushels of corn, without fertilization, or 300 pounds of seed cotton, to the acre is a fair yield for them. They are all drift or transported soils, made up of decomposed, or comminuted rocks of the midland district, that have been brought down and ground up, leached, sifted and sorted. The oxides of iron and clay in finer particles have been carried out to the ocean in rapid, glacial currents, leaving behind the heavier and coarser, sandy material. This gives the essential conditions that determine their fitness for the production of yellow tobacco,—warmth and thorough drainage, aided by the negative conditions of the absence of iron, humus and an excess of clay.

The late Professor Kerr, from whose careful observations many of these facts are drawn, asserted that the early ripening of the plant was a notable peculiarity of the growth of tobacco in the Champaign district. The yellow hue, which indicates maturity, anticipates the beginning of August, and sometimes the harvesting begins the first week in July, and the crop is gathered and cured before the first cuttings are made in the more westerly districts. This is regarded as an advantage, as it lessens the liability of damage from worms and droughts, or from excessive rains. Professor Kerr was of the opinion that at least one-half of the cotton area of the Champaign districts in the States of Virginia and North Carolina is adapted to the growth of yellow tobacco.

The Midland district of North Carolina and Virginia, lying to the west of the Champaign districts, is where the industry originated, and where the product reached its highest perfection and won its most brilliant triumphs. In North Carolina, the counties in the Midland district best known for producing this tobacco are Caswell, Person, Granville, Vance, Orange, Durham, Alamance, Guilford, Rockingham, Stokes, Forsyth and Surry. Two counties in Virginia, Halifax and Pittsylvania, have also won a well-merited distinction for growing yellow tobacco.

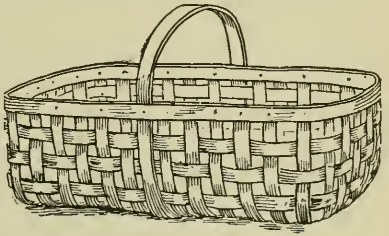

FIG. 104. BASKET FOR CARRYING PLANTS.

All this region is hilly, often rough, having numerous rivers, fed by hundreds of tributaries, cutting down through the soft, crumbling strata to a depth varying from 50 to 200 feet below the summits of the ridges that separate the streams. A very small portion of the soil of this entire district is adapted to the growth of yellow tobacco. The best tobacco lands are found on the tops of the ridges, where there is a gray, sandy or gravelly soil, with a cream-colored subsoil of a sandy material. The favorable indications and conditions that promise success are good drainage, an open texture of the soil, a freedom from the oxides of iron, a forest growth of stunted oaks, "bald face Spanish oaks," white oaks and post oaks—with old field pines, chinquapin, huckleberry, dogwood, scrub, hickory, persimmon, sourwood and other natural growth, such as broom sedge, poverty grass and small green briers, that betray a lean or impoverished soil. All these are the vegetable flags of sterility, and the forerunners of success for the yellow tobacco grower in that district.

Such places are called by the inhabitants "pea ridges," "chinquapin ridges" and "huckleberry ridges." Wheat, oats, or corn planted upon such soil will rarely reproduce the seed. All the soils in the Midland districts are sedentary, with the exception of the triassic and alluvial, that is, they have been formed by the crumbling down of the underlying rocks, and the constituent elements of the rocks are for the most part identical with those of the resulting soils. Where the trap rocks come to the surface, the soils are reddish in color, due to the presence of the oxides of iron. Such soils are fatal to the growth of yellow tobacco.

So controlling is the character of the soil, that one part of a farm may produce the very finest grades of tobacco found in the market, and another part will grow the commonest article. The writer examined a large tobacco farm in Granville county upon which the very highest priced tobacco was produced. On one part of the farm only, and that the most sterile, was any attempt made to produce the yellow tobacco. Where the soil was derived from the gneisses, quartzites, light colored feldspathic rocks and dove-colored slates, tobacco in its highest perfection and greatest beauty was grown, but no grain, no vegetables, no fruits. Where the soil was the result of the decomposition of the trappoid rocks, and reddish in color, wheat, rye, corn and potatoes were grown, with generous yields, but no tobacco was planted, except for the purpose of growing a heavy shipping leaf.

An analysis of the tobacco soil taken from this farm shows organic and vegetable matter, 1.205; silicic anhydride, 93.50; ferric oxide, 0.2675; alumina, 2.496; manganous oxide, 0.0417: lime, 0.233; magnesia, 0.0847; potash, 0.5045; soda, 0.2892; phosphoric anhydride, 0.0379; sulphuric anhydride 0.0140. The soil geologically comes from the oldest known geological formation, the Archean. The field from which the sample of soil was taken for analysis had been used for tobacco six years in succession, but was previously an "old field" that had been exhausted by cultivation and had been allowed to lie untilled for some fourteen years previous to being used for tobacco. It is possible that the very small amount of organic and volatile matter reported was due to the application of small quantities of stable manure every year. Practically, this so-called soil is nothing but a porous sponge of sandy material, destitute almost of every element that supports vegetable life.

PREPARATION OF THE LAND.

The light grayish, sandy soil, with a yellowish, clayey or sandy subsoil, being selected, preference is given in nearly all the yellow-tobacco-growing districts to new lands, or rather to old fields that have grown up in pines and chinquapin bushes and cleared a second time. In Granville county, North Carolina, in the South Carolina tobacco districts, and in Halifax county, Virginia, the best farmers, however, prefer old lands, upon which some grain or grass crop had been grown the previous year. The rotation with tobacco in the South Carolina and in the Champaign district of North

Carolina, is cow peas, clover, or grass, tobacco being put on the same land every third year. Tobacco is often put in after an oat crop and also after hog weeds. It seems to be a conclusion, reached after much experimentation, that pine, or wheat straw, or coarse mold from the forest, plowed under in the fall, will cause tobacco to ripen yellow on the hill. Old land makes the heaviest product; new land the brightest tobacco.

If old land is selected, it is broken in the fall with a two-horse turning plow and rebroken with a single plow in the spring, often applying all the manure that can be raked up about the farmyard. This second plowing should only be half as deep as the first. In South Carolina, where very handsome yellow tobacco is now produced, the practice, after breaking in the fall, is

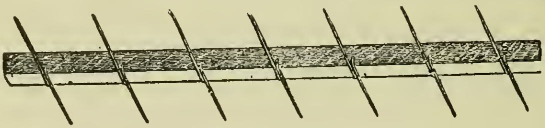

FIG. 105. HANGER FOR LEAVES IN SNOW BARN.

to lay off the ground in January, or early in February, in rows three feet six inches in width, and then distribute the manure in these rows, covering it lightly. About the middle of April run a furrow in the same place where the manure was distributed, and drill from 600 to 800 pounds of some good fertilizer to the acre. Throw two furrows on this open row. When the time for setting the tobacco arrives, drag the beds down with a log and pat places 30 inches apart where the plants are to be set.

In North Carolina, just before the plants are large enough to set out, the land is either rebroken and harrowed, or plowed with cultivators, and then harrowed until it becomes well pulverized. After this it is laid off into rows three and one-quarter, or three and one-half, feet apart, and in these rows about 75 bushels of stable manure, and from 200 to 800 pounds of some good commercial fertilizers, are distributed per acre. The fertilizers used are highly ammoniated guano, or superphosphates of lime, containing about eight per cent of phosphoric acid, three per cent of ammonia, and three per cent of potash. It is believed that too much potash will cause small, white specks ("frog eye") to appear on the leaves. Upon this fertilized row two furrows are thrown, making a ridge. Over this ridge a drag is run, leveling it down to the general level of the surface of the ground. Shallow rows are run at right angles to these decapitated ridges, and the land is ready for planting. In East Tennessee, the rows are run off from three to three and one-half feet, and the hills made from 18 inches to three feet in the row. The hills align only one way and are made over the fertilizers dropped in the row. In parts of Virginia, the practice is to throw four furrows instead of two on the fertilized row. This wide bed is then cut off and patted at intervals of two feet ten inches, the patted spots indicating the places for setting the plants. Tobacco set out with the plants aligning only in one direction can be plowed in one way only.

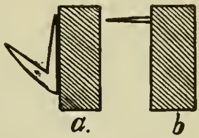

FIG. 106.
HOOKS ON LATH.

The planting and cultivation of the crop and the worming and suckering are done in the same manner, or with but little variation, that has already been described in the chapter on heavy shipping tobacco. In South Carolina, the planting begins about the 10th of April, in North Carolina and Virginia, from the 1st of May to the 10th, and the season continues until the 10th of June. In some parts of East Tennessee, notably Hamblen county, tobacco planted on new lands is not plowed in cultivating it, but simply hoed twice.

The last time a little dirt is pulled up to the plants. The number of leaves left in topping the plant is sometimes greater. Hardy, vigorous plants are topped very often to 14 leaves, but the general practice is to leave 10 or 12, the first topping, and diminish the number in subsequent toppings. A larger number of leaves is usually left where harvesting is done by picking off the leaves. Before topping, the lower leaves are taken off. They form a hiding place for the horn worm during the heat of the day.

HARVESTING OF YELLOW TOBACCO.

From two to four weeks in the Champaign districts, and from three to five weeks in the Piedmont districts, and from six to eight weeks in the mountainous districts, after the plants have been topped, the harvesting begins. Usually in the Champaign districts the first ripening of plants takes place about the 25th of July, while it is two or four weeks later in the Piedmont and mountainous districts. In all the yellow tobacco region two methods are employed in harvesting the crop. One is to strip the leaves from the plant as they ripen, and the other is to cut the whole plant, as in the heavy shipping districts. The first method is growing in popularity, and is almost universally employed in the new districts, where habit has not sanctioned and fixed the second method, that is, of cutting the entire plant. The new tobacco districts are more open to improvements than the old. Many intelligent growers, who use both methods, say that much better "cures" are made when the leaves are successively stripped from the stalk. Other planters, equally as intelligent, say that the tobacco lacks oil when so cured. When the stripping method is employed, the leaves, as they ripen, are pulled from the stalk, put in baskets (Fig. 104), or tied in a cloth, and sometimes taken directly from the strippers to a wagon and carried to the barn, where they are strung upon sticks, either with wire or twine. Others carry them to a brush harbor, which protects them from the sun, and where they are strung on sticks before being taken to the curing house.

Mr. John Sims, of Halifax county, Virginia, who is an old and successful tobacco grower, writes that there are several patents for stringing with wire. One of these consists of a stick four and a half feet long, with several wires twisted around at intervals of about eight inches. These wires extend out in opposite directions, about five inches perpendicular to the stick, Fig. 105. On each of these projections four or five leaves of tobacco are strung, by piercing the thick part of the stem with the wire. Each stick will hold from 60 to 70 leaves. Another patent has simply the wire bent in the middle so as to hug the stick. These wires, after they are filled with leaves, are slipped over the stick. We doubt the validity of these patents, as similar devices (Fig. 106) were used in the Connecticut valley long before these patents were taken out. The objection to the use of both of these appliances is that they are expensive, and that the tobacco cannot be bulked down while remaining on the sticks, which is often necessary, and it is also frequently necessary to hang it up on the tier poles again for reordering.

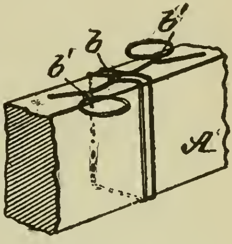

FIG. 107.
DRAW TWIST FOR TYING LEAVES TO POLES.

Mr. Sims says: "The easiest, cheapest and most convenient way is to use ordinary twine, or cotton strings large enough for bag strings. Cut off a piece about twice as long as a tobacco stick, and loop the middle of the string over the center of the stick. Place one end of the stick against the wall of the barn, and the other end against the stomach, so as to have the use of both hands. With one end of the string in the right hand, have a boy to hand three leaves at a time. Grasp these in the left hand and place them close to the stick, then wrap the string from you around the leaves, one half an inch from the ends of the stems, then turn the leaves completely over and across the stick, thus forming a draw twist (Fig. 107), which will never come off. The next three leaves are thrown over on the other side of the stick, and thus each trio of leaves is thrown alternately on one side and the other. Nine or ten bunches will fill half the stick (Fig. 108), and the string is fastened by drawing it through a sloping cut in the stick made from the person. The stick is then turned, and the other end filled in like manner." Tobacco tied with strings can be easily taken down and put in "coops," or hung in a pit to order for stripping.

It is claimed that this twist is covered by a valid patent. This method has long been in use in the Connecticut valley, where the whole plant, instead of a bundle of leaves, is tied upon the poles with string. Some still persist in twisting the string between the plant and the stick, but most growers long since gave up that twist as wholly unnecessary. The quickest way is good enough if the string is kept taut: Fix the string to a nail or slit in the end of the pole, pass it around the further side of the first plant, thence across to the next plant or bundle, the same as shown in pictures, without bothering with the twist at all.

Mr. J. B. Smith, of Milton, N. C., a strong advocate of the new method of housing tobacco by stripping the leaves from the stalk, says that the most important advantages of the new process over the old are:

1. The planter can begin to house his crop from two to four weeks earlier. 2. Everything is saved, and there is no loss by "firing on the hill." 3. As the

lower leaves are pulled off, those left on the stalk ripen up and yellow more rapidly, which enables the planter to get in his crop earlier in the season. 4. Tobacco can be cured a more uniform color. 5. Less fuel will be required. 6. The risk of setting fire to the barn will be greatly lessened. 7. The tobacco can be stored in a much smaller space, and with no danger of losing color, or of mold. 8. By this process enough leaves, which are lost by the old process, will be saved to pay for the fertilizer necessary to grow the crop, also to pay for all extra labor needed in housing the same. 9. It will help to solve the problem of overproduction, by grading up the tobacco in our section so as to place us above the competition of those sections which grow low grades of tobacco, which in the past few years has proved so detrimental to our pockets.

When the whole stalk is cut, in harvesting, it is not put upon the ground to wilt, as is done in the heavy

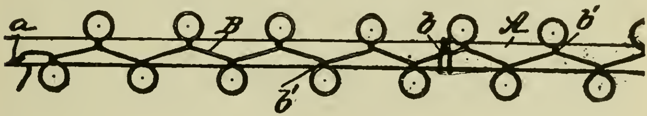

FIG. 108. POLE WITH "HANDS" OF LEAVES TIED ON EITHER SIDE.

tobacco districts. Two men cut, while another person holds a stick convenient for them to straddle each plant over it as it is severed from the ground. The stick, when it has six or seven plants on it, is taken to a wagon and either cooped or hung in a frame made for hauling green tobacco. Or it may be hauled on a sled, as seen in Fig. 109. When the tobacco is loaded, it is taken to the barn and arranged on tiers from eight inches to a foot apart.

There is no question that this is a much neater and safer plan for housing tobacco than that employed in the other tobacco districts, where it is put upon the ground to wilt, but the method practiced in the yellow tobacco districts could not be employed where the plants are very large and very heavy without the greatest injury from breaking and bruising the leaves. The ripened plants of yellow tobacco are small, with delicate midrib, and may, with a little care, be handled with safety without being wilted. The dangers to be apprehended from sunburn, rains, dirt, and bruising from handling, are all lessened by putting the plants on the sticks as they are cut.

MANAGEMENT OF YELLOW TOBACCO AFTER CURING.

Curing yellow tobacco has been described in Chapter X. Generally the following morning, after the fires under the tobacco have died out, if the doors are left open, the plants will be sufficiently limp to be handled without breaking. But should there not be enough humidity in the atmosphere to make the plants supple, wet straw should be scattered over the floor of the barn, and the doors shut so as to exclude the dry atmosphere. In 24 hours the tobacco will be in such order that it may be handled without damage. This result may be hastened by building small fires in the furnaces, and placing vessels containing water over the flues. When in order, the tobacco is "cooped" down on a platform, without removing it from the sticks, with the butts out and the tails lapping. The best way is to make a shingle pile of six or eight sticks, and then shingle backwards and forwards, in this way building up a pile five or six feet high and eight or ten feet long. Staying in such a pile greatly improves the color, and makes the leaves smooth and neat in appearance. The leaves should be soft and the stems hard half way from the butts to the tails, when the tobacco is taken down. It must be borne in mind, that any green stalks or stems will prove highly injurious to the tobacco so bulked down. When the leaves have been stripped from the stalk in housing, they are taken down in the same manner, but the condition of the stems must be carefully inspected.

The best planters now have, under their assorting and stripping rooms, a cellar six or eight feet deep, with tier poles put in, upon which the tobacco may be hung

FIG. 109. HARVESTING YELLOW TOBACCO.
These plants were strung on sticks in field and drawn to barn on sled. Flues with return pipes shown in front of barn. Coffee county, Central Tennessee.

to bring it into any order that may be required. Such a cellar makes one independent of the weather, and permits the work to go on at all times.

The assorting of yellow tobacco requires a strong light and a discriminating eye for colors on the part of the assorter. From six to fifteen grades are made by the planters. In fact, the prices depend, in a large measure, upon proper grading.

Bright wrappers are sometimes classified into three or more grades, as orange, lemon and mahogany; lugs into two or more grades, as sand and smooth lugs. Sometimes a third grade is made, called wrapping lugs. When the grade between the wrappers and lugs is of good body, and sweet, it is called fillers. When it is thin or light bodied, it is called cutters. These two classes, or grades, are sometimes interchangeable. The smokers are good bright lugs, or worm-eaten leaves of bright color. The highest grade of the yellow tobacco, and that which commands the best prices, has a large leaf of a bright lemon color, with yellow fibers, of good body, with silky texture, tough, elastic, oily, with no holes or spots or ragged edges. It is not unusual for this grade to bring 40 to 65 cents per pound. From this grade are made "extra wrappers." Orange-yellow perfect leaves command the next highest prices, then the mahogany wrapper. Clear yellow trash, or lugs greatly torn, will bring more money than perfect leaves that have a dull, greenish appearance. In fact, to avoid curing a crop green is the greatest ambition of the yellow-tobacco grower, and his success depends largely upon his ability to reduce the greenish-tinged tobacco to the minimum. Thin, papery tobacco, brittle, inelastic, easily torn and destitute of oil, will not bring a good price, however good the color may be.

The classification, as adopted in the Danville, Va., market, probably the largest yellow-tobacco market in the world, is as follows:

Wrappers.—The picked leaves, finest and brightest and most perfect leaves on the stalk. This grade will make one-sixth of the crop.

Fillers.—This is every grade except smokers, wrappers and cutters, and constitutes about one-half the crop.

Smokers.—Generally the lug leaves, which are the bottom leaves, and torn, worm-eaten or bruised leaves; in the aggregate making one-sixth of the crop.

Cutters.—Inferior to the wrappers, and superior to the smokers, deficient in color to wrappers, but more perfect leaves and heavier in body than smokers. These constitute one-sixth of the crop sold.

The description of the sub-grades is as follows:

Wrappers.—1. Common wrappers: Lowest grade of wrapper, and only a grade above a bright filler. 2. Medium wrapper: Not uniform in color, dingy, or piebald, but of good form and quality. 3. Good wrapper: Tobacco of heavy body, orange color, generally styled mahogany. 4. Fine wrapper: Second grade of lemon color, but inferior to the fancy. 5. Fancy wrapper: Fine, delicate fiber, silky, fresh lemon color, very leafy, perfect leaves, and the highest class made in assorting.

Fillers.—1. Common: All of the inferior and nondescript grades. 2. Medium: Good, rich lugs, and the dark leaves with good body. 3. Good: Tips, and the better and brighter heavy lugs and short leaves with body. 4. Fine: All the brightest, best and richest leaves next below common wrapper, and generally of a gray and cherry-red color.

Smokers.—1. Lowest grade: Worm-eaten and discolored. 2. Brown and short leaves. 3. Grade above four, and not so colory. 4. Best smooth lugs, which make the highest class of smokers.

Cutters.—1. Thin, papery leaves, thrown out from fine fillers when assorting; lowest grade. 2. Same grade as three, but not so colory. 3. Fine cutters, leafy and inferior leaves taken from stalk that produced the best wrappers.

CHAPTER XVI.

PERIQUE TOBACCO.

Of all the product of the tobacco plant in America, the Perique—its culture, curing and preparation for market—is the most interesting; not on account of the quantity produced, or of its importance to commerce, but because of the peculiarity of the people by whom it is grown, and the singular method by which it is cured. Its culture is confined to a very limited area in Louisiana, and to a class of people whose history is full of suffering and pathos—the Arcadians.

One of their number, Pierre Chenet, introduced the cultivation of tobacco and taught his countrymen how to prepare it for market, by making tightly wrapped rolls, called carottes, that could be carried to market and handled with ease. In his honor, the tobacco so prepared was called Perique. For nearly 100 years this tobacco has been grown in St. James Parish, with but little variation as to quantity, except when calamity visits the people. In 1859 the product of the Parish was 22,000 pounds, in 1869 it was reduced to 3450 pounds, by reason of political troubles. In 1879 it rose to 14,680 pounds, and in 1889 the quantity produced was almost identical with that of 1859, being 22,360 pounds.

There are two places in St. James Parish where Perique tobacco is grown. One of the points lies immediately on the left bank of the Mississippi river, the post village Convent being about the longitudinal center. The other is on the same side of the river at Grande

Pointe, which is three miles from the river, and occupies an insular position beyond the swamps, which here run parallel with the course of the river.

These spots are elevated only a few feet above the encompassing swamps, but they are well drained and have friable, sandy and calcareous soils, black, deep and exceedingly fertile. Soil here, as well as everywhere, has a controlling influence on the quality of the product. The soils on the river bank at Convent are a gray alluvium, and the tobacco is brighter in color, but comparatively destitute of gummy matter, and, therefore, not so well adapted to the manufacture of Perique as that grown in black soils in the Vacheries, where the tobacco is fine, but gummy, elastic and of good body. The best soils are those known as magnolia soils, which are dark in color, but made friable by a suitable admixture of sand. They are warm and well drained. Black lands mixed with yellow sands are the next in order of preference. Where the lands are lacking in the sandy material they compact so closely that the tobacco plant does not grow in healthful vigor.

The variety planted is called the Perique, which has a leaf of medium size, is a rapid grower, small stem, and fiber tough and gummy, curing to a dark brown color. Its rapidity of growth is probably due to the warm situation and fertile soils on which it is produced.

The making of seed beds is unlike the same work in other States. It begins in October. Cow manure at that time is applied to the depth of six inches to a chosen spot in the forest, and turned under with a spade. In December the bed is reworked, but not burned, and ditches are cut through it to secure drainage. The seed is sown the first of January, and the bed is then covered with palmetto leaves, as a safeguard against the frosts of February.

The land is broken to the depth of six or eight inches in January when it is dry enough to be worked. If plowed too wet, and hot suns supervene, the land becomes as hard as a sun-dried brick. Another plowing is given to the soil about the middle of February, when furrows are run from four to five feet apart and beds thrown on these. Towards the end of February a rake is run over the beds, or ridges, giving each a wide, level top. Other beds are then thrown on top of the original beds with a one-horse plow, and the top of the new bed raked off with a hand rake. The plants are then set

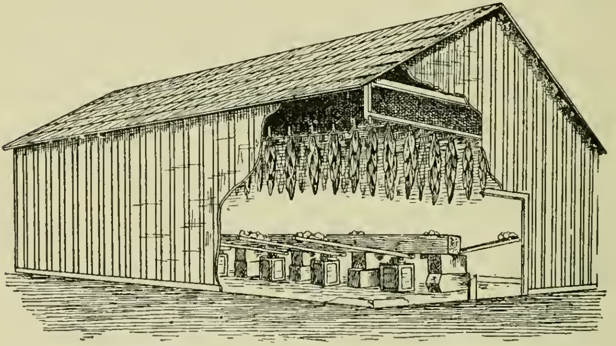

FIG. 110. CURING PERIQUE TOBACCO.

out three feet apart on the beds, usually upon the heel of a good shower, but frequently the plants are set in dry weather and watered every evening for several days. The main planting takes place about the last week in February, or the first week in March. The cultivation is all done one way.

The crop is cultivated in much the same manner as in other tobacco growing sections, the main purpose being to keep the land loose and to destroy all weeds and grasses that spring up. Topping is done about the 15th of May, without priming the plant. Early in the season, from 12 to 18 leaves are left on each plant, fewer as the season advances. There is no essential difference in the manner of suckering and worming the crop between the growers of Perique and the growers of other types.

Harvesting begins about the last of June, and it is deemed highly important that the cutting of the plant should be preceded by copious dews, that appear to give a great activity to the secreting organs in storing up the rich juices and gums in the vesicular system that give flavor and strength to the cured product. The plants, without having the stalks split, are cut with a hatchet during the hottest part of the day, about three inches above the ground, leaving two or three leaves bespattered with dirt on the stump. Hands stand ready to take the tobacco to a shed as fast as it is cut. No tobacco sticks are used. Small pieces of cane are sharpened and one is driven into each plant of tobacco near the end where it was severed, giving the cane such an angle with the stalk as to form a hook. The plants are suspended by these hooks upon ropes stretched one foot apart longitudinally in the shed, as shown in Fig. 110. As the plants wilt, they are pushed up closer together. No artificial heat is used in curing.

As rapidly as the leafy part of the leaves become embrowned, without waiting for the midrib to be cured, the plants are taken down from the ropes and the leaves pulled from the stalk. The first leaves are taken off in about ten days after the tobacco is put in the shed. After this two or three leaves are taken from the stalk, at intervals of a few days, until the stalk is bare. The stem or midrib, often green, is taken out immediately after the leaves are pulled from the stalk, and these "strips," or half-leaves, are made into loose twists, some 15 or 20 leaves being put together. A dozen, or more, of these twists are packed in a box 11 inches square, with a capacity of holding 50 pounds.

When the box has been filled nearly to the top, it is put under a lever press, the lever being about 12 feet long, to the ends of which heavy weights are attached so as to bring a pressure of about 7000 pounds upon the tobacco in the box. After the tobacco has been under this continual pressure for 24 hours, it is taken out and the twists are opened, shaken and exposed to the air for a short time until the exuded juices are reabsorbed. These juices resemble thin tar, being black, thick and ropy. After this curing, the twists are again put under pressure for 24 hours, and then aired for a second time. This process continues with each box of tobacco for 10 days in succession, and then the manipulation is less frequent, once in every three or four days being deemed sufficient. When the tobacco, at the expiration of some three months, is fully cured in its own juices, it diffuses a rich, spirituous, aromatic odor, exceedingly agreeable, the results of the aeration and absorption of its own juices. From a light brown, the tobacco has gradually grown darker, until, at the close of the process, it shines in oily and lustrous blackness.

The Perique tobacco is cured and preserved by the resinous and fatty substances, and the alkaloids and acids contained in the natural leaf. The pressure of a screw will not answer the purpose, for in that case the juices would be gradually reabsorbed without being aerated. It is important that there be a continuity of pressure, so as to keep the juices pressed from the leaf. Dr. Gideon E. Moore, who spent much time in investigating for the government the changes that take place in the tobacco plant by different methods of curing, says:

"In the case of Perique tobacco, 'cured in its juices,' we have manifestly an instance of a conversion of a large portion of both the citric and the malic acids into acetic and butyric acid, and the agreeable, fruity odor which this tobacco acquires during the fermentation, while partly due to these acids, would indicate the presence of substances similar to the volatile oil obtained by Liebig, during the fermentation of malic acid. The Perique tobacco," he says, "contains but little over one-fourth of the citric acid, but one-half of the nitric acid, and about six times the amount of acetic acid contained in the air-cured-leaf." There was a total absence of nitric acid in the Perique cured in its juices, but it was present in the air-cured sample.

The robe, or wrapper, leaves are the highest grade of product. They constitute 10 per cent of the usual crop. The next grade is good leaf, which forms the fillers for chewing tobacco. This grade usually forms one-half the crop. Smokers, or the lowest grade, are made of the lower leaves of the plant, and constitute 40

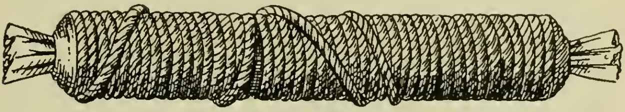

FIG. 111. CAROTTE OF PERIQUE TOBACCO.

per cent of the crop ordinarily. All these grades are kept in separate twists.

After the tobacco has been properly assorted and cured, it is put into cylindrical rolls called carottes, each carotte usually containing four pounds of tobacco, but sometimes carottes weighing one pound are put up for local demand. To put up a carotte, the tobacco is taken from under pressure, each leaf opened, straightened and aired. A cotton cloth, 24x18 inches, is laid upon a table and covered with robe or wrapper leaves, the under surface of the leaf being turned uppermost. The fibers of the leaves are so arranged as to point to the middle longitudinal line of the cloth. A layer of filler leaves, one-half inch in thickness, is placed on the wrapper leaves, extending to within one inch of the edge of the cloth. Over this layer of leaves a second cloth is placed and the tobacco tramped. The layer of tobacco then is doubled over at each end about three inches and tramped again. The entire mass—cloth, wrappers and fillers—is then rolled into a cylinder fifteen inches long and three inches in diameter, a hole being kept through the center, making a tube, into which the ends of the wrapper leaves are tucked. The ends of the cloth are then tied with strings, and a rope, one-third of an inch in diameter, is wound tightly into a coil around the roll from end to end, by the use of a windlass made for the purpose. The rope is removed from the roll at the end of 24 hours, and then rewound more tightly. The carotte is then ready for market. A day's work for a man, assisted by a boy, is 10 carottes a day.

These carottes are usually put up during the winter months, and this work employs every member of the household in taking the twists from the presses and opening them, straightening and weighing the tobacco, before putting it into carottes. The tobacco often remains under pressure for twelve months, and it is said to grow sweeter and better with time. As there is a demand for it, the tobacco is put into carottes. The carottes form a species of currency with the local merchants, and they are always taken in exchange for goods, or received in payment of debts.

Though the production is small, it has established a character throughout two continents for its rare qualities. It is unlike any other tobacco grown, in taste and flavor, and those who use it claim that it has more aroma than any other type; that it is free from the acrid, biting, creosotic taste so common in other Southern-grown tobaccos; that it has a rich, fragrant odor, with a smooth, delicate and agreeable taste, and that it stimulates the action of the brain without impairing the organs of digestion, or affecting the nervous system.

PART III.

CIGAR LEAF TOBACCOS.

FIG. 112. HAVANA SEEDLEAF TOBACCO—CONNECTICUT VALLEY.

Grown by W. W. Sanderson, South Deerfield, Mass., in 1896. On 1200 pounds per acre of cottonseed meal and 1200 pounds of Stockbridge special tobacco manure (made by the Bowker Fertilizer Co., Boston and New York), the nine acres average one ton of fine leaf per acre that has for years commanded the highest prices.

CHAPTER XVII.

GENERAL CONSIDERATIONS OF CIGAR LEAF.

The most difficult kind of tobacco to produce in perfection, is the leaf used in the manufacture of cigars of the finest quality. Until the advent of wrappers imported from the island of Sumatra, the most popular cigar in the United States was one made with Havana fillers (grown in Cuba), bound with Connecticut binders, and wrapped with the finest selections of Connecticut broadleaf or Connecticut-valley-grown Havana seedleaf. Selections from the cigar-leaf tobacco grown in the Onondaga and Chemung valleys of Central New York, Lancaster and Bucks counties, Pa., the Miami valley of Ohio, and Dane and Rock counties in Wisconsin, have also been used in the place of, or in addition to, Connecticut leaf. In some years the crop, in some one or two of these sections, may be superior to that grown in other parts of the cigar-leaf States. Inferior cigar-leaf tobaccos are largely used in making the cheaper grades of smokers, stogies, etc. Some years part of the crop is so poor in quality as to be unsuitable even for this purpose. In that event, it is usually sold for export to Germany, and used in manufacturing the low grade smoking tobaccos and so-called cigars common in the low countries of Europe.

Since the advent of Sumatran wrappers, the industry has been considerably depressed, because the use of Sumatran wrappers displaced great quantities of domestic leaf. This Sumatran leaf is no better in appearance than the best American wrappers, and is destitute of quality or aroma, but is used because it is so light and thin that but two pounds of it are required to wrap 1000 cigars, whereas four to ten pounds of American leaf are needed to cover that number of cigars, owing to the heavier weight of domestic wrappers, which, however, are superior in other respects. This Sumatran leaf got its foothold in the American market by the grossest customs frauds. The tariff of 1883 imposed a duty of 75 cents per pound on leaf suitable for cigar wrappers, but this was avoided by importing Sumatran leaf as fillers at only 35 cents per pound. Government was thus swindled out of millions of revenue, while at the same time domestic leaf was driven out of the home market. In the tariff of 1890, the duty was raised to two dollars per pound on leaf suitable for wrappers, being left at 35 cents on fillers. In anticipation of higher rates, however, nearly two years' supply of Sumatran leaf was imported before the latter went into effect, and has since continued on a large scale, as the following table shows:

Table V.—IMPORTS OF LEAF TOBACCO INTO THE UNITED STATES.
(In millions of pounds and dollars.)

YRS. ENDED	From Cuba		From Sumatra		Oth Countries		Total Imports	
June 30.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value	Lbs.	Value.
1880,	9.3	4.7			0.5	0.2	9.7	4.9
1885,	9.7	3.9	2.2	1.9	0.9	0.5	12.9	6.3
1886,	10.9	4.1	4.0	3.4	0.8	0.4	15.7	7.8
1887,	11.8	4.4	4.2	3.6	1.5	0.7	17.5	8.7
1888,	11.5	4.6	5.9	5.6	1.2	0.6	18.6	10.9
1889,	13.4	5.7	5.0	4.3	1.6	0.8	20.1	10.9
1890,	16.9	7.1	9.7	9.0	2.1	1.5	28.7	17.6
1891,	16.1	7.1	4.9	4.7	2.1	1.5	23.1	13.3
1892,	18.4	8.0	2.7	1.9	0.9	0.4	22.0	10.3
1893,	21.7	8.9	5.4	5.1	1.0	0.7	28.1	14.7
1894,	14.6	5.8	3.9	4.5	1.2	0.6	19.7	11.0
1895,	19.7	7.2	5.1	6.7	1.8	0.9	26.7	14.7
1896,	26.5	10.5	4.3	4.7	2.1	1.3	32.9	16.5
Total '85-'96	191.2	77.3	57.3	55.4	17.2	9.9	266.0	142.7

In explanation of this table, it should be said that practically all the leaf imported from Sumatra (the bulk of which comes via Amsterdam) is suitable for cigar wrappers, while only a small fraction of the Cuban leaf is used for this purpose, say 15 to 30 per cent. The leaf imported from other countries is mainly fillers. There is no longer doubt but that the United States can produce an abundance of both fillers and wrappers, and it is not surprising that American farmers should insist upon having the American market for all grades of cigar leaf. It will be seen that during the 12 years for which statistics are given, nearly $150,000,000 has been paid out for this imported leaf. More than one-third of this has been for Sumatran wrappers, which displace the American product. Since 1885, the average importation of this Sumatran intruder has been 4,775,000 pounds annually. As only about two pounds of it are required to wrap 1000 cigars, the supply has been sufficient to cover an average of over 2300 million cigars annually, or more than half the average production of cigars in the United States. The wonder is, that our domestic cigar wrapper leaf industry has stood up so well under such terrific and unfair competition.

It is now evident, however, that higher duties on wrapper leaf are likely to prevail for years to come. Meanwhile, there is a more confident feeling among growers in the future of the cigar-leaf industry, the more so because of the immense development of cigar manufacture and consumption, as set forth in Chapter II. But the marvelous profits of the Sumatran tobacco syndicates have directed the attention of other countries to the possibilities of growing tobacco for cigar purposes. Borneo, Manilla and other Eastern islands are experimenting extensively and intelligently, while Mexico, Central America and certain sections of South America are giving more attention to the same industry. In Mexico, quite a boom in cigar-leaf tobacco culture has been developed during the past few years, and some of the Mexican leaf is of promising quality, in spite of the crude conditions under which it is grown. We may see quite a development of cigar-leaf culture in the Hawaiian islands also.

The famous Havana tobacco of Cuba will probably be produced on a much larger scale, and of even finer quality, when a stable government has been established in that island, that will encourage enterprise and thrift. The attractive qualities of the best grades of Havana leaf, especially from Vuelta de Abajo, are due more to the peculiar climate and soil of that region than to methods of culture. These are still crude in the extreme, owing to the natural indolence of the Creole planters. The best lands are flooded during the rainy season, and when the waters recede, a deposit of rich alluvium is left, but the rainfall is so uncertain, and irrigation not being practiced, that only one extra-prime crop can be counted on every five years, although one or two medium good crops may be obtained in the interval. Even where efforts have been made to produce larger crops by the use of manures or fertilizers, the work has not been done with judgment, and in some instances the burn and other qualities have been injuriously affected, —not so much because of the plant food, as of the ignorance in its use. It is very evident that the quantity of leaf produced on the island of Cuba can be enormously extended, and probably its quality improved, by the application of intelligence, brains and energy. This fact must also be borne in mind, in considering the future of the cigar-leaf crop of the United States.

On the island of Sumatra, however, cigar-wrapper tobacco culture has been reduced to a science, being controlled mainly by a few Dutch syndicates. Latterly, however, these people have tried to "kill the goose that lays the golden egg," by forcing a large yield through improper fertilization, not realizing the judgment that must be employed in artificially feeding this delicate plant. In 1895, there were 26 stock companies and 21 private plantations engaged in the industry on the east coast. The rapidity with which the industry has developed since this leaf got a foothold on the American market is shown in the accompanying table:

Table VI.—SUMATRA TOBACCO—QUANTITY AND VALUE.

Crop. Year.	Bales. 175 lbs.	Value per lb.*	Crop. Value.*	Crop. Year.	Bales. 175 lbs.	Value per lb.*	Crop. Value.*
1864,	50	17 2-5c	$1.600	1880,	64,964	40 3-4c	$4,536,000
1865,	189	54 1-5	16,000	1881,	82,356	41 3-4	5,792,000
1866,	174	41	12,000	1882,	102,050	49 3-4	8,566,000
1867,	224	25 2-5	8,000	1883,	93,530	48	7,620 000
1868,	890	51 3-5	80,000	1884,	125,264	52 3-5	10,900,000
1869,	1,381	46 4-5	100,000	1885,	124,718	51 2-5	10,720,000
1870,	3,114	44 1-5	200,000	1886,	139,512	56	13,080,000
1871,	3,922	49 4-5	300.000	1887,	144,400	43 4-5	10,560,000
1872,	6,409	47 4 5	400,000	1888,	82,284	46 2-5	14,200,000
1873,	9,238	66	1,000.000	1889,	182,241	53	16,180,000
1874,	12,895	54 2-5	1,140.000	1890,	234,062	26 1-4	10,320,000
1875,	15,355	61 4-5	1,560.000	1891,	225,629	33 2-5	12,640,000
1876,	29,030	55 1.4	2,580.000	1892,	144,689	45 3-5	10,920,000
1877,	36,520	45 3-4	2,676,000	1893,	169,520	52 2-5	15,040,000
1878,	48,550	45	3,648,000	1894,	192,767	43 1-5	14,000,000
1879,	57,553	42 1-8	4,120,000	1895,	204,347	32 2-5	11,330,000

*Values are in United States currency.

The effect of the McKinley duty of $2 per pound on wrappers, was to very largely reduce Sumatra's crop in 1892. Many acres were surrendered to the jungle, and the crop that year was almost 100,000 bales less than the production of 234,000 bales in 1890. This decrease in the supply, and the reduction in the American duty to $1.50 per pound in 1894, gave another stimulus to the industry in Sumatra, and the '95 crop reached almost as large figures as that of six years earlier.

The famous Deli Maatschappy, or Pioneer Dutch county, produces nearly one-third of the entire Sumatran crop. It signalized the closing of its first quarter-century existence by submitting an elaborate report of its operations at the extraordinary general meeting of the company at Amsterdam, in November, 1894, from which our facts are condensed. It owns 21 establishments, and now produces about 50,000 bales yearly. In 1893, it paid a dividend of 100 per cent, and the average dividends paid to its stockholders have been over 75 per cent annually since 1880. During the past 23 years it has received an average of 50 cents per pound (United States currency) for its crop. Starting with a capital of $120,000 in 1869, in 1894 its capital was $1,608,000, with a reserve fund of almost $2,000,000, besides paying the enormous dividends alluded to. In the course of 24 crop years, the company delivered to the Amsterdam market a total of 494,491 packages of tobacco, all its own product, or about 79,000,000 Amsterdam pounds, representing a value of $42,612,000, upon which a clear profit was made and paid to shareholders, of more than $11,457,000. This concern also handles the product of other plantations,—as much as 71,000 packages in one year. This is done not only for the profit arising from commissions on such sales, but to concentrate the entire Sumatra tobacco market at Amsterdam.

The plantations of this mammoth enterprise are arranged and conducted in the most businesslike and scientific manner. It employs over 16,000 workmen, and the European personnel of experts and administrators consists of 160 persons. Each of the 21 establishments has its administrator, and four or five assistants. The real office is at Medan, where is located an extensive hospital for the help, and similar hospitals are provided at other points. It has built fine roads, large canals for water drainage, railroads, and other public works.

The Deli Maatschappy's report shows that it was instrumental in organizing a combination among the planters to import coolie labor and pay it the lowest possible price. This policy involved certain features and exactions that were most reprehensible, and the result of which (in the ordinance of 1880) was to reduce the coolies to a condition of practical slavery. One Chinese coolie is employed to each one and three-fourths acres, and is paid from $1 to $8 for each 1000 tobacco plants delivered after the harvest. Japanese coolies get $6 a month, half as much for women, and board themselves; other help and foremen getting $9 to $12 per month and boarding themselves. With a plow and two pair of buffalo, about half an acre per day is plowed, after the cane brake and tropical growth has been cut away. Expert plowmen are paid $8 per month, and board themselves.

However high the tariff may be to exclude wrapper leaf from Sumatra, Mexico, or Cuba, another influence is at work that is destined to profoundly affect our domestic cigar-leaf industry. We refer to the experiments in cigar-leaf culture at the South and West and on the Pacific coast, to which a subsequent chapter is devoted. Unless all signs fail, leaf from those sections is destined to compete in the home market with crops grown in the old seedleaf States. It is too early to say whether the wrapper leaf industry will ever be driven out of the East, as the Eastern grower of wheat, broom corn, etc., has been obliged to give up these crops by Western competition.

But it is true that the demand for quality in cigar leaf is becoming more and more exacting. It is more true of cigar leaf than of manufacturing tobacco, that quality governs prices and profits. In many respects, also, cigar leaf is a more delicate plant than any of the manufacturing tobaccos—that is, its quality is more easily affected by soils, fertilizers, climate, culture and curing. Even after the crop is safely harvested, or properly cured, the cigar-leaf grower labors under another great disadvantage in having no regularly established market prices for his crop, owing to the illogical and unsystematic method of selling it, as described in Chapter XII.

The cost of producing cigar tobacco varies widely, even in the same sections. In the Connecticut valley, the most careful growers have arrived at the conclusion, that, taking one year with another, the actual cost of producing the crop ranges from 8 to 12 cents per pound, according to its quality and yield per acre. On the

FIG. 113. SWEATED WRAPPERS.

Havana seedleaf, 1895 crop, grown on Plot W, at Poquonock, with Mapes Tobacco Manure, Wrapper Brand, alone. Jenkins reports this plot as ranking second among all raised that year, with Mapes Plot V third, "although there is scarcely any perceptible difference between the first five lots of tobacco." These wrappers were used on cigars and proved the equal of any wrapper used in cigar selling at 10 to 15 cents each. This plot had received Mapes manure **only for five successive years.**

cheaper lands of Wisconsin, the cost varies from 5 to 10 cents, and may be even less in exceptional instances. Ordinarily, however, the planter considers that he is making very little profit if he gets less than 15 cents per pound through, for the entire crop, if grown in the Connecticut valley; 12 cents if grown in New York state; 10 to 14 cents if grown in Pennsylvania; 8 to 12 cents in the Miami valley, and about the latter range of values in Wisconsin.

These prices are often exceeded for prime crops in prosperous times. One-third of the Connecticut valley crop of 1892 was sold at an average of 26 cents per pound through, in the bundle on the farm, but when the presidential election, in November of that year, foreshadowed a lower tariff, prices rapidly declined, and the whole crop was moved only at 12 to 15 cents, averaging about 13 cents per pound, causing a loss of $3,200,000 to the planters of that section on that one crop. The decline in the Middle States was proportionately as serious.

Aside from these political conditions that affect the value of cigar-leaf tobacco, prices depend very much on the quality of the leaf produced, both in the United States and in other countries. Should failures occur with the Sumatran crop or in Cuba, or should these crops, in any way, prove to be of very inferior quality, these circumstances would have a stimulating effect on the value of domestic leaf. Should it so happen that only one or two States in America, the same year, produced a crop of satisfactory quality, the growers of such leaf would probably get extraordinary prices. Thus, the crop may fluctuate in value very seriously from year to year, and even from one part of the season to another. It is not always possible to tell at harvest time, or even after curing, what the quality of the leaf will be, and sometimes a crop that goes into the sweat in apparently the most promising condition, will come out of it in a very disappointing condition for cigar-making purposes. Should this prove true of any considerable proportion of the crop, it would increase the demand and prices for good crops the succeeding year. Hence, it is quite a difficult matter to follow the tobacco market closely in all its intricacies. Of course the grower should do this as well as he can, but the first and essential thing is to produce a crop of the finest possible quality.

Now this matter of quality in tobacco for cigar wrappers and binders is an undetermined thing. There are almost as many ideas about what constitutes quality as there are dealers of leaf, manufacturers of cigars, or smokers. At the present time, and for several years past, qualities upon which all are agreed as desirable are: A leaf of light color, free from spots, light in weight, fine in texture, containing few and small veins and midribs so that it will cut into wrappers with as little waste as possible. The leaf must also have good burning qualities, holding fire a reasonable length of time and burning with a white ash, and so that the ash will hold the form of the cigar until knocked off by the smoker. All manufacturers and cigar makers want a leaf that is not brittle, that is smooth, elastic and supple, yet not tough. With all these qualities, some insist upon having a fine gloss, or shiny appearance, on the wrapped cigar. Others don't want that at all. Some prefer leaf with a considerable amount of gummy or oily matter, and a reasonable amount of it is essential to the proper curing and handling of cigar leaf, but too much gum, or oil, usually accompanies a leaf of coarse texture and other inferiorities. If the leaf has large size, in addition to the foregoing qualities, it is also desirable.

The greater the proportion of fine wrappers in a crop, the larger its value. Sometimes a fine crop will yield 60 per cent, or more, of prime to good wrappers, 25 per cent seconds and balance fillers. A poor crop, from the same township the same year, may not yield more than 10 to 25 per cent wrappers, and these will be inferior compared to the fine crop. The proportion of wrappers in New England and Pennsylvania leaf is usually larger than in New York, Ohio, or Wisconsin crops.

To successfully raise, cure and market cigar wrapper tobacco of the finest quality is, therefore, a business of great care and involves constant attention to every detail of management at the different stages. The importance of attention to these details is of greater consequence in this crop than in almost any other that is generally grown. To successfully grow the crop, in the first place, is a difficult matter, to cure it properly is of almost equal importance. A thorough knowledge of every phase of culture and curing is essential to success, and it is difficult to say that one is of more consequence than the other, but if such a comparison were made, the preference would be given to culture; for, although a finely grown crop may be injured by careless curing, no skill in curing can make a first-class product of a poorly grown leaf.

The distribution of the cigar-leaf crop has been closely studied by the *New England Homestead*, whose reports upon it are the accepted authority. Its latest data is as follows, comparing the "boom year" of 1892 with some later crops:

NUMBER OF PLANTERS AND ACREAGE.

	No. of Growers.		No. of Acres.		
	1896	1892	1896	1895	1892
New Hampshire,	29	32	43	54	85
Vermont,	48	69	120	108	164
Massachusetts,	953	1,165	2,849	2,768	3,666
Connecticut,	2,970	3,353	8,262	8,170	9,851
Total for New England,	4,000	4,619	11,274	11,100	13,766
New York,	2,324	4,175	4,535	5,712	12,272
*Pennsylvania,	9,500	13.425	17 463	19.435	30,000
*Ohio,	7,500	8,000	19 000	22.500	25.010
*Wisconsin,	2,800	5,160	10,500	11,381	20,000
Total,	26,124	35,379	62,772	70,128	101,038

*In the absence of the complete system of keeping tab upon the crop in these States which we have perfected for New York and New England by a farm-to-farm census, the data for Pennsylvania, Ohio and Wisconsin are partly estimated.

YIELD PER ACRE AND TOTAL CROP.

	Pounds per Acre.			Yield (cases of 350 lbs.)		
	1896	1895	1892	1896	1895	1892
New Hampshire,	1,575	1,750	1,634	222	270	397
Vermont,	1,600	1,575	1,624	548	486	761
Massachusetts,	1,700	1,681	1,633	13,838	13,016	17,104
Connecticut,	1,750	1,721	1,664	41,338	40,190	47,486
Total for N. E., Av.,	1,656	1.681	1.638	55,946	53,962	65,748
New York,	1,350	1,274	1,882	17,492	20.764	43,381
Pennsylvania,	1,500	1,000	1,000	74.841	55,528	85 714
Ohio,	800	600	750	43 429	38,571	53,600
Wisconsin,	1,000	700	892	30,000	22 762	51,420
Total,				221,708	191,587	299,871

PRICES AND VALUES.

Average prices at which the '95 crop sold and at which the market for '92 leaf opened are given in this table, together with total value of the 1896 crop at (*a*) the prices paid in 1895 and (*b*) could growers get the average open prices of 1892.

	Average Price.		Total Value of Crop.			
	1895	1892	1896 (*a*)	1896 (*b*)	1895	1892
New Hampshire,	9c	25c	$7,000	$19.500	$8,000	$35.000
Vermont,	9c	25c	17,000	48,000	15.000	64 000
Massachusetts,	9c	27c	436.000	1,308,000	410,000	1,445.000
Connecticut,	9c	26c	1,302,000	3,762,000	1,265,000	4,507,000
Total for N. E.,			$1,762,000	$5,137,500	$1,699,000	$6,053,000
New York,	8c	15c	90,000	918,000	581,000	2,278,000
Pennsylvania,	6c	12c	1,580,000	3,143,000	1,166,000	3,600,000
Ohio,	5c	9c	759,000	1,368,000	675,000	1,787,500
Wisconsin,	4c	10c	420,000	1,050,000	318,668	1,799,980
Total,			$3,011,000	$11,616,500	$4,439,668	$15,518,480

CHAPTER XVIII.

SPECIAL FERTILIZATION FOR CIGAR LEAF.

To definitely settle certain mooted points in fertilization for cigar wrappers, a number of progressive farmers organized The Connecticut Tobacco Experiment Company in 1892, bought a tract of old, worn-out land at Poquonock, and arranged with the Connecticut State experiment station to conduct tests on plots of one-twentieth of an acre each, upon the following general plan of experiment:

1. The following experiments should be carried out on the same land for at least five years in succession.

2. While the quantity of crop should be accurately determined, very special attention should be given to the judgment of its quality for cigar wrappers. This judgment should be given by men of large practical experience in the trade in leaf tobacco, and the samples should be so submitted that the judges should have no knowledge of any particulars regarding the manner in which the separate lots of leaf were raised.

3. The final judgment on its quality should be made after the leaf has been fermented in the usual way, and the whole crop, rather than small samples from each crop, should be fermented together.

4. The following questions are those which, as far as circumstances permit, should receive immediate attention:

a. What is the effect on quantity and quality of leaf of larger applications of cottonseed meal than are commonly used as a fertilizer?

b. What is the comparative effect on quantity and quality of leaf of applications of castor pomace containing the same amounts of nitrogen as the cottonseed meal used in experiments under *a*?

c. If a heavy application of nitrogen, in form of castor pomace, proves injurious to the leaf, can the injury be lessened, or prevented, if a half of this quantity of nitrogen is supplied by castor pomace and the other half by nitrate of soda?

d. What are the comparative effects on quality and quantity of leaf of applications of equal quantities of potash in the following forms: Cottonhull ashes, high grade sulphate of potash, the same with lime, double sulphate of potash and magnesia, the same with lime, pure carbonate of potash, and pure nitrate of potash?

e. Is it possible to absolutely prevent "pole burn" and to cure the crop perfectly on the stalk, by the use, in very damp, "muggy" weather, of artificial heat simply as a means of ventilating and partly drying the air of the barns?

The 1896 crop completed the experiments, which have been directed by E. H. Jenkins, vice director of the station. The interest in this work, the most exhaustive of the kind ever attempted, is so great that we have compiled a careful summary of the results. This appears in the annexed table, which is based on the average of the first four crops produced. The quantity of the different fertilizing materials applied per acre each year varied slightly, but averaged for the four years as stated in the table. The same is true of the actual plant food contained in these mixtures. The idea was to supply the same quantity of potash to each plot, but in different form. This was also true of phosphoric acid, but both the amount and form of nitrogen varied considerably. The season of '92 was favorable, and a large yield of fine quality was obtained; the next three seasons were comparatively dry. The crops, therefore, varied considerably in yield and quality, but the average for the four years partly removes these seasonal influences, and enables us to judge more clearly of the effect of the fertilizers.

FIG. 114. EXPERIMENTAL TOBACCO FIELD, POQUONOCK.

Table VII.—FERTILIZERS USED, QUANTITY AND KIND OF CROP.

Plot	Fertilizer Used	Fer Con'd Lbs of Nitro	Ph acid	Pot	Yield Pr ac ℔	Wt Wrap ₱ Ac Long	Short	Total	Pr et Wr L	S	Tot
A	1500 cottonseed meal, 1500 cottonhull ashes,	105	150	340	1611	716	240	956	44	14	58
B	1800 linseed meal, 1500 cottonhull ashes,	105	150	340	1561	692	252	944	44	17	61
C	2500 cottonseed meal, 1500 cottonhull ashes,	175	175	340	1686	790	275	1065	46	16	62
D	3000 cottonseed meal, 1500 cottonhull ashes,	210	180	340	1835	960	266	1226	51	15	66
E	2000 castor pomace, 1500 cottonhull ashes,	105	140	340	1761	765	275	1040	43	15	58
F	1800 linseed meal, 650 cottonhull ashes, 260 bone meal,	105	150	150	1653	736	271	1007	45	16	61
G	3300 castor pomace, 1500 cottonhull ashes,	175	760	340	1700	758	266	1024	44	15	59
H	4000 castor pomace, 1500 cottonhull ashes,	210	180	340	1881	1025	270	1295	53	14	67
I	2500 castor pomace, 1500 cottonhull ashes, 640 nitrate of soda,	210	150	340	1881	990	256	1246	52	15	67
J	2500 castor pomace, 1500 cottonhull ashes, 640 nitrate of soda,	210	150	340	1992	1083	295	1378	54	15	69
K	1500 cottonseed meal, 1200 double manure salt, 400 bone meal,	105	150	340	1804	866	275	1141	48	15	63
L	1500 cottonseed meal, 1200 double manure salt, 400 bone, 300 lime,	105	150	340	1685	720	290	1010	42	17	59
M	1500 cottonseed meal, 600 sulphate of potash, 400 bone meal,	110	150	340	1725	653	252	905	37	15	52
N	1500 cottonseed meal, 600 sulphate of potash, 400 bone, 300 lime,	110	150	340	1721	724	269	993	42	16	58
O	1500 cottonseed meal, 600 carbonate of potash, 400 bone meal,	110	150	340	1575	670	249	919	43	16	59
P	1500 cottonseed meal, 1700 doub car' po'sh & mag, 360 bone meal,	105	150	340	1414	550	231	781	38	16	54
	Average of all the plots,	141	155	328	1718	794	265	1058	45	15	63

The larger the amount of nitrogen used, the heavier was the crop and the larger the per cent of wrappers. (See Plots D, H, I, J.) There were no very marked differences in yield due to the form in which the nitrogen was applied,—castor pomace, G, shows a slight advantage over cottonseed meal, D, but when (J) all the nitrate of soda was applied between the rows, at first cultivation, the yield of wrappers averaged 132 pounds per acre more than Plot I, similarly fed, except that half of the nitrate was applied at the first and the balance at second cultivating. This fact is directly contrary to theory, and is not due to the absence of sufficient moisture after the second application to dissolve the nitrate so that the plants could feed upon it, because the same result was noted during the first dry season and the succeeding wet years.

Linseed meal gave quite as good results in yield and quality as cottonseed meal. Indeed, the more moderate application per acre, on Plot F, of linseed meal, with less than half as much cottonhull ashes as some of the other plots, and a little bone meal, produced one of the most profitable crops, because cost of fertilizer was smaller than on other plots. In view of results on F, it is a question whether so much as 340 pounds per acre of actual potash is at all necessary.

The form of potash used seems to have as much effect as the quantity. The carbonate of potash gave distinctly unfavorable results compared with sulphate, which is now used for tobacco by all scientific farmers. The poorest yield of all was on P, dressed with double carbonate of potash and magnesia. Yet tobacco on this soil evidently needed magnesia, for on K and L, where potash was put on in the form of double manure salt (consisting of sulphate of potash united with sulphate of magnesia), the yield was considerably better than where only high-grade sulphate of potash was concerned.

With these crops of cigar wrapper leaf, quality was what determined their market value. It depends upon color, texture, thinness, lightness, freedom from spots, holes, coarse ribs or other imperfections, burning quality, and other even more delicate points. It is not possible to intelligently average these points in the four years' crops from each plot. But the average number of wrappers required to weigh a pound is important, as the thinner the leaf the more cigars it will cover and—other qualities being equal—the more it is worth. The McKinley bill imposed a duty of $2 per pound on wrappers "of which more than 100 are required to weigh a pound." The length of time a cigar will hold its fire is also important. Hence, the comparative capacity of holding fire was ascertained by careful tests of each crop; the leaf which held fire the shortest time in each of the four crops was called 100, and the table gives the average of these determinations, the larger figures indicating the longer capacity to hold fire; the figures under the heading "Cured" are the average of fire tests made of the 1892-3-4 crops, when pole cured, or barn cured, while under "Fer." are given average results of similar tests of each of these crops after fermentation. After each crop had "gone through the sweat," or fermentation, judgment as to the quality for wrappers of the leaves from each plot was finally passed by practical experts, the best crop each year being marked 1, the second best 2, and so on, and this data is given in the last three columns of the following table. For conven-

Table VIII.—QUALITY OF THE VARIOUS CROPS.

Plot	*Yield of Wrappers*	**Wrapp's pr Lb*		*Fire Holding*		*Value as Wrappers*		
		Long	*Short*	*Cured*	*Fer.*	1892	'93	†'94
A	956	68	91	205	333	10	23	5
B	944	69	90	223	305	12	1	6
C	1065	63	86	221	275	2	5	11
D	1226	61	89	202	248	3	8	16
E	1040	61	84	167	236	16	29	28
F	1007	67	91	237	415	8	3	4
G	1024	62	82	208	245	4	22	15
H	1295	63	86	205	262	5	9	14
I	1246	64	83	202	240	19	21	20
J	1378	65	80	233	266	22	6	19
K	1141	61	89	159	215	6	15	17
L	1010	65	86	153	233	9	25	7
M	905	69	84	147	209	23	28	26
N	993	65	85	163	188	7	19	25
O	919	70	94	195	244	1	24	13
P	781	75	100	271	425	14	14	2
Av.,	1058	66	87	199	275	—	—	—

*Pole cured; leaves are lighter after going through the sweat. The 1894 crop averaged per pound of pole-cured short wrappers 88 leaves, fermented 97; long wrappers 64 pole cured, 71 fermented. †The '95 crop is yet in sweat.

ience of comparison, the average yield per acre of wrapper leaf is included from Table VII, which gives the methods of fertilization on each plot, total yield of all grades of leaf on each plot, etc.

Somewhat similar experiments have been made by the Pennsylvania experiment station, but were interrupted for lack of funds. The whole subject of feeding the tobacco plant is fully discussed in Chapter VI, but some further points applying specially to cigar leaf should be mentioned here. Especially would we reiterate that the proper use of appropriate commercial fertilizers or agricultural chemicals is not injurious to either quality or quantity of the yield. On the contrary, such use improves the quality and increases the yield. But "the proper use of appropriate fertilizers" covers many things that can only be learned by long experience, and cannot be taught in books. This matter has been closely studied by practical farmers and by fertilizer experts and manufacturers, especially during the past few years. In addition to the popular fertilizers previously used with general satisfaction by careful growers, this work has resulted in bringing out some new "tobacco ash" mixtures, for which much is expected.

The first of these new mixtures to be announced was Mapes "tobacco ash constituents," designed to be used in connection with cottonseed meal or any material supplying ammonia. The raw materials generally used by the most successful tobacco growers in connection with cottonseed meal, and also employed at Poquonock, are double sulphate of potash (containing sulphate of potash and sulphate of magnesia), high grade sulphate of potash, cottonhull ashes, wood ashes and bone meal. Both wood and cottonhull ash vary in quality, and are at times the most expensive forms of potash. These materials also may contain much more magnesia than the crop requires. Jenkins declares that an excess of magnesia in the plant is known to be injurious unless lime is also abundant. An average yield of tobacco takes some 30 pounds of magnesia from an acre, and this occurs mostly in the leaf. Yet 1500 pounds of cottonhull ashes, the amount usually used per acre, supplies about 165 pounds of magnesia, and less than one-half as much lime. The double sulphate of potash, in equivalent quantities, carries about 190 pounds of magnesia. "If too much magnesia is present in the leaf, it may show in the form of the so-called 'light mold' on the leaf when it comes out of the case, greatly damaging its salability, though not materially damaging its qualities for wrappers. This is not a true mold, but is a malate of magnesia—an effloresced crystalline matter which has come out of the leaf tissue." Whether this is caused by too much magnesia in the soil or fertilizers is not definitely determined, though such is the belief of some who have given up the use of cottonhull ashes in consequence. The high grade sulphate of potash, on the other hand, contains little or no magnesia.

As a substitute for the foregoing articles, this "tobacco ash constituents" has been prepared, 1000 pounds of it supplying 150 pounds actual potash, phosphoric acid 57 pounds, lime over 200 pounds, ammonia 6 pounds, magnesia 20 to 30 pounds. The lime is in the form of a finely powdered carbonate of lime, which is preferred for the reasons fully set forth in Chapter VI. This "tobacco ash constituents" is thus intended to be free from all objectionable characteristics of the substances usually used, and 1000 pounds of it, applied with 2000 pounds cottonseed meal, will be found to supply in liberal excess all the plant food required for an acre of cigar-leaf tobacco, and in thoroughly tested forms. Such a mixture will furnish of ammonia 156 pounds, phosphoric acid 77 pounds, and potash 170 pounds; while a crop of 2700 pounds of cured leaf and dried stalks per acre will contain 118, 16 and 138 pounds, respectively, of these elements.

Another attempt in the same direction is Bowker's "tobacco ash elements without ammonia," 1000 pounds of which are guaranteed to contain of soluble actual potash 160 pounds, phosphoric acid 60 pounds, lime 300 pounds, magnesia 30 pounds. This mixture is guaranteed "to be composed principally of wood ashes and bone ash, containing potash in the form of carbonate, and the phosphoric acid largely in available form, besides carbonate of lime and magnesia in the same form as in cottonhull ashes, and with a sufficient excess of lime to meet not only the wants of the tobacco crop, but also to counteract any acid condition of the soil, and to improve its texture and mechanical condition."

It will be seen that both these mixtures are free from the substances which have proven objectionable to the tobacco crop at the Poquonock experiment station—acids, chlorine, excessive magnesia, and deficiency of lime. It is recommended to plow in such mixtures two weeks before setting plants. If the fertilizer is only harrowed in, no harm need be feared if the quantity is moderate and seasonable showers fall; but if you get caught with a dry spell after setting, more or less damage follows. "But," says Jenkins, "be the season wet or dry, the crop will be likely to get the full benefit of fertilizer which has been plowed under, for the roots will find it." Indeed, tobacco has a widespreading root system, in addition to its taproot, and this is sufficient reason for broadcast applications of manures or fertilizers plowed under or thoroughly harrowed in.

A substitute for cottonhull ashes, or other forms of tobacco ash ingredients, also a substitute for cottonseed meal, or castor pomace, is put out by Mr. Bowker as modification of his "ash elements." It has ammonia, in addition to the ash elements, serving as a general fer-

FIG. 115. CONNECTICUT BROADLEAF, ANDROSS FIELD, EAST HARTFORD.
Grown on stems, castor pomace, and 800 pounds per acre of Baker's A A Tobacco Manure, made by H. J. Baker & Brother, 93 William street, New York City.

tilizer and starter. It is recommended to use 1000 pounds of this mixture with 1500 pounds of cottonseed meal per acre, the meal and half of the fertilizer being plowed under, and the rest of the fertilizer applied as a starter, and harrowed into the soil just before the plants are set out. The Mapes tobacco starter, for tobacco beds and for plants at setting out, has also been much used, and is serviceable in giving plants a prompt start. Such a start is important, as only the earlier grown and fully matured tobacco cures light and glossy under usual conditions.

More evidence that leaf of the best quality can be raised on commercial fertilizers, is shown by the fact that the largest prices in recent years have been for Connecticut leaf manured in this way. Special attention is directed to the magnificent Andross crop of broadleaf grown in the celebrated East Hartford section, an engraving of which (from a photograph taken for this work), appears on Page 400, while the typical plant of Connecticut broadleaf shown in Plates I and II, Pages 19 and 23, was from this crop. The fertilizer used was 4000 pounds of tobacco stems per acre, with 1500 pounds of Baker's castor pomace and 800 pounds of H. J. Baker & Bros.' A. A. brand of tobacco fertilizer. Another field was treated the same way the previous year, but upon it, in 1896, manure was substituted for the stems, with 2000 pounds of pomace, which was the treatment given the fields illustrated in 1895. Mr. Andross adds: "We generally alternate between stems and pomace, and manure and pomace or cottonseed meal. Sometimes we use manure two years and stems one year. It is safe to say that we get the cleanest, healthiest and heaviest crop the year when the stems are used. In my east field, not shown in the photograph, I used manure and pomace, but it is not as heavy as the field where the fertilizer is used."

The crop of one of the most celebrated growers in the Connecticut valley, Mr. W. W. Sanderson, is illustrated on Page 378. This field has been in tobacco for more than ten successive years, yielding an average of over one ton per acre in cured leaf annually. It has had a light coat of stable manure annually and lime every third year, and in the alternate season, 1500 to 2000 pounds per acre of Stockbridge special tobacco manure. In 1895, the Stockbridge was reduced to 1200 pounds per acre, and 1200 pounds cottonseed meal was also used. In 1896, the same doses were repeated. The 1895 crop on the nine acres weighed 19,795 pounds net when assorted and cased, 65 per cent being the light wrappers, 15 per cent dark wrappers, and the balance seconds and fillers. The '96 crop was over 50 per cent light wrappers of the finest quality, and 20 per cent dark wrappers, the leaf being very thin and fine. Mr. Sanderson finds that the addition of some cottonseed meal produces a more oily and glossy leaf, but too large quantities of this meal on medium to dark soils will give a dark colored leaf.

Another remarkable instance of results obtained with tobacco grown on commercial fertilizers, is offered by the experience of Mr. O. B. Lowell, of Tioga county, Pa., whose crop is illustrated on Page 416. He raises about 30 acres of tobacco annually, using 1000 pounds per acre of Mapes Wrapper Brand, with 500 pounds per acre of Mapes "tobacco starter," 20 loads of stable manure having been previously plowed under. The colors are remarkably light, the yield large, the texture fine and all that could be desired. A similar estimate comes from Joseph K. Schultz, of Washingtonboro, Lancaster county, Pa., whose 1896 crop of 40 acres, the eighteenth in succession on the same land, is the finest he ever raised, and it is the eighth year that the land has been manured in this way: Horse manure is plowed under, and from 1500 to 2000 pounds of Mapes Wrapper Brand harrowed in, with 400 to 600 pounds per acre of Mapes "starter."

These and other crops raised on the Mapes manures have yielded 1800 to 2000 pounds of assorted leaf per acre, and Mapes tobacco in the Connecticut valley, of the famous '92 crop, sold at 30 to 33 cents per pound,—the highest prices recorded in recent years. Crops grown on the other fertilizers mentioned have also for many years commanded the top of the market, demonstrating beyond a peradventure the correctness of our view, that the proper use of fertilizers is anything but detrimental to quantity or quality.

CHAPTER XIX.

CULTURE OF CIGAR LEAF TOBACCO.

Soils.—Throughout all the New England tobacco section, a warm, deep, sandy loam, having a permeable subsoil, is preferred for the crop. Occasionally, tobacco is grown upon the bottom lands, especially when well drained. The soil of these lands is dark with vegetable matter, but rendered easy of tillage in most cases by the large percentage of sand which it naturally contains. The popular impression is, that tobacco from the bottom lands is dark colored, and as only light wrappers are now in demand, and this can be expected when grown on the higher land, the bottom lands are not much used for tobacco. However, the most essential point looked for is that the soil is free from standing water, and susceptible of early and late cultivation. Providing this condition exists, the bottom lands can be used; but this condition is exceptional. The alluvial soil of the Connecticut bottoms differs from that of most bottom lands in the country, in possessing a considerable proportion of sand, which renders it warm and easy of cultivation, and is much less troubled with water than is usually found on similar lands in other valleys. Tobacco, therefore, can be raised on some lands in the Connecticut valley, when it would fail if placed on the bottom lands of other rivers.

Freedom from standing water,—a naturally well-drained soil,—is the first great essential to successful tobacco growing. The crop will not grow in a soil possessing an impervious subsoil that prevents drainage, for such soils are cold from the water of saturation. For the same reason, clay soils cannot be advantageously used. They are cold and wet, and, moreover, are with difficulty brought into and kept in the exceedingly fine state of tillage that is necessary for the success of tobacco. These lands are often admirably adapted to grass, potatoes, and other crops, but are disappointing for tobacco. It is far better economy to bring a poor piece of land of a sandy nature, warm and friable, into a proper state of fertility, by applying manures and fertilizers, than to endeavor to grow the crop on stronger but wet soil. Crops have been grown successfully on almost pure sand, but such instances are rare; soil that is too sandy will not hold water enough to support the plant or to distribute the fertilizers incorporated in it; and an excessively dry soil is almost as objectionable as one that is too wet. Much land of a sandy nature can be wonderfully improved in its capacity for retaining moisture, by a proper course of manuring, although the first cost of bringing such land into condition is very heavy. On a naturally warm, mellow, fertile soil, the expense of manuring, in the first instance, is much less, and such a soil is the one preferred.

Mr. Whitney has clearly shown that a dark, moist soil produces leaves dark in color, comparatively thick, and containing considerable oil and gum, but which, while sweating well, come out so dark that they are not suited for cigar wrappers, now that light color, thin-texture leaf is the fashion for this purpose. Upon light, sandy soil, the quality is very fine, the texture of the leaf is thin, and the color light, making the best cigar wrappers. The more clay and silt soils contain, the more retentive are they of moisture, and the heavier the type of leaf they produce. Thus, the leaves produced at Poquonock on a soil containing only seven per cent of water are lighter colored and of thinner texture than those produced at East Hartford, where the soil contains double the amount of water, and very much better than the leaf grown at Hatfield on soil containing 28 per cent of water. But the difference in color and texture in these cases is not wholly due to the difference in moisture. The difference is partly due to the mechanical condition of the land. That at East Hartford contains much more fine silt and clay than is the case at Poquonock.

Mr. Whitney's studies also show that, even if the soil does contain considerable clay and moisture, if it is well drained, either artificially or naturally, it may yet produce a very fine quality of tobacco. He believes that much land now comparatively moist can be adapted to the finer grades of cigar wrappers. "The first thing needed is to underdrain the land by tile drains, so as to remove, as much as possible, the excess of water. The tobacco should be grown on high beds, or ridges, which would keep the roots on higher soil, and improve the texture and quality of the crop. The texture of the soil should be changed, by judicious methods of cropping, manuring and culture, making it more loamy, and less retentive of moisture."

Mr. Whitney's investigations in Pennsylvania confirm the foregoing statements. The soils which contain much silt and clay also contain much water, and produce a heavy, dark leaf. These conditions should be realized by planters. When the fashion calls for light cigars, they should cultivate only lighter soils, and use their heavy land for other crops. When dark wrappers are in demand, the heavy soils should be devoted to this crop. Our own experience and observation confirms Mr. Whitney's views. This is also true, in a general way, of the tobacco lands of New York, the Miami valley and Wisconsin. In all these localities an "old" soil which, by cropping, has been freed from its original growth and, perhaps, rank vegetable matter, is preferred for cigar leaf.

Rotation of Crops.—The present practice among growers of the best quality of cigar leaf in the Connecticut and Housatonic valleys, is to select the land most suitable for the crop, and continue growing tobacco upon it year after year. There are several reasons for this practice, as stated by Frye, Sanderson, Andross and others.

In the first place, tobacco is so sensitive to the influence of fertilizers, or to an accumulation of vegetable matter in the soil, as to raise serious objections to any rotation. It is claimed by growers of highest experience, that tobacco fields need long and careful preparation to get into a condition that will yield a large crop with a perfect burn, thin leaf, bright and light colors. The manuring and treatment of the soils which may be best for other crops, may be objectionable for tobacco. The lower grades and cheaper forms of commercial fertilizers used for corn, grass, potatoes, etc., usually contain chlorine, salt and other substances that would have a bad effect on tobacco, directly following such a crop in a rotation.

The form in which potash is used is especially important. An oversupply of potash is not exhausted in one season, but apparently remains in the soil until taken out by successive crops. As the onion is a large potash feeder, and also responds to delicate feeding, it is probably the best crop to alternate with tobacco. Ash rich in potash is usually employed on onions, either in the form of carbonate of potash, or chemical fertilizers, supplying it in the form of high grade sulphate. The close culture of an onion field also assists in improving its mechanical and uniform condition, and in other ways assists in preparing the soil for tobacco. Potatoes are also good potash feeders, but it is not safe to use them on tobacco land, unless we are positive that the fertilizer used furnishes the potash in the form of high grade sulphate, as the muriate of potash, or lower grade potash, salts usually have a deleterious effect upon the quality of tobacco. A crop of turnips may be grown on tobacco fields the same season to advantage, provided the tops and small turnips are plowed under at the last moment possible before freezing up. Spinach or beet greens can be grown to advantage before tobacco plants are set in the spring, as working the soil for them assists in putting it in good mechanical condition, without drawing upon its elements of fertility to any appreciable extent.

Tobacco grown continuously on the same land, richly manured year after year, is in danger of containing too much potash or magnesia after a while. In such cases, and as a corrective of the soil, seeding to grass is the method now preferred. A liberal quantity of grass seed and clover seed is used, and the soil is so rich that a tremendous stand of grass is obtained, which is usually mowed twice the first year, but the second year, immediately after the first mowing, the sod is turned under with a shallow plow, the field being again more deeply plowed just before the ground freezes. It is then kept in tobacco for several years, according to the quality of the crop. If the land is used for corn or potatoes, such crops should be followed by oats or rye before the field is used for tobacco. The oat or rye stubble is turned under shallow immediately after the grain is cut, and is again plowed deeply in the fall, the same as for grass. This leaves the land in better condition for the tobacco crop than if it were set immediately after corn or potatoes. Grass can also follow the latter crops before tobacco is planted.

In central and southern New York, rotation of crops for tobacco is still practiced to a large extent, but the best growers are rapidly coming to adopt the Connecticut practice on this point. Tobacco has been produced on the same piece of land in Onondaga county, N. Y., for nearly forty successive years, yet the fields, of late years, have averaged nearly twice as much per acre as on newer lands, properly manured and cared for, while the quality is all that could be expected. Pennsylvania experience is much along the same line, and in Wisconsin tobacco is more and more grown upon old land.

Preparation of the soil.—This begins "the year before." Fall plowing is essential to the best results. Tobacco needs almost as deep and thoroughly pulverized soil as does the sugar beet. Many of the best growers prefer to plow under a grass sod as soon as the hay crop is secured, plowing as shallow as possible, and have the sward well turned under. Another plowing to the full depth, just before the ground freezes up, will do much to prevent trouble from cutworms. Manure may be plowed under in fall or spring. Thorough spring plowing is to be insisted upon. Some growers practice running a subsoil plow in the furrow after the fall plowing, especially on soils liable to drouth. Probably the better plan, with stable manure, tobacco stalks, and similar bulky material, is to spread it broadcast in the fall or early winter, to be plowed under in the early spring. All forms of vegetable fertilizer, such as cottonseed meal, linseed meal, etc., are broadcasted and harrowed in about two weeks before the time of setting plants, but long before this the soil has been wheel-harrowed after the spring plowing, and cross-harrowed with a fine-tooth harrow.

Varieties, and Other Points.—Manuring and fertilization have already been exhaustively treated in Chapters VI and XVIII, which should be carefully studied. The whole subject of varieties, seed and seedbeds, plants and transplanting, pests, etc., are covered in the chapters on those subjects. Formerly, Connecticut broadleaf, or some of its sub-varieties, was generally grown throughout the cigar-leaf sections of the North, but now its place has been quite generally taken by domesticated Cuban or Havana seed tobacco, several strains or sub-varieties of which are used in different localities. The way in which this variety has supplanted the old broadleaf is a marked instance of the change that may come to even the oldest agricultural industry. At present, the broadleaf is grown in perfection mainly in a limited section about East Hartford and Windsor in the Connecticut valley, where about 2000 acres are annually devoted

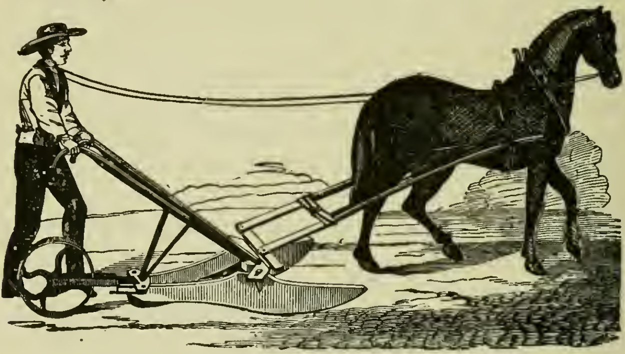

FIG. 116. GOSLEE'S RIDGER AND MARKER.
Made by the Belcher & Taylor Agricultural Tool Co., Chicopee Falls, Mass.

to it. Where plants are set by hand, the Goslee ridger (Fig. 116) is often used. Its wings gather the earth into a ridge, with the fertilizers that are spread broadcast for starting the plant. The smoothing plate that the machine rides on smooths the ridges, and the wheel with the points partly makes the holes for the plants, and spaces them off.

Doctor Daroczi, editor of the *Hungarian Tobacco Gazette*, of Budapest, has propagated tobacco from slips, and claims that the leaves harvested from such propagated plants are finer and of higher quality than those of the mother plant. We find, upon inquiry, however, that he has made only a few pot experiments. His claims have led to some discussion in Germany and Austro-Hungary, during which numerous instances have been reported of tobacco plants from three to seven years old. These plants were wintered in a greenhouse, the seven-year-old plant measuring six yards in hight and seven and one-half inches around the stem. Mr. Wallensick, of Buende, possesses a cane made of the stem of a five-year-old plant. In another case, new and vigorous plants started with independent roots from pieces of old root, this being really propagation by layering, the same as for grapevines.

Every practical tobacco grower in America, however, is familiar with the second growth of suckers that comes up from old stalks after a mild winter, or that grows after the harvest if the fall is favorable. Col. Killebrew has studied this point in Mexico, where tobacco is perennial, but even to make good leaf in that country no reliance can be placed upon suckers coming from the principle stalk. Whether it will ever be feasible to propagate by slips or layers, remains to be demonstrated. Until this is proven, we must sow the seed, raise the plants, and set them out with all their original vitality, in order to make good tobacco of any variety. In Cuba and southern Florida, a second, and even a third, crop of fillers may be obtained from a single sucker left at the first and second cuttings of the crop.

Opinions differ about distance to set tobacco. In New England, Havana seed is usually planted in rows three or three and one-fourth feet apart, and plants 12 to 18 inches apart in the row. For Connecticut broadleaf and all varieties of the larger domestic seedleaf, rows are usually three and one-half feet apart, with 18 inches between plants in the row. The object of having the plants closer in the row is to get a very thin leaf, but when set only 12 or 15 inches apart, this thing is apt to be overdone, and the leaf is likely to be too thin and very liable to damage when curing, especially if unfavorable weather occurs. Broadleaf or seedleaf, being used mostly for binders, must be thin, and hence is set about 18 inches apart, but in former times, before the trade was so particular for thin leaf, these varieties were set 26 to 30 inches in the row. Now, if it is desired to get the most wrapper leaves in a crop, plants are set 18 to 20 inches for Havana seed, and 22 to 24 inches apart in the row for broadleaf, as a general rule among planters who manure heavily and who are disappointed in much less than one ton of cured leaf per acre. Formerly the rows were four feet apart for Connecticut broadleaf, but three and one-half feet is now the almost universal rule throughout Pennsylvania, New York and Wisconsin, with the plants about the distance apart just mentioned.

Cultivation.—Abundance of manure does not remove the necessity of thorough cultivation. Crops often need such treatment very badly where there are no weeds at all. The soil should be kept pulverized and loosened to as great a depth as possible without injury to the roots of the plant, particularly in the early stages of growth. The tobacco crop especially needs thorough cultivation, not so much with the hoe as with the cultivator, or with other labor-saving machines, care being taken to use only those machines, as the crop advances, that do their work without injury to the fibrous roots, or, in other words, which cut deepest in the center of the row and work closer to the surface near the plant. When plants are set by machine, an attachment can be affixed that will act as a cultivator, thus killing any weeds that may be starting. It is well to go over the field in a few days with a hand hoe and gently loosen the earth around and between the plants. It is the glory of the thrifty planter, not to allow a weed to be seen in his tobacco patch, and this is carried out to the greatest perfection in Lancaster county, Pennsylvania. As tobacco is grown solely for the leaf, great care should be taken in the later cultivation that no injury be done to the leaves. When land has been thoroughly cultivated, the weeds are entirely eliminated in the early part of the season, and the plant so shades the ground, in its later stage of growth, that weeds cannot flourish.

Within a week from the first, light hoeing, a cultivator, set narrow, should be run between the rows and run deeply, for too much care cannot be taken to

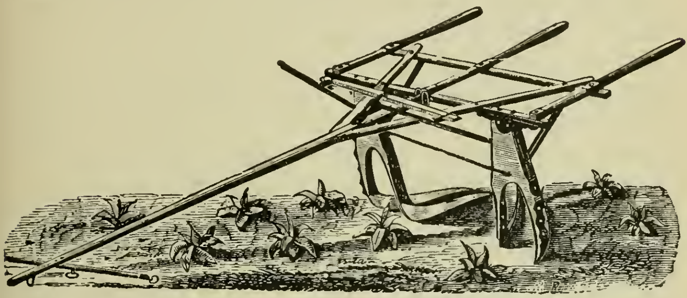

FIG. 117. PROUT'S HOEING MACHINE.

For tobacco and other crops requiring close culture. It can be used with one or two horses. When the ground is level and you wish to keep it so, run the hoes even, but if you wish to ridge, the hoes can be fitted to the desired angle. It can be adjusted so as to hoe the most delicate plants without injury, and to any width of row. It is made by the Belcher & Taylor Agricultural Tool Co., of Chicopee Falls, Mass.

keep the under soil mellow. A good stirring of the soil at this time is desirable, pulverizing, admitting light and air and leaving it in a condition more favorable to the plant. It is well to go over the field a week later with the hand hoe, to destroy any weeds missed by the cultivator. If the right tools are used, horse labor can be employed very largely in cultivation, and this is coming to be the practice throughout the cigar-leaf regions, and with great benefit to the crop, as well as saving to the planter. A favorite implement with New England

and New York planters is Prout's hoeing machine, Fig. 117, which is peculiarly adapted to this crop. Of course, other cultivators and horse hoes are used, but this is considered one of the best.

With seedleaf, it is a rule to draw the dirt towards the plant at the second hoeing, so as to hill it a very little. The cultivator may be run between the rows to advantage five or six times, but do not commit the error of using it too late, for it is quite certain that after the plant is half grown, the cultivator does more harm than good by disturbing the roots, and the roots of seedleaf reach out further from the plant than do the roots of Havana. When tobacco is ready to top, the roots are too much developed to permit cultivating. All the later culture that is needed—the cutting down of weeds in the row—can be better done with the hand hoe. Some growers, who believe in "feeding high," sow 100 to 300 pounds per acre in the rows just before the second cultivation.

Havana seed requires considerable more hilling than seedleaf, because it tips over more readily. The first hilling should be the same, but at the second cultivating hill up decidedly more than for seedleaf. When the ridger has been used in preparing the land, a hiller, such as is attached to some cultivators, can be used advantageously, or one can be made readily as follows: Take a board, five inches wide and two feet long, sharpen to a point from a distance of one foot from the apex. Upon each side of the edge nail a piece of barrel stave, two and one-half feet long and five inches wide, making the upper edge even with the top of the wedge; make a hole near the apex, and fasten to the middle piece of a common cultivator between the horse-hoe teeth, leaving the cutter turned out. At a third cultivation, this same hiller can again be used to advantage, but place a four-inch block upon the point of the hiller, so that it will take the dirt from the middle of the row, and build up the ridges still more. The hiller will not be found desirable where the ridger has not been used, as it will "hill" too much.

When the ground has been fitted by hand, use a common cultivator with the horse-hoe teeth turned out at the second hoeing; the amount of hilling can be regulated, of course, by the operator. At the third cultivation you can narrow the cultivator, bear a trifle harder on the handles, run the hoe teeth a little deeper, and then hill still more. When Havana stands up, the leaves do not lop towards the ground as much as do those of the seedleaf plant; consequently it can be cultivated later without danger of the horse stepping on the leaves. The shorter roots of the Havana also admit of later cultivation by horse power than is practicable, or desirable, with seedleaf.

Management of the Crop. — Where the stand is uneven, it always pays to reset with good plants and water them carefully. Sometimes plants are tipped over by heavy rains when the ground is soft. All such plants should be set up again and the earth firmed about them. Many prudent growers, while setting out their plants, provide an extra one here and there—sometimes as often as every other hill in every tenth or twelfth row—so as to have stock at hand to reset in place of plants that have died, or that are eaten by worms, or cut by careless hoeing. If a good body of earth is taken up with such plants, they can be set up in the vacant spaces even when fully a foot high. If the weather is favorable, these transplanted plants will quickly thrive; if it is hot and dry, they wilt at first, but will usually straighten up nearly as well as those that have not been moved. This near-at-hand transplanting is much more desirable at this late day than any transfer from distant tobacco beds, as the roots are less disturbed and

FIG. 118. HARVESTING HAVANA SEEDLEAF IN TIOGA COUNTY, PENNSYLVANIA.

A large yield per acre of such remarkable quality that after curing, from 90 to 110 leaves (25 inches long) were required to weigh a pound. Grown by O. B. Lowell on old land, with 1000 pounds per acre of Mapes Wrapper Brand and 500 pounds of Mapes Starter. Thirty acres of tobacco are thus treated by Mr. Lowell each year, as stated in more detail on Pages 399 and 402.

the chances of success greater, and the plant has already had a better growth. In some cases, Havana is toppled over so that it does not show badly at first and will soon hold up its head, but neglect, even in such cases, results in crooked stalks, which do not hang so well on the poles and by contact increase liability to pole sweat. Beside, such leaf will not strip as well, or sell as well, as if it had been promptly straightened up. Usually, this trouble occurs before or about the time of topping; after the plant has been topped, it stands up firmer. Should any plant have its center bud broken, or eaten off, early in the season, it will come up with several suckers, or sprouts, and will not amount to much; such plants should be replaced, if not too late.

Priming.—This consists in pulling off the bottom leaves, to the number of four or five. Any plant, large enough to top, ought to be primed first, and a general rule is not to prime until the plant is ready to top also. Many good growers omit this process altogether, although by that plan they increase the class called "lugs," and lighten the weight of the better leaves.

Topping.—As to when and how much to top (see Fig. 86, Page 294), there is a large difference of opinion and practice. Some begin as soon as a majority of the plants in a field have budded, and thus go over the ground a second time. Others make it a rule to wait until a majority of the plants have blossomed, with the idea of finishing the job at one time as far as possible. A feeble plant will do better if topped low, so that it will have comparatively few leaves mature. But whether cigar-leaf plants in general should be topped high, or low, is a disputed point. Those who advocate low topping claim they get lower leaves thereby; on the other hand, the high toppers say the leaves thus obtained, although large, are coarse; immense in quantity, but not superior in quality. With high topping, it is claimed the grower secures not only more wrappers, but more total weight. Every grower must decide, from the condition of the growing crop, how high or low to top.

Suckering.—The natural inclination of the plant to propagate itself through the formation of the seed, is intercepted by topping, but the plant at once attempts to repair the damage. In a few days, say five or seven, suckers, or shoots, begin to appear at the junction of the leaf with the parent stem. When three or four inches long, they must be pinched off. As in topping, this must be done with thumb and fingers, to prevent the too copious exudation of the sap. Cigar-leaf tobacco usually requires suckering but twice; at first, about half way down, and the second time clean from top to bottom. Unless removed when young and tender, they grow hard and fibrous and must be removed with a knife, which results in severe bleeding. In suckering, as in topping, the utmost care must be taken not to break or injure the leaves. If the leaves are found turned up by the wind, or any other cause, they should be put into their natural position, for the sun has a bad effect upon the underside, often scorching, or blistering it. Many otherwise careful growers neglect to properly "sucker," especially in Pennsylvania and Wisconsin, to the serious detriment of the crop.

Ripening.—In the course of two or three weeks after topping, the plants will begin to ripen, which may be known by the change in the color of the leaf. It will look spotted with spots of a lighter, yellowish green. When fully ripe, the leaf may be folded and considerably pressed without breaking. This is the time to harvest. It is well to let the crop stand, if not fully ripe, as long as it can safely be done, for the cool nights have a tendency to thicken the leaf, or give it more "body," without interfering with its quality in other respects. Many, however, prefer to cut as soon as ripe, and get it safely housed and out of danger from frost and hail. It certainly is a great temptation to cut before it has been touched by hail, frost, rust, or any other disease. It is true that tobacco affected by any of these things is nearly worthless, but the same is also true of plants cut too early. Such tobacco is almost sure to pole sweat and then it is gone, anyway, and even if the leaf does escape, it is thin and lacking in weight and is also liable to white veins. A rule which was in force years ago, to cut only such plants as were thoroughly ripe, hunting them out for the purpose and leaving the unripe ones to stand some days longer, is still a good one. This is especially applicable to all plants grown in wet spots, for these do not mature as early as those in dry places.

Some experienced growers maintain that there is a certain date when tobacco is ripe, and that if allowed to stand after this date it deteriorates in color and quality. When tobacco, for lack of fertilizers, or for any other reason, turns yellow, or fades, and the plant neither ripens nor grows, the longer it stands the more it deteriorates in value and quality and shrinks in quantity, and the sooner such fields are cut the better. No precise rule can be given as to when tobacco is ripe. Some say that seedleaf will ripen in from ten days to three weeks after topping, and Havana in about three weeks, but, generally, Havana should stand quite four weeks, though it will, of course, depend on the weather and plants; if it is wet, tobacco won't ripen as quickly as when dry. Some fertilizers will keep the plant fresh, green and growing longer than others. Tobacco cut before fully ripe may look nice before going through the sweat, but when it comes out, it is tender and will make but few wrappers, to say nothing of the greater liability to pole sweat. The green cut leaf may cure off darker, but it is not so well filled out, is not so smooth and fine, and

FIG. 119. HANGING UNWILTED TOBACCO ON HOOKED LATH, CONNECTICUT VALLEY.

will not bring as high price as the ripe leaf when properly cured.

Harvesting.—Cutting tobacco in the Northern cigar-leaf States usually begins about the middle of August, and continues, as the plant arrives at maturity, through the month of September, but it may begin and end considerably earlier or later, according to the season. The plants, when grown upon warm, sandy soils, mature from one to two weeks earlier than when upon dark soils. Cut from the time the dew is nearly off the ground until three o'clock, when all plants must be cut down at once which are to be hauled that day. Do not leave any out over night if possible. On the other hand, take care that too much is not cut when the sun is so hot as to sunburn the leaves. Such leaves will not cure, but are always green. Don't cut when there is danger of frost, because it will have a serious effect on wilted tobacco, whereas it might not injure the growing leaf at all. The plants should be put into the shed as soon after cutting as can be done without breaking the leaves. It must be wilted somewhat to be handled comfortably. If wilted too much, the leaves will stick together and then will never cure well. After one side is wilted, the cut plant should be turned over so that the other side may wilt. Some prefer a cloudy day for cutting, as the plants are less liable to sunburn.

In cutting, the stalk is grasped with the left hand, bent over to the left until the bottom of the stalk is exposed, and is then cut off close to the ground with one blow of a hatchet, or cleaver. Some, however, prefer to saw it off with a handsaw. In Pennsylvania and Wisconsin, a kind of shears is now commonly used, the long handles of which give a leverage that easily cuts off the stoutest plant. Let the stalk drop over on the ground, without doubling the leaves under; lay the plants at right angles to the row with the butts all one way; those from the next row should be laid with the butts towards those of the first row, and so proceed until all is cut that can be attended to. Some think a better way is to lay them down lengthwise with the row itself, lapping them partly over each other, as the plant does not have to be moved out of the row and there is not so much danger of injuring the leaves.

The practice of scaffolding in the field, once almost universal, has been largely discontinued throughout the cigar-leaf States. A majority of farmers now carry the plants directly to the barn without any previous wilting, save what is possible while lying on the ground awhile. On scaffolds, heavy rains will wash off more or less of the gum. Even those who follow the practice seldom leave the stalks on the scaffold longer than three days.

The simplest convenience for transporting to the barn is the best, as illustrated and described in Part II. If the plants are to be strung on poles in the barn, the old way, substitute for the wagon body a long, flat rack, upon which load the plants from each side, butts out, letting the tips overlap each other alternately in the center. Load regularly and evenly, care being taken not to break or damage the leaves in handling. Four or five hundred plants may be carried at a load. If the day is very hot, drive to the shed rapidly, or the load may heat, especially if the distance is long. All large sheds should be provided with wagon doors so that a team can drive directly in. If the weather is hot, the plants should be laid on the ground floor, only one plant deep. If the day is cool and they are to be hung up soon, they may lie much thicker. The doors are left open until the tobacco is thoroughly wilted and the leaves lie straight, when it is strung and hung.

The wagon rack, in Fig. 119, is very simple. An independent rack in forward holds up two upright posts, which are framed on top to two 4x6 timbers, 28

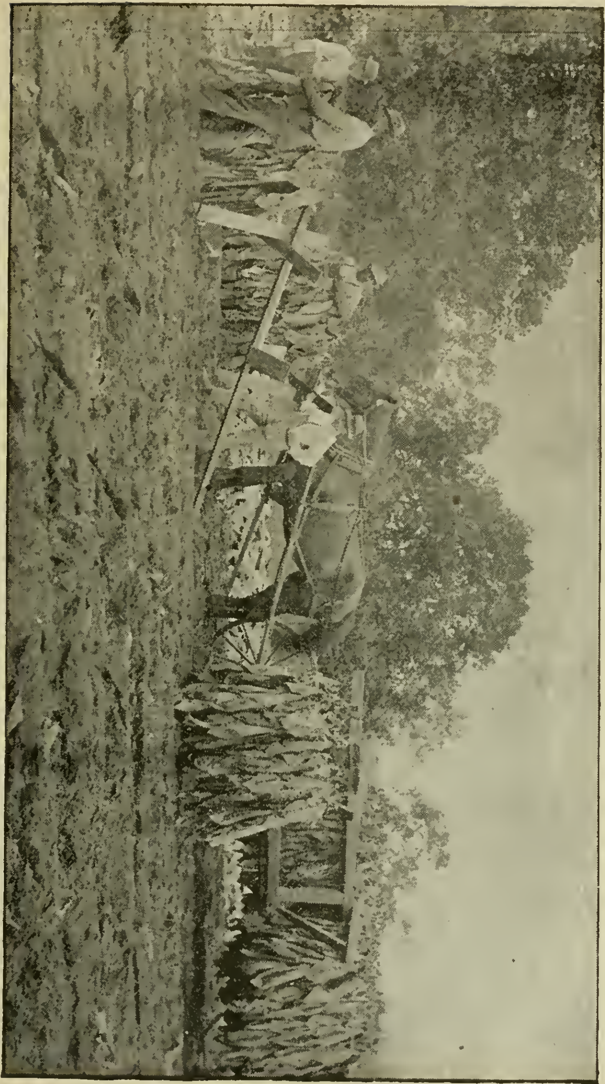

FIG. 120. "SPEARING" TOBACCO ONTO LATH AND CARTING TO THE BARN, CONNECTICUT VALLEY.

to 32 feet long. Crosspieces, $3\frac{1}{2}$ feet apart, and strongly braced, extend well over the sides. Upon these the lath full of plants is placed, the rack being just high enough to allow this to be done without stretching, and still have the plants clear the ground. Low, wide wheels are better than common wagon wheels, hence the popularity of the wagon shown in Fig. 91.

Hanging Cigar Leaf.—There are two ways of hanging, with twine and with lath, and each has its advocates. The latter way is the cheaper and requires the least help, but many still think hanging by twine is, on the whole, the fastest and best way. But if the barn is very high, it is cheaper to hang the upper tiers with lath, because it would need so much help to hang with twine. The difference in different years, and with different crops, accounts largely for the difference in opinion in regard to the methods of hanging. Don't hang it too thick, 30 to 34 Havana plants on a 12-foot pole is about right for twine. Be careful not to have the poles too close together. Ten poles in 15 feet is close enough, and there will be less danger of pole sweat than if thicker. Don't hang tobacco while wet, because it will pole sweat more readily, and besides, more dirt sticks to it. A wet leaf won't cure off quite so nice, smooth and pliable as when hung dry.

The new way, which is in use in the Connecticut valley, is to hang on laths, about twice the thickness of ordinary laths such as are used for plastering. The laths are four feet long, to carry four to six plants, as to their size. Some put a spear head on end of lath, run it through butt of plant, about six inches from the end, and then slide plant onto lath. For this purpose, the lath is held in a hurdle, as shown in Fig. 120. A better plan—because quicker, and requiring less handling and less injury, or danger, to plants—is to attach hooks to the lath, on which to hang the plants. For this purpose use lath five-eighths inch thick, one and five-eighths inch wide and four feet long. On one side put in a hook six inches from the end, and two more fourteen inches apart; do the same on the other side, alternating, and the lath contains six hooks about seven inches apart, to hang as many plants. Make some with only four hooks for the biggest plants. The hooks may be like *a*, Fig. 106, or simply drive wire nails at an angle through the lath. The hooked lath is held in a standard (shown at left in Fig. 119), while the plants are being hung on it. If the plants are well wilted when thus hung, they are at once carted to the barn on a rack, or rigging, like that in Figs. 118 or 120. But on a cool or cloudy day, the lath, when filled with plants, is hung on a rack in the field, until wilted, as shown at the right in Fig. 119. By the latter plan, harvesting can proceed in bad weather. These strung laths can be quickly hung in the barn, on poles about four feet apart. Fill upper tiers first, lifting to them by using a pitchfork at middle of lath. Leave space enough between laths in barn for air to circulate freely; the larger the plants, the more space.

Curing.—See Chapter X for full particulars.

Stripping.—When the leaves and stems are completely cured, so that no green is visible in the leaf and the leaf stems are dried out, the tobacco is ready to strip. The sooner this work is done, the better. If the colors are uneven, they will become as near uniform in the pile after it is stripped as by hanging, if taken down in proper condition and kept so. When tobacco is cured, it can be brought into condition for stripping in any damp weather. Watch a favorable time, when it rains, or is very damp, to open the building and let in the damp air, until the tobacco is sufficiently moistened to be handled without danger of breaking the leaves. A leaf of good body and strong fiber can be taken down

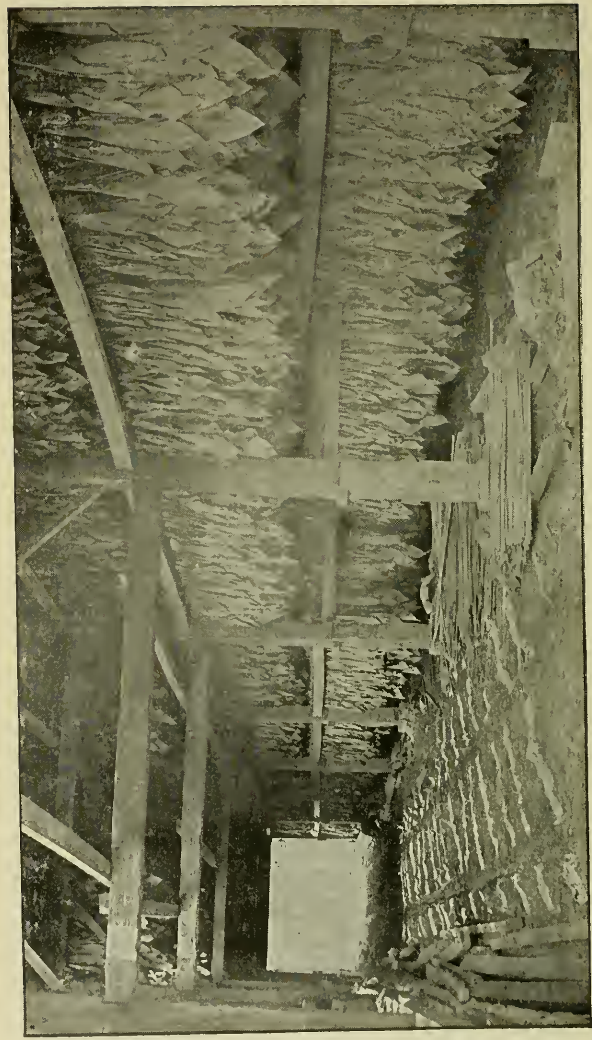

FIG. 121. PENNSYLVANIA HAVANA LEAF, HANGING IN BARN.
Crop of O. B. Lowell, Tioga County, illustrated on Page 416.

damper than thin, or papery, leaf. Early in the season, it should not be taken down as damp as is required later on. A good rule to determine when it is in proper condition to take down, is to clasp the leaves near the tip of the plant and squeeze tightly; when the pressure is removed and they expand in a few seconds and are stained but very little, the crop is just right to take down. It should be watched while dampening, to guard against rain driving in at the doors. If the outside plants get wet, or too damp, hang them up until dried sufficiently.

Make a floor of sawed poles, planks, or boards, laid on the ground, edge to edge, and pile the plants, a small armful at a time, about two feet high. The pile should be made with the butts out and the tips in and overlapping about one-third the length. This should be done evenly, in layers, so that no leaves may hang out and get dry, and thus be wasted. If the stalks are frozen, do not take down until the dripping stops, as the juice will stain the leaf. The sooner it is stripped after taking down, the better, as the leaves are liable to stick to the stalk and get stained and be torn when stripped. If warm weather prevails, the plants will soon heat after taking down, and they should be examined frequently. On the first indication of heating, carefully lay the pile over, making it about half as high as before and let it lie as loose as possible. Removing the plants from the lath is quite a task.

A common way to take plants from the laths is for one man to slip the plants to near one end of the lath and hold them, butts up, while another pulls out the lath. One man can strip lath alone by slipping the plants to one end and placing one foot on them to pull against. Some strip the upper tier of lath by placing two poles two inches apart on the first tier, shoving the lath through from above, while a man below pulls it out.

The method of pulling tobacco from lath between two short, upright sticks has been long in occasional use. In case of large, green stalks that slip hard, it saves labor.

To strip a plant, hold it in the left hand by the butt, and with the other pull off all the bottom leaves and drop them in a pile for "fillers;" next take off three or four more, or until the best leaves are reached, and put these in another heap for "seconds;" then strip off the remainder for wrappers, except such as are badly worm-eaten, or otherwise injured, which are, of course, of a poorer quality. Throw the stalk away and proceed with another. When a sufficient number of leaves of one grade are obtained to make a bundle, they are arranged with all the butts even at one end, and then bound firmly together by winding a leaf around them at the butt, commencing within a half or three-quarters of an inch from the end and winding down smoothly about two inches, and secure the end of the binder by slipping it through the leaves and pulling it tightly against the twist. Much of the value of tobacco depends upon the manner in which it is assorted and done up, as a few poor leaves in a parcel would make a difference of several cents per pound in the price. None but good, sound leaves, free from rust, pole sweat, frost, or large holes, should go into the best quality. The bundles should be made of leaves of an even length, uniform in color and quality, weighing about half a pound. Many careful growers make a practice of wrapping the bundles in manilla paper, 36x40 inches square. The bundles are usually 36 inches long and the 40 inches goes around the bundle. There should be three strong strings around each bundle. This paper keeps the tobacco clean and from getting dry. In this, as in everything else, neat packages pay well. The same method is pursued for seconds and fillers. Sometimes

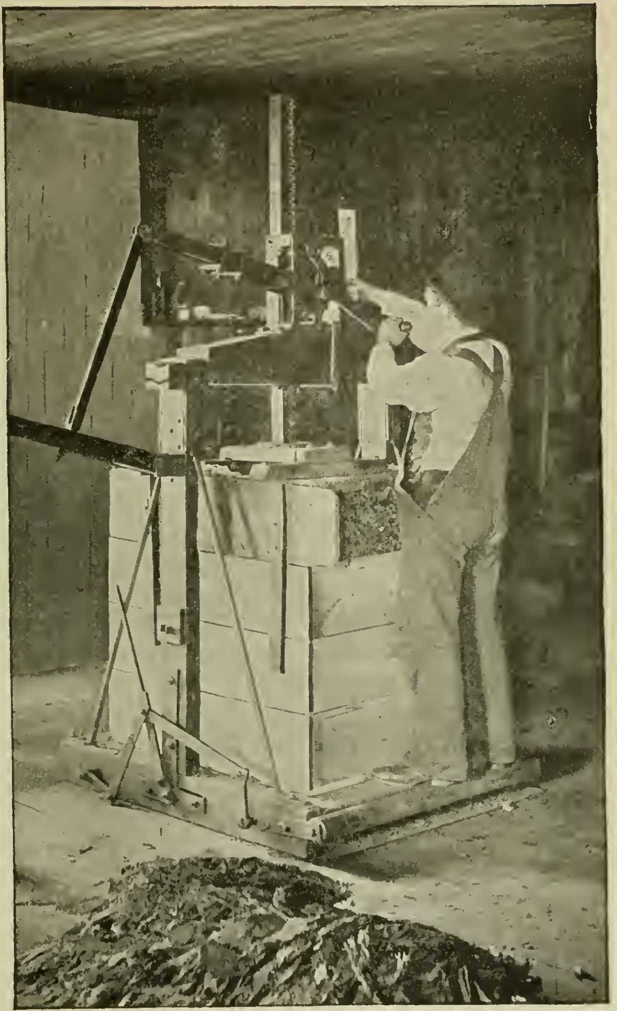

FIG. 122. PRESSING CIGAR LEAF INTO THE CASE.

leaves are found with green, or "fat," stems; these should not be included in the bundle, but laid one side to dry out, for the excessive moisture would cause the stem to rot and thereby injure the whole bundle. Leaves having very light veins should also be excluded, for these veins will turn white when the leaf passes through the sweat, which greatly detracts from the value of the leaf.

After being bundled, the "hands," as the bundles are called, are laid together in a pile, not on the floor, but raised from the ground a few inches by making a rough platform of poles and boards. Commence by laying a row on one side of the platform with the butts out, then on the other side in the same way, letting the tips lap over slightly, just enough to keep the pile level. Proceed in this way, laying on each side alternately, until all is packed. Lay some boards on top of the pile, and put on just weight enough to keep them snug. Some covering should be put at the end of the pile to keep it from drying out. The seconds and fillers are each packed in a pile separate from the others. If it remains long in the pile, it should be inspected occasionally to see that it does not heat. If it has been packed when too damp, it is quite apt to heat, especially if the pile is large. When this is apparent, the pile should be made over and the damp bundles shaken out to dry.

Assorting.—Most dealers prefer to have tobacco delivered in the bundle, for they have their individual methods of assorting and prefer to do it themselves so their goods may all run alike; when assorted by many different farmers, there is much liability of variation. Farmers who have a good reputation for assorting, however, not only assort their own crops, but are often employed by packers to assort other crops in the section. Assorting can be done during the stripping process, but it is almost always done later and special work made of it. The tobacco is packed in bundles, or small bales, and carried to the local assorting place, where it is unpacked and assorted into grades, according to the color, texture, length and condition of the leaf. When tobacco is packed, it is very important that it should be at the proper degree of pliability. If too dry, great damage is done to the leaf by breakage, and the best wrappers may be ruined when handled dry. On the other hand, if there is too much moisture in the leaf, a fermentation will be produced, so excessive as to destroy the vitality of the tobacco and produce a mold that imparts a disagreeable odor. Good judgment is required at this stage. If bulked in cold weather, the amount of water is often greatly underestimated and if warm weather comes on, danger ensues. There is no danger, whatever, if the stems are thoroughly dried out when the tobacco is taken down from the poles.

Casing or Boxing.—When cased, the boxes for wrappers are 36 inches long and 28 inches square at the head, and 36 or 38 inches long by 28 inches for seconds and fillers. The tobacco must be packed in these boxes, so that the ends of the hands stand from one to two inches from the side of the box. The quantity in each box runs about 300 to 350 pounds for wrappers, 325 pounds for seconds and 300 pounds for fillers. It usually requires quite a good deal of pressure, Fig. 122, to get the box full. It is best to leave the casing to the middlemen, unless the business is well understood.

Sweating.—The later fermentation, or "sweating," process is generally done by the dealers. It usually comes after assorting and casing. The tobacco is packed, or cased, and allowed to remain; as the weather grows warmer, the sweating begins and continues for many weeks. In this time the tobacco becomes warm, reaching 100° F., and sometimes more. During the sweat, the boxes are piled one on another on their sides, but never exposed to the rays of the sun. A sealed room is usually preferred for the purpose, and the heat generated is at times so great as to be quite uncomfortable. The sweating process is to tobacco what fermentation is to wine; it ripens and prepares it for use, perfecting its color and improving its flavor. The acrid, or pungent, taste is subdued, while the burning qualities are increased and it also gives a shiny, oily surface, which is called "satin face." All tobacco does not go through this process equally well. Some of it comes out dead and lifeless in appearance and lacking in texture and elasticity. The loss in weight is also quite considerable, often amounting to 10 or 15 per cent.

CHAPTER XX.

CIGAR-LEAF TOBACCO AT THE WEST AND SOUTH.

During the last few years of agricultural depression, many special crops, heretofore confined to limited regions, have been experimented with in other sections. Where these experiments have proven successful, such crops have been largely grown. Not many years ago, the broom corn supplies of the United States came largely from the Connecticut valley, then the crop emigrated to the Mohawk valley, but now it is mainly grown in Illinois, Kansas and Nebraska. Hops were formerly largely grown in New England, but were superseded by hops produced in Central New York, yet the remarkable success of hop culture on the Pacific coast has caused such overproduction and low prices that it is a question whether the New York State hop industry will be able to maintain itself.

Whether a like state of affairs is destined to come about in the cigar-leaf tobacco industry remains to be seen. It is true that for many years this industry has been confined to limited areas in New England, Central New York and Eastern Pennsylvania, but it has long been a feature of Southern Ohio agriculture and, more recently, in Wisconsin. During the past six years, cigar-leaf tobacco has been experimented with in many other sections of the United States, and in some of these cases with such attractive results as to indicate that the industry is destined to have a large development in those regions. Promising results have been obtained in certain parts of Nebraska, especially at Schuyler, in

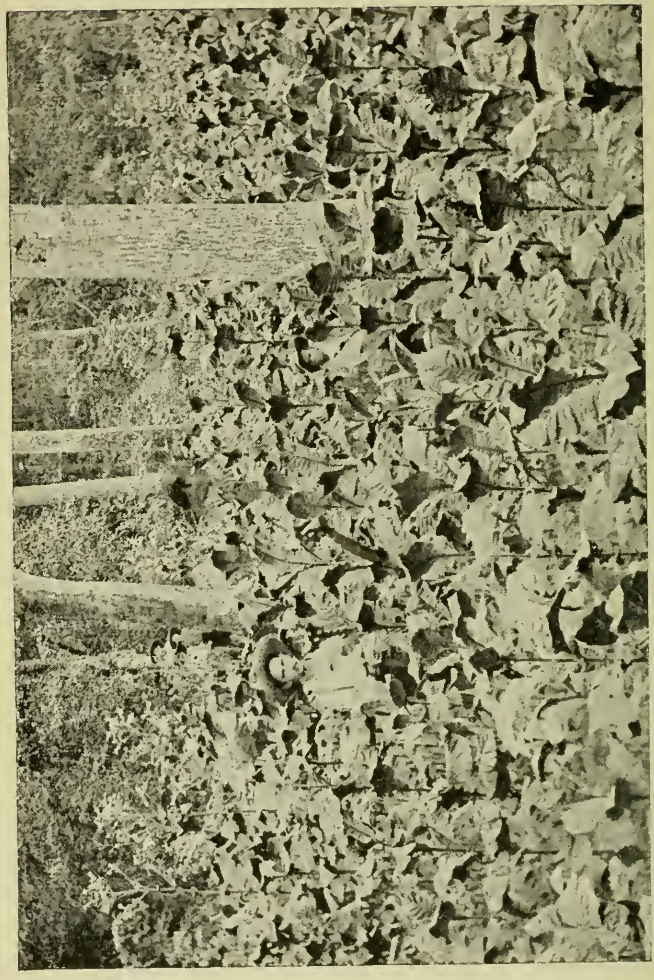

FIG. 123. GROWING SUMATRAN SEEDLEAF TOBACCO IN FLORIDA.

several localities of Colorado, and to a more limited extent in Washington, Oregon and California. In the latter State, cigar-leaf tobacco culture is now receiving the close attention of practical and scientific men, and should their work prove successful in obtaining leaf of good quality, its culture will doubtless be developed on the large scale characteristic of California enterprise.

In Texas, quite a number of crops of fine tobacco have been raised during the past three or four years, more especially in the southeastern part of the State, particularly in Montgomery, Victoria and Calhoun counties, the latter adjoining the coast between Aransas Bay and Matagorda Bay, Victoria adjoining it to the west. It is stated that one farmer, in Montgomery county, sold 8,000 pounds of cigar leaf grown, in 1894, on nine acres of "gray hickory" land, and that he got 40 cents per pound for the better grades for cigar wrappers, and a satisfactory price for the lower grades for fillers. Tobacco grown in Calhoun county has sold as high as 50 cents per pound. It is claimed for selections of the leaf grown in that section, that it is equal to the best tobacco grown on the Island of Cuba, for either fillers or wrappers. Well-informed Texas growers express a confidence that they will be able to successfully compete with tobacco grown in any part of the world.

The greatest interest and largest development of late years, however, of the industry in the so-called "new sections," has been in Florida and the adjoining counties of Southern Georgia. Forty years ago, much of this area produced a leaf which was considered desirable for cigars then in use, though most of the Florida crop, before the war, was exported to Bremen and Amsterdam, and was popular for its light color and mild flavor. But the industry languished until the tariff agitation of 1889 directed attention to tests that had been conducted privately in Gadsden county, and

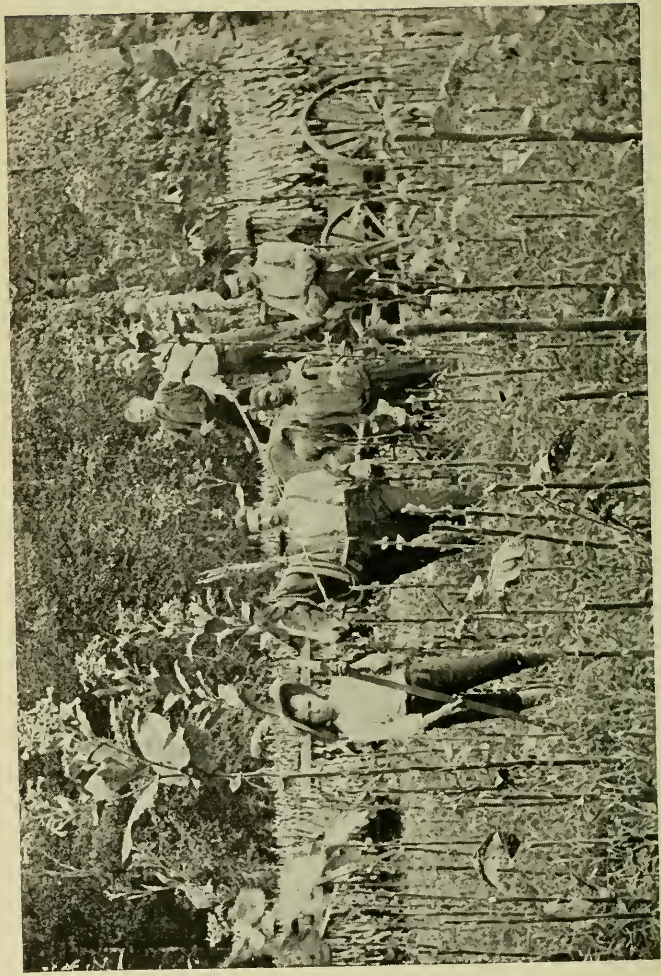

FIG. 124. HARVESTING SUMATRAN SEEDLEAF IN FLORIDA.

publicly by the Florida experiment station. The Florida tobacco "boom," started by the tariff of 1890, was short-lived, but the work has been persisted in. It is now demonstrated, since that date, that Florida has all the natural conditions necessary for growing cigar-leaf tobacco, both wrappers and fillers, of a quality equal to most of that which has been imported from the Island of Cuba in recent years, and wrappers of finer quality than those imported from Sumatra. These are strong statements, but they are justified.

The industry in Florida has practically three divisions: First, the culture of domestic varieties, which are rapidly giving way to (second) the culture of tobacco plants raised from the best Cuban seed, and (third) the raising of Sumatran seedleaf. The seed of the latter was obtained with difficulty by a man sent to Sumatra for the purpose. A little of this importation was planted in Connecticut and Pennsylvania, and has given promising results, but the bulk of the seed was distributed in Florida. The 1896 was the third crop of this new variety since its importation, and it is conservative to say that it has already revolutionized the cigar-leaf industry of Florida, and upward of 1,000,000 pounds of it were produced in 1896. Plates V and VI, on Page 36, give an admirable idea of this Florida-grown Sumatran seedleaf, which is quite different from all other tobaccos grown in America, or Cuba, and a view of a whole field of it is afforded on Page 434.

Havana wrappers and fillers have been grown very successfully in Northern Florida, the most extensive operations being conducted by the Owl Cigar Company, in Gadsden county, who also grow Sumatran leaf. This concern owns 17,000 acres, divided into nine plantations and each having its superintendent. It owns 146 barns (each from 40x60 to 40x108 feet), 210 tenements for laborers, besides its own mills, repair shops, etc.

At Quincy, it has four large warehouses, besides the buildings where the final fermentation and packing is done. The company raises 900 acres of tobacco annually, besides other crops, and packs 2500 bales of tobacco each year. It employs 1200 men in the growing season and 500 men the year through, at an annual payroll of $150,000. Other planters raised about 1000 acres of cigar leaf in the Gadsden section during 1896, making a total of nearly 2000 acres in that region, practically all of which is usually sold by the growers by October.

The plant of Sumatran seedleaf in bloom (except for its flower) reminds one of the common sunflower rather than of what we are accustomed to in tobacco. Its leaves are of so delicate a nature that after being fermented it will take about 200 of them to weigh a pound. Hence the wonderful "wrapping" capacity of this leaf—that is, the great number of cigars that can be covered with one pound of Sumatran seedleaf. The 1896 crop of it in Florida was nearly all bought up before election, at 20 to 50 cents per pound for the cured leaf, while it is claimed that selections of Florida-grown Sumatran leaf have sold to cigar manufacturers for $1.50 to $2 per pound, in appearance rivaling as cigar wrappers the finest imported from Sumatra, while in quality (that is, flavor, body, burn, etc.), surpassing the best Sumatran leaf. Unlike the leaf direct from Sumatra, which is so poor in quality as to be unfit for the bulk of the cigar (fillers and binders), this Sumatran seedleaf, when allowed to fully ripen, possesses quality and aroma that make it desirable for fillers, being wholly free from the bitter taste of the imported article. In this respect, it seems to improve after one or two years' domestication. In Florida, it does well on both old and new lands, while in Sumatra tobacco is grown largely on new land. Aside from its hardiness, thrift and quick-growing qualities, and the high price the best leaf commands,

FIG. 125. "STRINGING" SUMATRAN SEEDLEAF UPON LATH. LAKE CITY, COLUMBIA COUNTY, NORTHERN FLA.

this Florida Sumatran seedleaf is specially attractive to the planter, because, under the same conditions, it averages more pounds of cured leaf per acre than do other varieties heretofore grown in Florida. Sumatran seedleaf makes 800 pounds under average conditions, and as high as 1000 to 1200 pounds have been claimed in a few instances. Mr. Curry, who had 130 acres of Sumatran seedleaf under his charge in Florida in 1896, reports an average of 800 pounds of merchantable cured leaf per acre. Being so upright in growth, plants are set 12 to 15 inches apart, in rows three and one-half to four feet apart, giving 10,000 to 12,000 plants per acre. Col. F. B. Moodie, who has done much to develop the industry as president of the Florida tobacco growers' association, and to whom we are greatly indebted for much information, reports that with proper care seventy-five per cent of the crop will be fine A wrappers, the balance seconds, binders and fillers.

Imported seed is very delicate, but that from the first or second year's growth in Florida is much more hardy. But even in Northern Florida, it is never safe to sow this variety before the middle of March, by which time other varieties are usually transplanted. In Gadsden county, on the Gulf side, Sumatran seedleaf is transplanted as early as April 1 to 10. Under favorable conditions, it is a rapid grower, and within 40 to 50 days will attain the remarkable hight of six to eight feet, and when in flower nine to ten feet. It has been found best not to top the plant at all, and if at all, not until about four-fifths of the leaves have been harvested. Some top to 24 leaves, while others get 30 to 40 leaves on the taller plants. Early planted Sumatra is without spots, but the later planted crop is spotted. If the soil is poor, or the season dry, so that growth is slow, or if the plant is topped too low, the leaves are thick, dark and comparatively undesirable. Harvesting of the early crop is done from June 15 to September 15, by breaking off (or "priming") the leaves as fast as they "speck." Let it be noted that the word "speck" is used for "ripe." Indeed, this variety of wrapper leaf must not be allowed to fully ripen, as its texture and its popular and delicate light pea-greenish hue will be spoiled by deepening into the "brown and sear." If the leaves are allowed to ripen, they make a good filler, better still after one or more years' reproduction in Florida. If harvested before July 1, a second crop may be grown on the same land. In harvesting the tobacco crop, the stalk is not cut until the leaves are all gathered. As soon as the lower leaves are ready to harvest, they are plucked by hand, carefully laid in baskets covered with burlap, and brought in carts designed for this use to a tent at one end of the curing barn. Three or four pickings at different times are necessary, to handle the whole crop. The field work is all done by negroes, who are paid 75 cents per day, and are under white superintendents.

For hanging in the barn, laths are used. They are deeply notched at one end with a saw, and into these cuts the cord is drawn, which holds the leaves. Girls or boys string the leaves on these cords with a needle made for this purpose. The girls get 20 cents per 100 laths and will sometimes string 350 per day. The leaves hang face to face and back to back, a finger breadth apart, 40 to 50 leaves to a lath, as shown in Fig. 125. The laths hang from four to six inches apart on the poles in the barn, and a barn holds from 20,000 to 25,000 lath, being filled in a day or day and a half. The barn curing is done much as it is at the North, with careful attention to ventilation and moisture, but without artificial heat, as white vein and pole burn seem to be unknown. The cure is usually completed within 35 to 40 days, when the green color has disappeared from

FIG. 126. GROWING CUBAN TOBACCO IN SOUTHERN FLORIDA.

From a photograph taken Nov. 1, 1896. In the foreground, a crop ten days from planting is being hoed; in background, at right, tobacco 45 days old nearly ready to harvest, and at left, harvesting has begun. Showing also elevated water tank in distance that supplies the irrigation sprays illustrated.

the midrib. Then the leaves are pulled together in the middle of the string, with which they are tied into bundles and delivered to the buyer's warehouse, the assorting having been done at the time the leaves were strung.

The so-called "fermentation house" of the Owl Cigar Company, at Quincy, Florida, is thus described for this work by Dr. E. H. Jenkins, Ph. D., vice director Connecticut experiment station: "This house is perfectly equipped for its purpose, and in all its arrangements and the conduct of the operations, is a model of absolute neatness, order and good management. The rooms where the tobacco is handled over in any way are steam heated, so that the temperature can be kept at the desired point night and day. Without noting the thermometer, I should say that none of them were below 75° F., and the air is kept very moist with escaping steam. Tobacco lies loosely on the tables, without drying out at all. The tobacco is 'bulked' immediately upon its receipt for fermentation. The aim is to 'cook it in its own juice,' and no blowing or dampening of the leaf is allowed. This is regarded as vital to success. A 'bulk' is made by covering the floor with trash tobacco, fermented cuttings, etc., about six to eight inches deep. Uprights, to which boards can be tacked as the bulk is built up, hold it in place. On this trash tobacco, the leaves are laid, tied in hands. Trash tobacco is also laid next the side boards. The bulks which we saw were from five to six feet, or more, high, and when made are covered with trash tobacco and blankets. The temperature of the pile rises rapidly and sometimes will reach 180° F., in the center. When the expert judges it necessary,—in extreme cases, within twenty-four hours after the bulk is built,—it is all handled over and built again close by. The leaves which were in the middle of the first bulk are put on the outside of the second. The aim is not only to make the fermentation even for all the tobacco, but each hand is shaken out, as, otherwise, the leaves will stick together and be uneven in color, and it may be impossible to pull them apart without tearing. It may be necessary to repeat this turning of the bulks six or eight times before the process is complete. Often two bulks are mixed, if one is rather too damp and the other too dry. When the fermentation is done, the leaves are very carefully sorted as to both size and color, are tied into hands, these put in carottes and baled to 'age' for one or two years. They are first put into a warm room to cool down and finally into a cooler storage. While this process of fermentation is much more expensive than that of fermenting in the case, it has the great advantage that the time required is much less, and the whole process can be watched and controlled, whereas, when sweated in the case, there is absolutely no supervision or control possible."

Both spring and fall planting, in most parts of Florida, have advantages and disadvantages, but it is probable that the fall planting will become quite as general as spring setting. Fall tobacco in Florida will be in no more danger from frost than is the spring crop at the North, while the fall crop escapes grass and weeds, grasshoppers, and most of the worms and other pests. Only about one-fourth as much rainfall is needed for the crop in October, November and December, as during April, May and June. It is believed, also, that this late crop will average in quality superior to the spring crop, especially for fillers, as is the case in Cuba.

The best soil for this crop in Florida, Col. Moodie finds, after studying experiments in all parts of the State, to be a light, sandy loam, well drained, fine and friable, with no crude limestone cropping out, and particularly should it be free from loose arenaceous or so-called "rotten" limestone, common in many parts of northern, central and western Florida, where fossilized organic remains and phosphates are found. The tobacco field should be near a body or stream of fresh water, to insure humidity from the constant evaporation. In Gadsden county, where tobacco is extensively grown, the soils used are fine, light and sandy on the surface, but resting on a clayey sand at a depth of ten inches to two feet, which is quite moist, and at the same time readily permeable by water. In heavy rains, the water is quickly taken up from the surface, yet in very dry weather, the soil is damp at a depth of a few inches.

Opinions differ as to the proper manuring of soils of this character for tobacco. Moodie's advice is to make no application of stable or barnyard manures, except a light dressing of well-rotted manure on sterile soils, to impregnate them with the bacteria of nitrification. On the Gadsden extensive plantations, cottonseed meal is the only fertilizer used. The cautions in the use of manures and fertilizers that are stated in Chapter VI must all be observed, but much has yet to be learned about their application in the semi-tropics. Moodie maintains that the double manure salt (sulphate of potash and magnesia) is even preferable to the high grade sulphate of potash under Florida conditions.

Southern Florida, much nearer the tropics than the northern part of the State, is also coming to the front in tobacco culture. It has much the same climate and soil as Cuba, and has naturally attracted the attention of those driven out of Cuba by the war. The first plantation to be established was that at Fort Meade, Polk county, by the Cuban Tobacco Growers' Co., limited, incorporated in January, 1896, with a capital of $150,-000. Its officers, with one exception, are Cubans, and the president and general manager have had long experience in growing and handling tobacco in that island. Dr. E. H. Jenkins contributes to this work the follow-

FIG. 127. VUELTA ABAJO TOBACCO IN FLORIDA.
Ready to harvest, Nov. 1, at Ft. Meade, in 45 days from planting, grown by means of artificial irrigation.

ing interesting account of it, based on a visit made a year later.

The tobacco lands of the Fort Meade region are very light, deep, sandy soils, finer in texture than those of the Connecticut valley, and contain some humus. They have been covered, from time immemorial, with a growth of wood, the best of them with oak, hickory, live oak, magnolia, etc. At the time of our visit, no rain had fallen for many weeks, yet the soil was damper in appearance and feel than our Connecticut soils after two weeks of dry weather. Nevertheless, the company has put in an irrigating plant and uses it during the growing season.

The seed beds made on new lands, protected from light frost by the surrounding timber, and fertilized only with the ashes of the wood and trash cut to clear them, are sowed in January. On Jan. 15, some beds were not yet sowed, in others the plants were an inch high and were being weeded. The plants are set in the field early in March, at the rate of about 15,000 per acre. Native Cubans do all the work on the crops, which are cultivated wholly by hand, with short-handled, very heavy hoes. The only fertilizer used is Peruvian guano, at the rate of about 450 pounds to the acre. The land appears to be kept clear of weeds, and the plants are hilled up, but not quite as much, perhaps, as in Connecticut. The irrigating is done from standpipes six or seven feet high, with a spraying fixture which distributes the water (Fig. 126) over a circular area about sixty feet in diameter. The plants are suckered, and after topping have only eight to ten leaves on the average per plant, more leaves being left on strong plants than on feeble ones, and more on strong soil than on poorer land. It is stated that the plant, at harvest time, has the shape of an inverted cone, the top leaves being the largest, as appears in Fig. 127.

The first harvest is gathered early in June. The growing stalks are cut in sections, each carrying two leaves, and are hung on poles in the field, astraddle as it were, and close together. A preliminary sorting is done in the field, leaves of like character being hung on the same pole. These poles are carried to the curing barn by hand and put up for the barn cure. The barns built in the tobacco field are considerably smaller than those in New England or Pennsylvania. There is no arrangement for supplying artificial heat or moisture in the barns. The wrappers are kept housed till cured, but the fillers are occasionally brought out and hung in the sun and air during a part of the day, and always housed at night. During barn curing, as well as in the sweat, the crop is closely watched by the experts. Pole burn seems to be unknown. The whole process of sweating, "betuning," etc., requires considerable skill and experience, is a secret one, and naturally I made no inquiries regarding it.

When the first crop is cut, a sucker is left on the sunny side of each stalk, and this immediately starts to grow, and produces a second crop, sometimes in forty-five days, being already provided with a strong root system, and favored by the rains, which are more abundant from June on, through the summer. Even a third crop may sometimes be grown from the plants first set in February. Meantime, new seed beds have been made and the land is planted with tobacco a second time in September, and this is harvested in November or December. Under very favorable circumstances, a second (sucker) cutting may be made from the planting. The first cutting of each crop consists chiefly of wrappers. The second and third are for the most part fillers. It is stated that an acre of land should produce at least 1250 pounds annually, of which one-half should be wrappers. As none of the company's tobacco has yet been sold, no definite statement of price can be made. It is believed that it will command the same price as the best grades of imported Havana. This company was organized in January, 1896. Since then it is stated to have cleared 100 acres of land, and to have harvested and cured the tobacco from this area. The crop harvested in June has been fermented, and I smoked cigars made wholly of this stock. It is not yet regarded as ready for manufacture, however. The cure is not complete till May, and the tobacco should then "age" a year before it will be at its best. The company itself will double its acreage in 1897, and has opportunity for unlimited extension as soon as capital is secured.

Many farmers see in this enterprise a very hopeful outlook for men of skill and energy, and are preparing to grow tobacco under contract with this company. The terms of the contract are, in general, these: The farmer provides the land, barns and fertilizers. The company provides the laborers, to be paid by the farmer at the rate of one dollar per day for each working day, and a foreman to handle the men, also paid by the farmer. The work is also supervised by the manager of the company, without charge. The company sweats the tobacco and prepares it for market in the Cuban style, and for this receives one-third of the crop.

FIG. 128. ASSORTING HEAVY SHIPPING TOBACCO, PREPARATORY TO PACKING IN HOGSHEADS AND PRIZING, SADLERSVILLE, TENN. SEE PAGE 321.

PART IV.

Tobacco Manufacture.

MISCELLANEOUS.

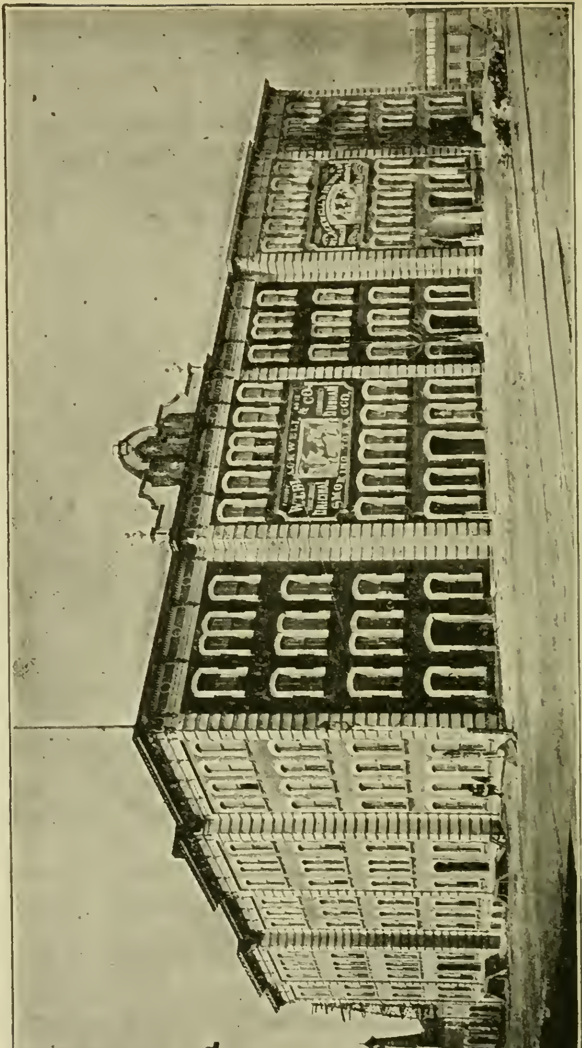

FIG. 129. ONE OF THE LARGEST FACTORIES FOR MAKING SMOKING TOBACCO.
Partial view of premises of Blackwell's Durham Tobacco Co., Durham, North Carolina.

CHAPTER XXI.

ON THE MANUFACTURE OF TOBACCO.

PLUGS FOR CHEWING AND SMOKING.

In no other line of manufacture is there so much to be gained by the proper selection and judicious use of the material, as in the manufacture of plug tobacco. How to combine the different qualities of tobacco, with what sauces to treat them, how to fashion the plugs or twists, and what markets are to be accommodated, require the most intelligent thought and the most skillful management. The tobacco leaf is exceedingly variable in its component elements. Its secrets are the secrets of chemistry and bacteriology. It presents endless problems and constant study for their solution. The manipulation differs with each variety or grade, and no two types or grades of tobacco will produce precisely the same results under the same treatment. The taste and flavor of the product must be agreeable to the consumer, and the tastes of consumers vary. What will suit one class of consumers would probably be very distasteful to another class. The man of sedentary habits prefers a mild, sweet tobacco, with a small content of nicotine. On the other hand, the field laborer, the sailor, the fisherman or the man living an outdoor life, is best pleased with strong tobacco. The habits, as well as the tastes, of men must therefore be considered by the successful manufacturer.

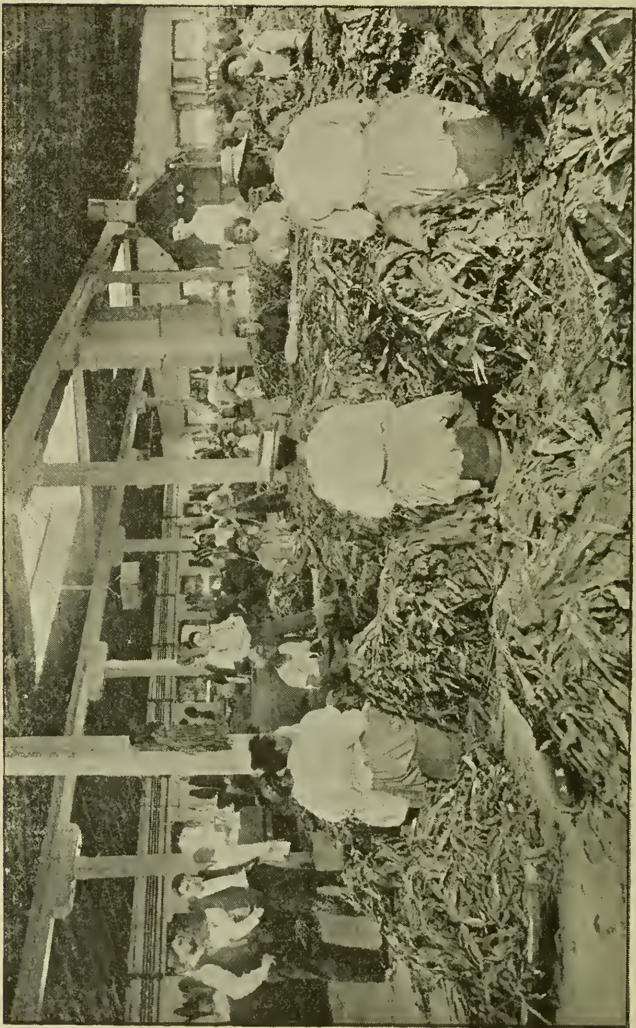

FIG. 130. LEAF ROOM IN J. WRIGHT CO.'S PLUG TOBACCO FACTORY, AT RICHMOND, VA.
Where tobacco is picked over, graded and stemmed.

The manufacture of tobacco has been going on for centuries, and from the simple operation of taking out the midrib and putting it up into twists, the industry now employs the most skilled labor and the most complete mechanical appliances for treating it with sauces, drying it by artificial heat, reordering it by steam, weighing, putting on the wrapper, and compressing into plugs in various forms and sizes.

The Burley of Kentucky and Ohio, and the sun, air and flue cured tobacco of Virginia and the Carolinas, constitute the fillers for the greatest part of the plug tobacco of the United States. The wrappers also come from Virginia, the Carolinas and the White Burley districts. The Burley fillers are sometimes whitish, but generally of a cinnamon color, of a tough, waxy finish and silky fiber. These fillers have more body and gum than the cutting leaf from the same districts. The raw material is put up in casks, of an average weight of 1000 pounds for Burley fillers, and 750 pounds for Virginia and Carolina wrappers. The tobacco is packed in uniform layers, and but slightly compressed, so the leaves may open freely.

In a properly constructed tobacco factory, the first work begins in the upper story, to which the hogsheads are elevated. The work begins in the leaf department. The casks are taken off, so as to expose the tobacco. It is taken up, bundle by bundle, and shaken. The inferior tobacco is thrown in one pile, and the better qualities assorted and put in other piles. Water is sprinkled over each layer of bundles as they are put in the piles, and the tobacco remains in this condition for twenty-four hours, so that the moisture may become evenly distributed. Women mainly, and sometimes men, are employed (see Fig. 130) in untying the bundles, and picking, leaf by leaf, assorting and separating them into the different qualities suitable for the various brands to be

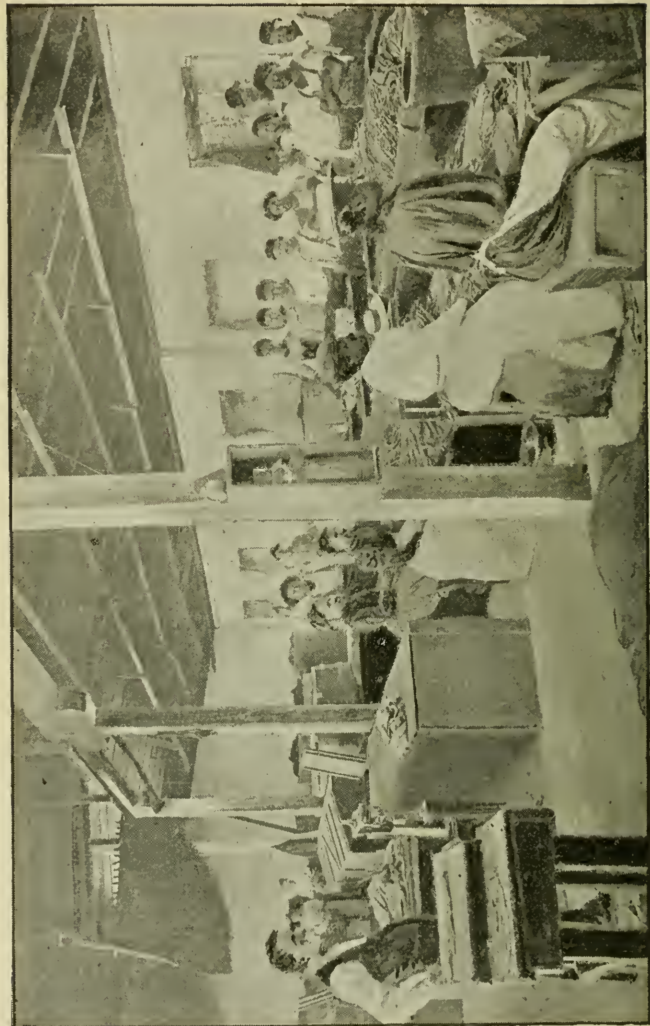

FIG. 131. WRAPPER ROOM IN J. WRIGHT CO.'S PLUG TOBACCO FACTORY, AT RICHMOND, VA.
Where the wrappers are picked over and graded, according to quality and color.

made in the factory. The leaves are then brought into a high state of moisture by steam, and the midribs or stems removed. The stems form about 30 per cent of the whole quantity, and the leaf about 70 per cent. After this, the strips or stemless leaves are passed, by chutes, to the next floor below, which is called the wrapper room (Fig. 131), where the sauces and other flavorings are applied by dipping the leaves in a vat filled with the flavoring liquids. These sauces are compounded and cooked in immense kettles arranged for the purpose, and their density is determined by hydrometers, so as to keep them true to the formula adopted. These formulas are usually one of the secrets of the manufacturer, and upon the popularity of the flavor used depend, in a great degree, the profits of the business. This sweetened and cooked liquid is poured into immense vats. After the leaves have been thoroughly saturated with the liquid, they are made to pass through wringers, so as to press out the surplus liquid, which flows back into the vat. The leaves are then passed over a series of heated rollers, becoming thoroughly dry, but are again reordered by steam and packed in bulk, to remain until wanted for making into plug.

The next step is to pass the mass of sweetened leaves, by a chute, to the floor below, or lump room, where it is weighed, enough at a time to make a plug, and this quantity is put in a shaper, which gives the desired form and size to the plugs. These pressed plugs are passed to benches or stands, where the wrappers are put on by skillful men. These wrappers are carefully selected, as to color and character of leaf, so that the same general appearance may be given to the plugs of the same class. All plugs deficient in weight or defective in color are rejected. The perfect plugs are now dried and packed in boxes for the floor below, where they are put in iron cases and pressed and creased (Fig. 132, Page 460).

The different brands require different hydraulic pressure. Shape mills and pot mills are used. While the plugs are under pressure, they are put in gums and allowed to sweat or ferment. Some brands are fermented lightly, others undergo a long process of fermentation. In each case, the purpose is to adapt it to the market for which it is intended and where it is in demand.

After this fermenting process, the plugs are taken out and again carefully inspected, the faulty ones being rejected and the perfect ones tagged and packed in boxes. When the boxes are filled, only enough pressure is put on to get in the heads. When these are fastened in the boxes, they are sent to the shipping room, where they are branded with name, size of the plug, and the gross and net weights of each box. There is a groove on each box for the government stamp, which must be placed on each package, and then varnished and canceled. The boxes are strapped in packages of five or more, for shipment.

Cut plug tobacco is carried through a similar process, except that it is not wrapped. It is made into various sizes, blocks or slabs, and cut into slices for fancy tin or paper box work, or shagged for boxes or pouches, as customers may desire. Cut plug is made by a costly patented machine, constructed for the purpose. It is put up in packages varying in weight from two to sixteen ounces, stamped and packed in wooden cases for shipment, according to the requirements of the trade.

The J. Wright Company, of Richmond, Va., to whom the authors are indebted for the cuts that accompany this description, and also for the main data contained in it, is one of the largest plug manufacturing establishments in the world. The company has every modern appliance, convenience and improvement for facilitating the work and obtaining the highest results, as to the excellence and handsome appearance of their products.

It uses seven distinct styles of wrappers: 1, Lemon; 2, orange; 3, bright mahogany; 4, dark mahogany; 5, piebald or tortoise shell; 6, black wrapper; 7, cherry red. The factory employs from 350 to 400 hands, and has the capacity for turning out 15,000 pounds of manufactured work daily. Every department is thoroughly organized and run on correct business principles. An idea of its works is given in Fig. 133, Page 462.

THE MANUFACTURE OF SNUFF.

There are five kinds of snuff manufactured in the United States: The Scotch or "eating" snuff, the maccaboy or inhaling snuff, the sweet snuff and salting snuff, the two latter being used for dipping. Rappee snuff is made, to some extent, in the United States, but largely in France, from American tobacco.

The material used for making Scotch snuff consists of heavy, dark tobacco of medium grade, and good "fatty" lugs. The stock is kept at least two years in hogsheads before it is used. It is then taken out, bundle by bundle, and passed through a cutting machine, where the leaves, including the stems, are coarsely cut. When cut, it is packed in hogsheads and made to go through three successive fermentations.

In these processes of fermentation, the heat reaches from 90° to 100° F. Each period of fermentation is arrested by exposing the tobacco to the air. It is then repacked and made to go through another fermentation. After three fermentations, which require about six weeks,—sometimes more, sometimes less, according to the richness and character of the tobacco used,—the tobacco is thoroughly dried, by exposing it in wide, flat iron pans for a short time to a high degree of heat. It is then carried from the pans to pulverizers, which consist of a series of mills, each of which has three heavy iron rollers rubbing against the concave and inner sur-

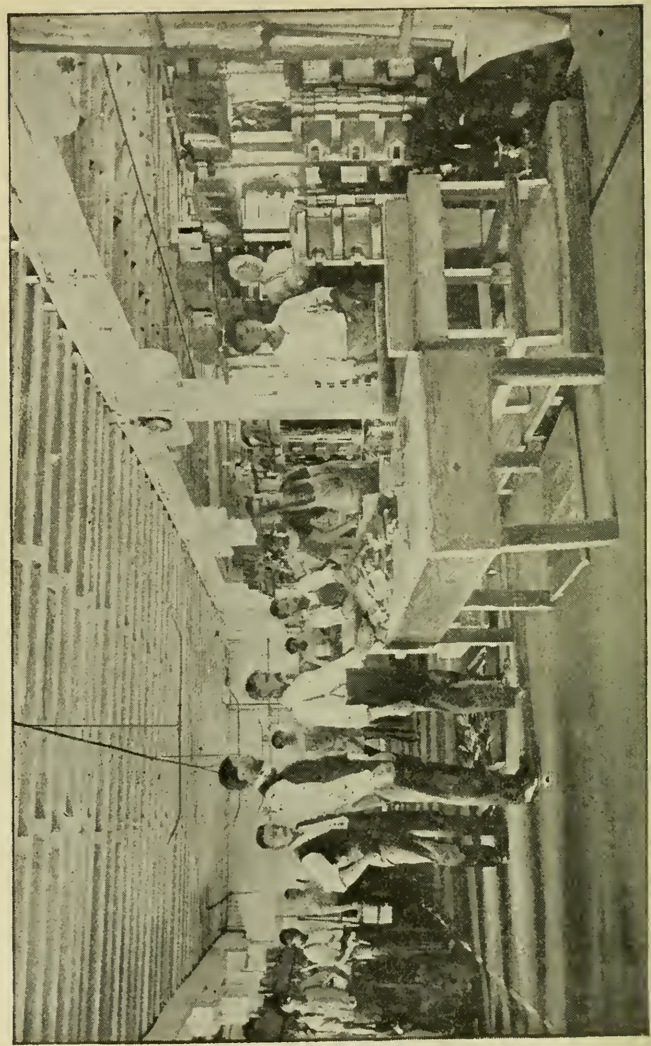

FIG. 132. "PRESS ROOM," WHERE THE PLUGS ARE PRIZED AND PACKED IN BOXES.

face of a hemispherical iron vessel, the pulverized tobacco being discharged through an opening in the bottom, like that of a fixed wash basin. The snuff passes from the pulverizers to bolting cloths, not unlike those used for bolting flour. After it is bolted, the process of manufacture is completed. The snuff is then, by a machine, packed automatically in six-ounce bottles made for the purpose, or in four-ounce tin cans, and put in wooden boxes holding eighteen pounds or less, for shipping. The largest market for this snuff is Germany. It is used extensively, especially by the negroes, and to a lesser extent by white people, in Louisiana, Mississippi, Arkansas, Texas and the Indian Territory. Smaller quantities are used in all the States.

Maccaboy snuff is used, both for inhaling and the mouth. It is highly perfumed, the attar of roses being the chief ingredient. It is consumed largely in New England. Until recently, only Virginia tobacco was employed in its manufacture, but now about an equal quantity of Tennessee, or Kentucky, and Virginia is used, and it consists of a heavy bodied leaf of a waxen character. The snuff is darkened by being scorched to some extent, and by being subjected to treatment by dark sauces.

Sweet snuff is made, like Scotch snuff, by treating the leaves of tobacco with some preparation of licorice before the snuff is made. It is used exclusively for dipping, and finds the greatest number of consumers in the Carolinas.

Salting snuff is made of the same character of tobacco as Scotch snuff, but it is salted. It is also used for the mouth.

Rappee snuff is made exclusively from Virginia tobacco. It is manufactured principally in France, the tobacco for that purpose being imported by the regie contractors. Years ago, when the dark crop of tobacco was much larger than it is now, the French government aimed to secure for this purpose a short, waxy leaf, and heavy bodied, low grades, but the area of dark tobacco having become circumscribed in Virginia, as compared with that for bright leaf, these fine grades of short leaf and best lugs have been in demand for the German markets at such high prices that France now substitutes a commoner grade of Virginia tobacco for making rappee snuff. This lower grade is soaked in some decoction which turns it black, after which it is dried, prized and sent to France for that purpose. Rappee snuff is used

FIG. 133. PLUG TOBACCO FACTORY OF J. WRIGHT CO., RICHMOND, VA.

altogether for inhaling. The practice of inhaling snuff through the nostrils was once very common, but this habit has nearly gone out of use. It was once much affected by royal personages, and snuff boxes were considered not inappropriate presents from one monarch to another, or from kings to those subjects who had distinguished themselves in the battlefield or in the councils of the State.

Much of the information contained in this article was furnished by Mr. B. F. McKeage, of the snuff factory belonging to the Stewart-Ralph Company, of Clarksville, Tenn. This factory, under his management, is supplied with the most modern machinery and convenience for making Scotch snuff, and it has a capacity of 8000 pounds per day.

PIPE-SMOKING TOBACCO.

The manufacture of this article, as the working of tobacco for any purpose, involves the most experienced judgment and knowledge of market wants and consumers' tastes. The various kinds and qualities of leaf are carefully assorted and brought together in the desired quantities and proportions. The leaf is then cut into flakes and afterwards granulated by a machine made for the purpose. By straining the granulated product through sieves, the exact size for pipe smoking is separated. The tobacco for granulation should contain enough moisture to prevent its being ground into powder or snuff, when it could be drawn through the stem of a pipe in smoking, causing discomfort to the smoker. The granulated tobacco is dampened with spirits, or liquids, of special formulas, in order to keep it in proper condition when packed. Certain flavors are also added to certain brands in the process of manufacture. Smoking tobacco is packed by machinery in cotton sacks of various colors and sizes, each holding from two ounces to a pound. The sacks are provided with a draw string and an internal revenue stamp is put upon each sack. Some tobacco is not granulated, but simply cut into shreds for smoking, Perique being often so prepared. The making of these bags constitutes an important department, and 100,000 of the sacks are produced daily in the Durham factory described herewith. The manufacturers' labels are pasted upon the sacks in the stamping room, and the filled bags are packed in paper boxes, these being shipped in wooden cases. The box shop and printing office (Fig. 134) is an important department of a large factory, while the packing room (Fig. 135, page 476,) is larger and employs even more help. The internal revenue stamps are put onto the packages in a special department, called the stamp room and canceling room (Fig. 136), in which millions of stamps are used and canceled, the amount paid for stamps by the Durham Company reaching upwards of a million dollars a year. A new machine automatically packs tobacco in the bags and labels them.

The largest manufactory of pipe-smoking tobacco in the world is that of Blackwell's Durham Tobacco Company at Durham, N. C., the main building of which is illustrated in Fig. 129, and glimpses into some of its departments are given in illustrations 134, 135 and 136, all made from photographs taken specially for this work. This business was established by the late John R. Green, who selected the famous trade-mark of the Durham bull that is now so familiar all over the habitable globe, this trade-mark being an absolute guarantee of a quality of smoking tobacco that never varies and never deteriorates. W. T. Blackwell succeeded the founder of the business, and later, Mr. Julian S. Carr became president and has enormously developed the business, which has resulted in the development of a populous and prosperous city at Durham. The premises occupy 13 acres of ground and the main factory has a frontage of 350 feet, exclusive of seven large warehouses for the storage of tobacco, besides outbuildings, engine room, stables, etc. The company also manufactures cut plug tobacco for either chewing or smoking, and during the busy season employs 1000 hands.

FINE CUT TOBACCO.

Fine cut tobacco is only the leaf cut into fine shreds. The tobacco employed for this purpose in the United

States is very thin, chaffy and, as far as possible, destitute of gummy matter. It is stemmed, moistened and pressed by a screw into a trough, and fed by machinery to a series of knives arranged around the outer circumference of a wheel. The wheel is made to revolve with great rapidity. After the tobacco is cut into fine shreds, it is spread upon trays and exposed to heat, which causes the compressed shreds to fall apart. The cut product is packed in buckets and sometimes in boxes or bags. It is used for chewing, smoking and the manufacture of cigarettes. When used for chewing, it is sauced with sweet liquids as plug tobacco.

CIGARETTES AND CIGARETTE TOBACCO.

The manufacture and consumption of cigarettes has increased amazingly in the United States during the past 20 years. The production in the United States in 1875 was 41,000,000 ; in 1896 it was 4,000,000,000, or nearly 100 times as great.

Cigarettes of the best quality are made of tobacco from three to four years old. The leaves are verv carefully selected, stemmed and dried, and then brought into order and cut into shreds, of which the finer qualities of cigarettes are made. It requires four pounds of leaf tobacco, or three pounds of stemmed tobacco, to make one thousand cigarettes. The wrappers are of either tobacco or paper. When made of tobacco, the best leaves are used for this purpose, and the wrappers are cut by hand between the veins, so that the small stems, or veins, will not show on the cigarette. The paper used is made mainly in France and is called rice paper. It burns without odor and almost without ash. It is very thin, but tough and almost transparent, and is said to be made from the fiber of the cocoanut palm. Paste of the finest quality is used for cementing the wrappers ; sometimes the wrappers are fastened by crimping the edges. After the tobacco is cut, it is dried and made ready for working, either by hand or by a machine. The machine for making cigarettes (of which there are about 25 different kinds), although simple to operate, is a wonderful piece of mechanism, which takes the to bacco and converts it into perfect cigarettes at the rate of 100,000 to 200,000 per day of 10 hours.

Before the invention of this machine, cigarettes were made almost entirely by girls, whose deft fingers enabled them to do the work more rapidly and more neatly than when done by men. The average number made by each girl is about 2000 per day, sometimes 2500, by which it appears that one machine, operated at a minimum capacity, can do the work of about 50 girls in the manufacture of cigarettes. A large number of girls, however, find employment in packing and stamping the product turned out by the machine. The packages are put up in a highly artistic and attractive way, so as to catch the eye of the consumer.

There are some markets in which the handmade cigarettes are preferred to those made by machinery, and the supply for these markets are made by girls. The all-tobacco cigarettes are made by hand, and the wrappers and fillers used are of the finest selections of Virginia and Havana tobacco. The fillers are first pressed in molds and then wrapped, just as cigars are made. Virginia fillers are preferred by most manufacturers. An expert maker of cigarettes can earn from $1.50 to $2 per day. All-tobacco cigarettes require the greatest care in the selection of suitable tobacco.

One of the leading manufacturers of cigarettes in Richmond, Va., Cameron & Cameron, blend together, for making cigarettes, various kinds of tobacco, embracing the Virginia, North Carolina, Turkish, Perique, Havana, Latakio and Brazilian. The manipulation of so many kinds can be successfully accomplished only by long experience, good judgment, acquaintance with the markets and with the tastes of the consumers. Two weeks are required from the time the tobacco goes into the factory until it comes out in the form of cigarettes.

THE MAKING OF CIGARS.

This is "easy enough when you know how," but as has been stated (Pages 71-75), the ins and outs of making cigars are to be learned only by practical experience. The selection of the qualities of leaf for the different parts of the cigar requires a peculiar combination of experience, knowledge and taste, that brings to its happy possessor a large salary in the great cigar factories. The leaf, or part of it for the cigar, is often treated with sauces, or special preparations, to improve its quality, to hide its inferiorities, or to suit certain tastes. It must also be properly moistened to work nicely. In Havana, Catalan wine is sometimes put in the water in which fillers are immersed, to improve the quality.

The regulations of the internal revenue bureau impose strict accountability upon cigar makers, as well as upon manufacturers of other leaf, for all of the tobacco they use. Evasion of these rules is heavily punished, and the system has been reduced to an almost perfect state, to secure the utmost amount of revenue from the taxes imposed, with the least interference with the trade, or inconvenience to manufacturers. The maker of cigars has to conform to government rules, and this involves certain restrictions. The government even limits the number of pounds of cigar leaf required for certain purposes, and every bit of leaves, stems, waste, etc., must be accounted for. The allowance is 25 pounds of wrappers, binders and fillers for 1000 cigars. The way in which this quantity is divided varies according to the kind of cigars made and quality of product. Two pounds of the very finest quality of Sumatran leaf has wrapped 1000 five-inch, handmade cigars, and four or five pounds finest quality domestic seedleaf, but a less amount is required to wrap form-made cigars. An experienced manufacturer estimates as a fair average four pounds wrappers, nine pounds binders and twelve pounds fillers to make 1000 cigars of ordinary size and good quality; another says five, eight and twelve pounds respectively, and still another, seven, seven and eleven pounds.

Machinery has already invaded the field of cigar manufacture. At present, however, only about 12 per cent of the cigar factories of the United States are sufficiently large to profitably employ the most modern method of machinery. In Europe, still fewer factories are of sufficient size to warrant the investment necessary in a machine plant, except in the Regie countries. The history of the development of the application of machinery to cigar making is full of interest. The suction roller table has, to a certain extent, revolutionized cigar manufacture, and, at the present time, it is claimed that about one-fifth of the cigars made in the United States are rolled upon it. Many of the cheap cigars are made in the larger factories, either throughout or in part, by machinery. One of the most useful and most common is the stripping machine, which contains a small round knife that cuts the stem out clean, without tearing the leaf. Space forbids a detailed description of the various machines employed. Even the details of cigar making by hand, vary with different workmen and in different factories, but the bulk of the cigars consumed in the United States are still made by hand or form. Cigar makers are thoroughly organized and obtain excellent wages. The handmade method of cigar manufacture is about as follows:

Casing.—When the manufacturer opens the one or more cases, or bales, of tobacco he has purchased to carry on his business, he finds the contents very dry and breakable. This dry tobacco has to be carefully taken out, as needed, piece by piece, shaken gently to separate the leaves, dipped thoroughly in a tub of water and removed, or well drenched with a sprinkling pot, and left to "draw" over night. It is then moist and pliable, and ready for stripping.

Stripping.—This is done mostly by girls and women, and consists in stemming and booking. The worker is given a quantity of tobacco, and she first takes the stem out of each leaf and puts the divided leaf in a little pile. Then, when she thinks she has enough stemmed tobacco, say for a pad, she smooths out over her knee, or books, each piece, and when she has enough for a pad (the weight may or may not be defined), she doubles the smoothed-out pile over once and ties it up, and this tied-up bunch is the pad. Of course, the wrapper stripper is given the finest and most costly tobacco, that which is to be used for the outside of the cigar, and as even this contains a good deal of inferior leaf, she must throw aside such into the binder pile, and it is included by the binder stripper in the binder-leaf tobacco that has been given her to strip. Sometimes there is a leaf selector, who does nothing but sort out the inferior leaf from the unstemmed wrappers, and then the wrapper stripper does not have to stop to do any sorting herself. It is only the expert stripper, she who has the best and most practical understanding of the kind of leaf requisite for wrapping cigars, and who has the delicacy of touch and the trained eye for color to enable her to make a quick decision of the unsuitability for wrappers of the leaf she handles, who is accepted as a wrapper stripper, and she, of course, is given higher wages than the handler of binders and fillers. The fillers are partly stemmed and thrown carelessly into a pile, except the finer grades, which are more often booked. The fillers

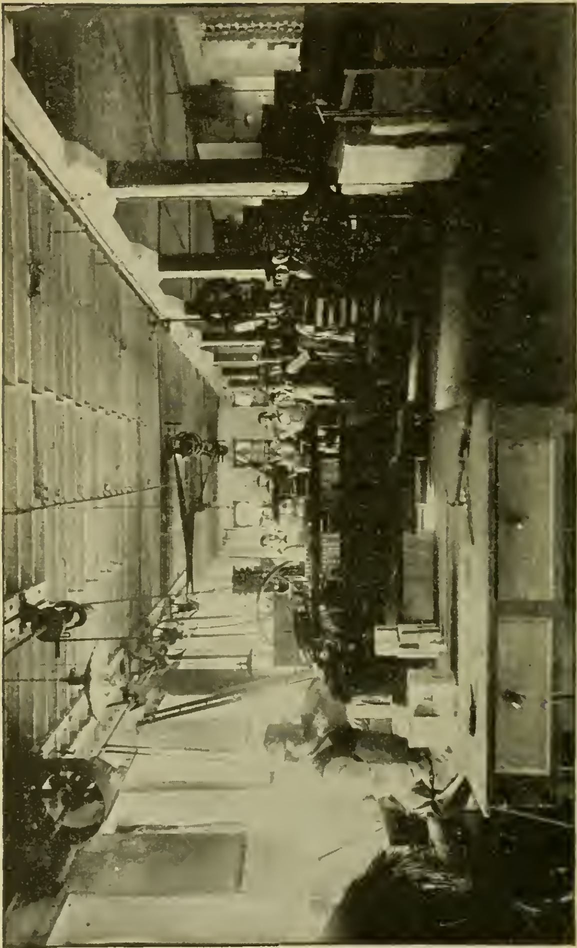

FIG. 134. BOX SHOP AND PRINTING OFFICE, BLACKWELL'S DURHAM TOBACCO CO., DURHAM, N. C.

that are not booked sometimes get too dry for use, when they are moistened, and also often treated with a flavoring preparation.

Preparing for Work.—The workman sits at a table, which contains a drawer for waste, and on which is placed a rack for holding the cigars he makes; he has also, attached to his table, a "board" of some hard material, on which he rolls his cigars, a stationary knife (tuck cutter) for cutting them off the desired length, a box of gum tragacanth colored with licorice to make it of the color of tobacco, with which he pastes the ends of tobacco around the tip or head of the cigar, and a smaller knife to cut the leaf. At his side is a box of fillers. On the table at the left is a pad of wrappers, unbound, and covered over with a damp cloth, and in front a pad of binders. He is now ready to go to work.

The Making of Handmade Cigars.—The workman takes a wrapper leaf from under the cloth at his left, spreads it out on his board, and cuts it into one, two or three wrappers (remember, that what is now called the leaf is but half of the original leaf, since the middle stem has been taken out). If this leaf (that is, half leaf) is very fine, he can, perhaps, cut three wrappers, but generally this is not done, as the veins are likely to get too thick as you get down to the butt of the leaf, and it will not do to have the thick veins show on the cigar covering. Sometimes, in large factories, the Sumatra is divided into three parts, No. 1, 2 and 3. If the workman gets a pad marked No. 1, he knows he is expected to get one wrapper out of each leaf; No. 2 requires two wrappers, and from No. 3 he is expected to cut three wrappers. The wrapper being cut into, say, two pieces, the workman lays them to one side, throwing what is left into his drawer. Next, he takes a binder, lays it on the board, breaks it into a large and small piece, throws the bits not wanted into the drawer, then takes the larger piece and smooths it out, lays the smaller piece on top of it for the inside lining, gathers up a handful of fillers, which he makes of the right thickness and nearly the right length, then puts this filler bunch inside the binder and rolls it up smoothly by hand. If the filler is not put into the binder straight, the binder will roll up twisted and the cigar will smoke one-sided. When the binder is rolled up over the filler, then the wrapper is rolled on, tucking it well in at the beginning, and rounding it to a more or less pointed tip or head, which is pasted together with the gum tragacanth, cutting the head neatly around with the hand knife. In some factories, a thimble is used to more perfectly and neatly shape the head. Then the cigar is set under the stationary knife, or tuck cutter, and cut off the desired length at the butt or tuck, the name being derived from the careful tucking in of the wrapper at this place. This cutter contains a movable contrivance for measuring the desired length of cigar, which varies from three to seven inches. The cigar is now finished and set in the rack, head front.

Form Cigars.—These are made the same as the handmade, except that the bunch of fillers is not so thick, and is put into a wooden form of any desired shape, which varies from a Perfecto shape, which is pointed at both ends, to a straight cigar, of even thickness all the way through. These molds usually hold twenty bunches. When the mold is filled, it is placed under a press for seven or eight hours, or longer, when the bunches are ready to be taken out and covered with the wrapper. These form cigars are usually of an inferior grade to the handmade, and do not require such expert workmanship. Of course, high-grade cigars can be made with the form, but the smoker generally gets more for his money in the handmade, in which the filler bunch is more solid, causing the cigar to be filled with more smoking material. In some large factories, however, the "handmade" workman is required to use a shaper, a small mold that will contain and shape one bunch while another is being got ready. This workman need not be so expert in his ability to make the cigar of just the required shape from the sense of feeling as is the genuine handmade worker.

Packing.—The filled rack of cigars is taken from the workman's table into the packing room, and the packer, who must be an expert at distinguishing colors, sorts the cigars into the five common colors, the cigar being "stronger" as the color grows darker. The packer also inserts the box scent, then tacks down the cover.

The Flavoring or Scent.—Inferior fillers are often "doctored" with sharp-flavored liquids to improve their taste, such as rum and water, alcohol and water, various sour wines, cider, vinegar, etc. Box scent, so-called, is not necessarily used to cover imperfections, but to keep the cigars, which are sometimes shut up for a long time, and would likely suffer from atmospheric changes, in good flavor and smell. Still, this scent has a good deal to do with the popularity of even fine-grade goods, and the secret of its various combinations is impossible to discover from the manufacturer who makes a popular brand. Various articles are, of course, used, among them being Spanish licorice, rum, lemon, cedar, vanilla bean, the oils of various spices, and so on ad infinitum. Then there are many flavors on the market, but the secret of their manufacture is kept, and while a good deal of these prepared flavors is bought, the ambitious manufacturer is ever on the alert to discover some more popular combination. The packer sprinkles a little of the scent he is required to use in the bottom of the box, or on the top or middle row of cigars.

The Waste.—The bits from the wrappers and binders in the workman's drawer, together with refuse left from the fillers that were too short to be used as such, and the tucks that are cut off from the cigar in measuring its length, are dried and run through a sieve, and thus made into scraps, of which the cheapest or scrap cigars are made, these siftings being used as filling. They are also used to manufacture cigarettes. These scraps are, in turn, run through a finer sieve, and the comparatively very small amount of dust that runs through, which consists of about five per cent of the whole amount of tobacco used, is employed for snuff, or sold for fertilizing purposes.

CHAPTER XXII.

TOBACCO AS A REMEDY.

Tobacco has almost passed out of the *materia medica* in the modern practice of medicine. Rarely is it now prescribed for any ailment whatever, though at one time it was thought to be a specific for many diseases. Within recent years, however, attention has again been directed to tobacco as a remedial agent, through the efforts of the late Gen. T. L. Clingman, of North Carolina, who for many years represented that State in Congress, first as a representative and then as a senator. Gen. Clingman believes there is no remedy so effective for relieving wounds, bruises, sprains, etc., as tobacco applied externally, in the form of a poultice. He cured a severe sprain of the ankle by poulticing it with wet tobacco leaves and keeping them moist. A severe gunshot wound of the leg was cured by wrapping the limb in leaf tobacco covered with wet cloths. An injury to his eye was also cured by a wet tobacco poultice. Its effect seems to be to take out all the inflammation, and where promptly applied, Gen. Clingman claims, any external wound cannot become sufficiently inflamed to cause mortification. In case of his eye, sight was given up by all the doctors, but after the tobacco poultice had been kept on five days, the eye resumed its natural appearance and the sight was fully restored. He reports physicians using a tobacco poultice since then, and cites many instances of its successful application for sore eyes, sore throat, erysipelas (some very bad cases), sciatica, bunions, corns, bites, boils, tumors, swelling of various

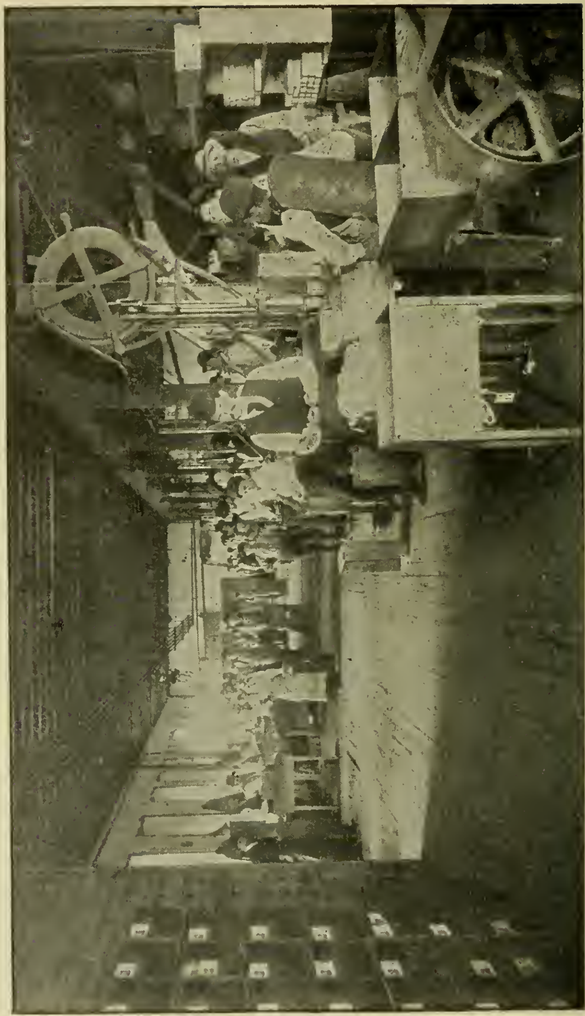

FIG. 135. PACKING ROOM, BLACKWELL'S DURHAM TOBACCO COMPANY (See Page 463).

kinds, colds and similar troubles. When the wet tobacco is applied, says General Clingman, the first effect is stimulating. In twenty or thirty minutes, however, the sedative effect is perceived. When it is placed on the eyelids, as some of the juice gets into the eye, there is usually an itching sensation and a little pain, but in a few minutes this passes off and there is no more feeling than if a wet cloth were applied. Most persons sleep under the influence, but some do not, as it is a nerve tonic as well as a sedative. If the tobacco be applied only to the affected parts, no nausea will be felt until the inflammation has been subdued, when the bandage should be removed. Generally, two hours after application a sedative effect is attained, but in obstinate cases a much longer time may be required.

Leaf tobacco should be used for the poultices, but if this is not practicable, manufactured, or plug, tobacco, well softened in water, may be applied, but the latter frequently contains drugs that may interfere with its usefulness. The darker leaves are stronger and better than the light yellow leaves. Leaves of plants cut last year are better than those freshly cut, as tobacco seems to gather strength with age. A bunch of these leaves, thrown into a bowl of cold water, will become moist and soft, so that the large stem in the center may be taken out. Hot water will answer the purpose sooner than cold, but either will do. When this is done, not less than two thicknesses of the leaf should be placed directly on the part to be relieved. As, however, the heat of the skin tends to dry the tobacco in a few minutes, a wet bandage must be laid over it. About four thicknesses of common white cotton cloth will be sufficient, but this should be well soaked in the water before it is put on, then a bandage of the same cloth may be tied over it, and water from time to time should be applied by pressing a wet rag on it, so as to keep the

FIG. 136. STAMPING ROOM, BLACKWELL'S DURHAM TOBACCO FACTORY (See Page 463).

tobacco moist. When one wishes to cure a bunion or corn, after the tobacco has been applied as above directed, it is easy to get the sock over it, and by moistening the sock from time to time, a cure is usually effected in a single night.

General Clingman, speaking of cases coming under his own observation, says: "All cases of erysipelas, whether on the head or face, or any other part of the body, are cured. In some cases, where the head was swollen to almost double size, and the patient was supposed by the attending physician about to die, an application of tobacco effected a complete cure. Again, all cases of sore eyes, whether caused by injury or disease, and whether old cases, or fresh ones, have been cured. In some cases, where there was total blindness, a cure was at once effected and the sight restored perfectly. In the third place, all wounds, whether cuts, bruises or contusions, have been easily cured. Sprains of the knee or ankle joints, where they were swollen to double the natural size, have been completely cured by a single night's application. Old cases, where the patient has suffered for months and years, have been cured. Cases of sore throat are cured, whether caused by diphtheria, croup, scarlet fever, or quinsy. In more than one instance, the patient was cured when seemingly at the point of death, and the case pronounced hopeless by the attending physician. Bone felons have been cured, usually by a single night's application of the tobacco."

General Clingman was informed of a number of cases in which the tobacco was applied as a remedy for hemorrhoids, and in every instance a single night's application is represented to have effected a cure. If tobacco should be applied to a wound, neither mortification nor lockjaw would ever supervene. In one case of lockjaw, where the surgeon had pronounced the case hopeless, according to the public statement of a gentleman, a cure, it is asserted, was effected by the application of a tobacco poultice to the stomach.

For cholera morbus, an application of tobacco to the stomach, it is said, gives relief. A senator told him that when suffering constipation most terribly he had

FIG. 137. A PEEP INTO THE "DURHAM" OFFICE (See Page 463).

two physicians with him for two days and nights, with no advantage from their remedies, and when the pain became so intolerable that he felt that he would not get through the night, he caused a poultice of tobacco to be applied to his side and back, and in half an hour he was relieved and immediately recovered. Again, a great many cases of neuralgia, whether the case was accompanied with inflammation or not, General Clingman says, have been cured by tobacco. In one case, the patient said his eye was so much inflamed that it seemed about to burst, and the application effected a complete cure. Physicians in some parts of North Carolina aver that all cases of orchitis are cured by tobacco, and usually in one night.

Tobacco is a very valuable insecticide for use against vermin on domestic animals, and in the greenhouse, as well as for other pests. It may be used in the form of a decoction, in smoke, or dry. The refuse stems and powders from the cigar factories are very valuable as insecticides and fertilizers, and frequently, in the Middle Western States, they may be obtained for little, or nothing. The decoction is made by boiling refuse tobacco stems or dust in water, or pouring water over them. This gives a concentrated liquid, which is to be diluted with cold water, until there are two gallons of water for each pound of tobacco used. It is a good remedy for plant lice. A stronger formula, recommended by Mr. M. V. Slingerland, is to steep five pounds of tobacco stems in three gallons of water for three hours; then strain, and dilute with enough water to make seven gallons, when the decoction is ready to use. A cheap grade of tobacco is employed in making a sheep wash. About 20 pounds of tobacco is steeped, or boiled, in 40 gallons of water, and the sheep dipped in the liquid. This is a sure remedy for ticks and other vermin; and is of frequent use by the flockmasters of the West.

No application to young fruit trees is so effective in destroying grubs and other pests as tobacco. Tobacco stalks may be used for the purpose. They are piled up around the roots of the trees, about a large armful to each tree. These stalks are also an excellent fertilizer

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for the young trees, stimulating their growth without producing a dryness in the soil, or attracting vermin, as stable manure often does. After the decay of the stalks, the ground is left mellow and moist.

Tobacco stems are an excellent top-dressing for young grass. They conserve moisture and add fertility to the soil. Applied to wheat fields in autumn, in any form,—leaves, stalks or stems,—tobacco exerts the most beneficent influence, both on the character of the growth and the quality of the berry. In a pulverized condition, it makes one of the best applications for seed beds. Put in the hills where the tobacco plant is to be set, it greatly aids the growth and improves the quality of the cured product.

APPENDIX.

Chemical Analyses.
Statistics of Yield and Manufacture.
Prices in Home and Foreign Markets.
Taxation and Consumption.
Books on Tobacco.
Index.

APPENDIX.

CHEMICAL ANALYSES OF THE TOBACCO PLANT.

R. J. Davidson, at the Virginia experiment station, is doing (1890-'97) a great amount of original analytical work of practical value, from which we condense the following :

Table IX.—COMPOSITION OF VIRGINIA LEAF (AVERAGE OF MATURE BRADLEY BROADLEAF, GOLD FINDER, PLANTS OF WHITE BURLEY AND YELLOW ORINOCO).

				100 lbs. of each part of the plant contains		
	Leaf.	Stalk.	Root.	Leaf.	Stalk.	Root.
Percent. of parts of plant,	55.03	21.87	23.10			
100 lbs. each part contains						
Water	7.62	6.18	6.22	7.62	6.18	6.22
Ash	21.59	13.28	8.14			
Vegetable matter	70.79	80.54	85.64			
Total	100.00	100.00	100.00			
Contains nitrogen	4.37	3.17	1.88	4.37	3.17	1.88
100 lbs. of the ash contains						
Potash	26.60	37.78	22.07	5.74	5.02	1.78
Lime	25.21	16.81	15.95	5.43	2.22	1.28
Magnesia	4.43	4.44	2.54	0.96	0.59	0.21
Phosphoric acid	2.33	4.79	2.50	0.50	0.65	0.21
Insoluble matter	9.01	4.92	34.98	1.94	0.66	2.88
Other substances	32.42	31.26	21.96	73.44	81.51	85.54
Total	100.00	100.00	100.00	100.00	100.00	100.00

Analyses of seed of ten varieties of Virginia tobacco show that the air-dried seed contains 5½ to 6 per cent of water, of nitrogen 3.44 to 3.78 per cent, and of ash 3 to 4 per cent. Of the ash, about one-third is phosphoric acid, one-third potash and one-fifth magnesia. The ash of the seed contains over ten times as much phosphoric acid, about four times as much magnesia and nearly one-fourth more potash than the ash of tobacco leaf.

Analyses of the whole plant,—root, stem and leaf,—at three stages of growth, calculated from the average results for three leading varieties (White Burley, Medley Pryor and Yellow Orinoco) show that their composition at these three stages is alike only in nitrogen, soda and magnesia. As would be expected, the plant from the plant bed has the highest percentage of moisture. It also shows the highest ash, phosphoric acid and potash. These last two ingredients gradually diminish as the age of the plant increases, thus showing that the young plant requires a large amount of potash and phosphoric acid. The percentages of lime and chlorine are just the reverse of the phosphoric acid and potash, as they increase with the age of the plant. The percentage of the insoluble matter is comparatively small in the plant from the plant bed, and is only about one-fourth as much as at the time of topping and cutting. It appears that the plant taken from the plant bed contains, in the air-dried state, nearly three per cent of nitrogen, nearly 1 per cent of phosphoric acid, over 8 per cent of potash and about 2½ per cent of lime. Taken at the time of topping, it contains about 3 per cent of nitrogen, one-third of 1 per cent of phosphoric acid, about 4 per cent of potash and over 2 per cent of lime. Taken at time of cutting, it contains nearly three per cent of nitrogen, one-third of 1 per cent of phosphoric acid, nearly 3½ per cent of potash and over 3½ per cent of lime.

F. G. Carpenter has also done much analytical work at the North Carolina experiment station, so have Johnson and Jenkins at the Connecticut station, Goessman at Amherst, Frear at the Pennsylvania station, and others at the experiment stations of Kentucky, Tennessee, Louisiana, Alabama and Wisconsin. All this work is bringing out much valuable data in addition to the chemical inquiries into tobacco, conducted by Dr. Gideon E. Moore for the tenth census, from which the following table is compiled:

Table X.—AVERAGE COMPOSITION OF CIGAR LEAF (POLE CURED).

	Silica.	Chlorine.	Sulphuric Acid.	Phosphoric Acid.	Lime.	Magnesia.	Potash.	Soda.	Total Ash.	Nitrogen.
Av. 12 Conn. crops..	0.14	1.55	1.09	0.59	5.71	1.36	5.79	0.33	16.55	4.24
New Milford, Ct....	0.21	0.33	0.62	0.48	6.10	1.71	5.20	trace	15.10	4.97
Hartford, Ct.... ...	0.20	2.14	0.62	0.61	5.33	1.40	7.66	0.05	18.56	4.10
Pa., Lancaster Co..	0.19	0.27	0.47	1.03	5.13	1.47	8.92	0.06	17.98	2.70
Ohio	0.44	0.22	0.49	0.61	4.93	2.46	4.75	0.04	14.22	4.42
New York..........	0.75	0.95	0.59	0.56	6.09	1.33	5.13	0.06	15.50	4.59
Wis. and Ill.........	0.72	0.15	0.60	0.48	5.17	1.94	5.97	0.17	15.52	5.23
Average.........	0.35	0.66	0.64	0.62	5.50	1.67	6.20	0.10	16.19	4.12

Omitting from the above the percentage of nitrogen in Pennsylvania seedleaf, which is exceptionally low, the average of the other samples gives 4.41 per cent of nitrogen in pole-cured tobacco leaves.

Table XI.—THE AMERICAN TOBACCO CROP.

The United States crop of 1849 was returned by the census at 199,753,000 pounds, and of 1859 at 434,209,000. The census for 1869 was incomplete in the South, and, especially in North Carolina, has been imperfect since. That State was credited with only 36,000,000 pounds in 1889 by the 11th census. W. W. Wood's elaborate inquiries show it to have been 76,000,000. The census figures are used below, except that *American Agriculturist's* returns for 1895 are given. Weights are in thousands of pounds, last three figures (000's) omitted.

THE AMERICAN TOBACCO CROP.

TOBACCO BY STATES.	Number of Acres.			Weight of crop. In thousands of pounds, last three ciphers omitted.			
	1895.	1889.	1879.	1895.	1889.	1879.	1869.
North Atlantic Division....	36,253	44,080	44,854	44,933	50,133	63,313	21,730
Maine..................		1	1				15
New Hampshire.........	54	57	88	95	87	171	155
Vermont.....	108	50	84	170	71	131	73
Massachusetts...........	2,863	2,012	3,358	4,556	2,795	5,369	7,313
Rhode Island............			2			1	1
Connecticut.............	8,077	6,331	8,666	14,067	8,875	14,045	8,329
New York...............	5,712	8,629	4,937	7,267	9,316	6,481	2,350
New Jersey.............		45	152		33	172	41
Pennsylvania	19,439	26,955	27,566	18,778	28,956	36,943	3,468
South Atlantic Division....	210,844	234,981	141,480	92,297	100,844	136,051	66,548
Delaware		20	4		30	1	
Maryland................	19,950	20,274	38,174	14,962	12,357	26,082	15,785
District of Columbia....			2		23	1	
Virginia.................	97,654	110,579	40,791	39,939	48,523	79,989	37,086
West Virginia...........	4,400	4,647	4,071	1,760	2,602	2,296	2,046
North Carolina..........	125,840	97,077	57,208	94,336	36,375	26,986	11,150
South Carolina..........	500	394	169	200	223	46	35
Georgia..................	1,000	800	971	350	264	229	289
Florida..................	1,500	1,190	90	730	470	21	157
North Central Division.....	74,252	86,787	78,038	46,370	77,604	70,994	46,721
Ohio	40,401	44,303	34,676	23,433	37,854	34,735	18,742
Indiana..................	6,185	9,373	11,955	4,330	7,710	8,873	9,325
Illinois..................	3,460	4,155	5,612	2,214	3,043	3.936	5,249
Michigan	25	22	170	15	12	84	5
Wisconsin	11,381	17,241	8,810	9,958	19,389	10,608	961
Minnesota	50	49	163	30	23	70	8
Iowa	150	124	692	90	74	420	72
Missouri	12,450	11,350	15,521	6,225	9,425	12,016	12,320
North Dakota		2	5		1	2	
South Dakota...........		1			10		
Nebraska................		46	101		11	58	6
Kansas	150	123	333	75	62	192	33
South Central Division.....	337,673	329.379	274,322	252,606	259,651	202,600	125,656
Kentucky	288,116	274,587	226,120	216,087	221,880	171,121	103,306
Tennessee	45,607	51.471	41,532	34,889	36,368	29,365	21,465
Alabama.................	800	679	2,197	320	163	452	153
Mississippi	500	234	1,471	200	62	415	61
Louisiana................	150	109	253	60	47	56	16
Texas	500	423	685	250	176	221	60
Oklahoma							
Arkansas	2,000	1,876	2,064	800	955	970	595
Western Division..........	80	72	147	72	25	101	81
Montana..................							1
Wyoming.................							
Colorado	2	2					1
New Mexico.............	6	6	7		2	1	9
Arizona..................			1			1	
Utah							
Nevada			2			2	
Idaho			2				
Washington	30	25	8	18	7	7	2
Oregon...................	20	12	43	14	3	17	4
California................	50	27	84	40	13	73	64
United States...........	699,102	695,301	174,173	496,278	488,257	110,131	262,735

Table XII.—GROWTH OF TOBACCO MANUFACTURING IN EACH STATE.

	a Cigar factories.		Millions of cigars made.		*a* No. of factories.		*b* Product mil'n's lbs.	
	1894	1886	1894	1886	1894	1886	1894	1886
Alabama	61	33	5.3	4.1	6		—	—
Arkansas	43	22	1.6	2.3	7	8	—	—
California	602	383	66.5	127.4	24	5	—	—
Colorado	216	100	10.9	8.7	18	1	—	—
Connecticut	434	311	38.7	34.8	60	1	—	—
Florida	400	194	147.8	92.6	11	—	—	—
Georgia	73	39	4.5	2.0	20	12	—	—
Illinois	2,256	1,454	247.8	181.3	348	31	11.9	8.1
Indiana	794	495	63.7	42.7	92	15	—	—
Iowa	596	305	66.9	42.3	102	4	—	—
Kansas	308	203	20.4	17.9	45	1	—	—
Kentucky	295	273	42.0	29.6	147	86	26.3	15.2
Louisiana	177	139	66.2	43.6	67	41	1.3	2.0
Maryland	875	815	90.9	97.5	36	11	10.5	7.1
Massachusetts	699	585	106.5	97.3	29	8	—	—
Michigan	1,123	670	106.3	87.4	144	8	17.0	9.7
Minnesota	394	218	39.3	30.8	87	3	—	—
Missouri	878	721	65.4	59.5	92	74	7.6	34.5
Montana	77	13	3.7	—	17	—	—	—
Nebraska	342	189	20.5	18.2	64	—	—	—
New Hampshire	160	41	16.5	3.2	8	—	—	—
New Jersey	1,077	868	68.5	67.4	74	12	24.9	30.2
New Mexico	10	2	—	—	5		—	—
New York	6,847	5,155	1,044.3	1,085.9	371	99	17.9	16.9
North Carolina	42	26	7.0	2.1	253	211	24.7	18.5
Ohio	2,028	1,691	406.4	277.1	238	40	19.3	14.0
Oregon	164	29	6.8	1.2	21	—	—	—
Pennsylvania	5,661	4,887	1,149.9	847.9	355	37	6.9	3.2
South Carolina	13	21	—	1.1	4	1	—	—
Tennessee	67	36	4.4	3.5	63	42	2.6	1.4
Texas	127	53	9.3	4.6	28	2	—	—
Virginia	241	168	86.8	24.8	134	197	36.3	39.3
West Virginia	138	115	63.7	41.7	31	12	3.6	
Wisconsin	955	596	83.9	60.1	79	7	6.3	5.4
Total	28,173	21,053	4,163.0	3,462.0	3,080	971	268.6	210.4

a Each account with the internal revenue department is here considered as a factory. As a matter of fact, there may be several accounts in the same building. Hence the discrepancy between these figures and those of the federal census, which last represent different establishments.

b Product of manufactured tobacco.

Cigarettes: Total production in 1886 was 1607 millions, in 1894 was 3621 millions, divided between the States of principal production thus: Louisiana, 12 millions in '86 against 158 millions in '94; Maryland, 119 to 36; New York, 929 to 1838; North Carolina, 262 to 737, and Virginia's product of 273 million cigarettes in '86 increased to 823 millions in '94.

Plug Tobacco: Total product in 1886 was 131 million pounds, which for '94 had increased to 160 millions by leading States as follows: Kentucky, 13 million pounds in '86 and 22 millions in '94; Missouri 30 to 52; New Jersey, 18 to 12; New York, 4 to 3; North Carolina, 10 to 17; Ohio, 0 to 15; while Virginia's plug tobacco output of 38 million pounds in '86 dropped to 31 millions eight years later.

Fine Cut: Production in 1886 was 17 million pounds and only 14 millions in '94, as follows: Illinois, 1.6 to 2.1; Michigan, 0 to 4; New Jersey, 5 to 3; and New York dropped from 3.3 to 2.3 million pounds.

Smoking Tobaccos: Total product jumped from 55 million pounds in '86, to over 83 millions in '94, being from the principal States: Illinois, 4.9 to 8.6; Kentucky, 0 to 3.7; Louisiana, 0 to 1.3: Maryland, 6.3 to 9.3; Michigan, 5.8 to 8.2; Missouri, 4.5 to 5.6; New Jersey, 4.9 to 5.1; New York, 9.6 to 12.6; North Carolina, 4.7 to 7.1; Ohio 2.6 to 3.9; Pennsylvania, stationary at 3; Wisconsin, 4.7 to 5.5; while Virginia and West Virginia, which manufactured no smoking tobacco in '86, reported 4.1 and 3.6 million pounds respectively for 1894.

Snuff: Product for 1886 was 6,547,000 pounds against 11,583,000 pounds in 1894. In the latter year, the principal States that producing snuff were: New Jersey, 4,920,000 pounds; Pennsylvania, 3,822,000 pounds; Tennessee, 965,000; Virginia, 726,000; Maryland, 493,000; Illinois, 347,000 pounds. In 1886, the principal snuff-producing States were: Delaware, 2,284,000 and New Jersey, 2,500,000 pounds.

PRICES IN HOME AND FOREIGN MARKETS.

Table XIII.—CIGAR LEAF AT NEW YORK CITY.

This table gives the average wholesale quotations in January and October, at New York city, for the best grade of domestic tobacco used for filling cigars. Also the same for best grades of domestic wrapper leaf. The growths of Connecticut, New York State, Pennsylvania and Ohio are separately stated, as their qualities are usually quite different. From 1850 to 1857, Connecticut wrappers sold for 10 to 20 cents per pound at New York city. Thence to 1860 the price was 10 to 40 cents. Twenty and 25 cents was the top price until 1863, when the boom began that culminated a year later.

[Quotations are in cents per pound.]

	Cigar fillers.				Cigar wrappers.							
	Conn.		N. Y.		Conn.		N. Y.		Penn.		Ohio.	
	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.
1864	.20	.35	.18	.25	.45	.65	.30	.45	.30	.45	.30	.45
1865	.35	.09	.25	.09	.65	.40	.45	.40	.45	.20	.45	.20
1866	.09	.09	.09	.09	.45	.45	.45	.45	.20	.20	.20	.20
1868	.08	.08	.06	.07	.45	.55	.16	—	.32	.35	.45	—
1870	.18	.20	.13	.14	.50	.50	.50	.55	.55	.50	.55	.35
1872	.14	.15	.16	.16	.35	.30	.50	—	.45	.40	.45	.40
1873	.14	.15	.10	.09	.30	.45	.32	.30	.30	.60	.30	.60
1874	.15	.07	.09	.07	.45	.30	.25	.25	.60	.40	.60	.40
1875	.12	.08	.08	—	.30	.20	.25	—	.40	.35	—	—
1876	.08	.08	—	—	.20	.30	—	—	.35	.25	—	—
1878	.07	.08	.12	—	.25	.28	—	—	.50	.35	—	—
1881	.07	—	—	—	.35	.35	.15	.15	.45	.45	.25	.16
1882	.14	.12	.06	.06	.23	.22	—	—	.43	.43	.20	.14
1883	.15	.14	.05	.06	.43	.40	—	—	.43	.35	.14	.20
1884	.14	.14	.06	.07	.40	.35	—	—	.35	.25	.20	.25
1885	.13	.12	.06	.05	.30	.30	—	—	.23	.23	—	—
1886	.12	.12	.05	.05	.30	.30	—	—	.23	.23	—	—
1887	.18	.15	.05	.06	.28	.33	—	—	.23	.25	—	—
1888	.15	.15	.06	.06	.33	.33	—	—	.25	.25	—	—
1889	.15	.14	.06	.06	.33	.33	—	—	.25	.33	.18	.18
1890	.14	.14	.06	.06	.33	.33	—	—	.33	.33	.18	.18
1891	.14	—	.06	—	.33	—	—	—	.33	—	.18	—

Table XIV.—COMPARATIVE RELATIVE PRICES OF TOBACCO LEAF.

In this table, 100 is the basis of values, or the index number. It represents the average wholesale price of leaf tobacco for the year 1860. For the United States, this average is based on the mean wholesale quotation for the year, of all grades of leaf in the New York city and Cincinnati markets. For London, it is the average of the wholesale quotations on Virginia leaf. For Hamburg, it is the average of wholesale prices on both imported and the German-grown leaf. To compare the fluctuations in tobacco values, we add the index numbers for the United States only, of wheat, cotton, wool, and the general average for all farm products. Average comparative prices for the first six months '96 are given, as compiled by *American Agriculturist.*

	Tobacco.			Other Produce.			
	United States.	England.	Hamburg.	Wheat. U. S.	Wool. U. S.	Cotton. U. S.	General Av.
1860	100	100	100	100	100	100	100
1861	95	99	113	92	81	199	92
1862	187	126	120	87	100	523	132
1863	178	215	94	101	157	782	177
1864	200	215	94	116	184	1119	260
1865	126	—	79	141	171	453	195
1866	108	126	73	116	133	365	172
1867	138	133	81	213	111	199	171
1868	167	133	85	193	93	247	173
1869	168	111	97	119	97	254	162
1870	158	111	94	85	93	156	147
1871	188	104	97	118	110	183	130
1872	181	126	114	119	154	173	129
1873	216	130	103	130	119	170	133
1874	180	122	103	122	115	143	138
1875	161	170	99	95	107	121	126
1876	146	170	103	101	90	102	115
1877	149	141	93	117	91	103	111
1878	137	126	93	107	81	99	99
1879	119	104	88	84	76	96	98
1880	138	119	94	112	109	106	110
1881	134	107	91	93	98	109	121
1882	141	156	81	116	95	106	114
1883	138	163	79	88	90	98	100
1884	153	141	86	84	81	94	105
1885	122	152	87	71	72	93	94
1886	100	137	88	74	76	88	97
1887	123	133	80	74	79	88	95
1888	111	163	79	71	72	97	96
1889	122	148	86	86	80	101	91
1890	130	148	91	71	78	96	97
1891	140	163	85	88	75	80	97
1896	84	?	*91	53	45	?	57

*Average for 12 months, 1895, specially furnished for this work by the Hamburg statistical bureau. It also reports wheat averaging, for 1895, the equivalent of 69 cents per bushel, U. S. currency, against $1.20 at Hamburg, for 1891; the relative value of wheat being 82 for the year 1891, and only 46 for the year 1895.

Table XV.—COMPARATIVE MARKET PRICES OF LEAF—TOBACCO IN HOME AND FOREIGN MARKETS.

This table shows the average wholesale quotation of the best grades of Kentucky leaf at New York city in January, and again in October. The same facts are given for Virginia leaf on the London market in January and July. The yearly average wholesale price of all leaf tobacco at Hamburg, Germany, is then given. Also the average value per pound of the leaf tobacco exported each year from the United States.

	Kentucky leaf at New York.		Virginia leaf in London.		All leaf at Hamburg. Av. per yr.	Av. value leaf exp. from U. S.
	Jan.	Oct.	Jan.	July.		
1840	17	11				
1845	6	8				
1850	10	11				
1851	13	10	20	20	12	
1853	9	10	14	15	12	
1857	12	13	22	22	17	
1860	14	13	17	16	16	
1862	16	25	22	24	19	
1863	30	27	30	30	15	
1864	30	38	30	30	15	
1865	40	30	—	24	12	
1866	30	24	24	24	11	15.4
1867	12	14	22	22	13	10.6
1868	15	14	22	22	13	11.1
1869	13	13	20	20	15	11.3
1870	12	14	20	18	15	11.4
1871	9	11	16	16	15	9.2
1872	11	12	21	22	18	10.3
1873	12	11	22	22	16	10.7
1874	10	16	22	24	16	9.6
1875	16	15	35	35	15	11.3
1876	13	13	35	37	16	10.4
1877	12	10	28	24	15	10.2
1878	10	9	24	24	15	8.7
1879	8	—	20	20	14	7.8
1880	9	9	23	23	15	7.7
1881	10	12	20	20	14	8.3
1882	12	11	30	35	13	8.5
1883	11	11	35	30	12	8.3
1884	11	11	30	30	13	9.1
1885	11	11	30	30	14	9.9
1886	11	10	27	28	14	9.6
1887	10	11	26	28	12	8.7
1888	11	11	32	32	12	8.3
1889	11	10	32	32	13	8.8
1890	10	10	32	37	14	8.6
1891	10	—	37	37	13	8.8
1892			37	37	—	8.4
1893			35	—	—	

Table XVI.—PRICES AT INTERIOR MARKETS.

Cincinnati, Ohio, is one of the oldest tobacco markets in the interior, and is a distributing point for immense quantities of leaf, grown in the central portions of the United States. Its quotations are available since 1853, and are put on record here to show the fluctuations in prices at interior markets. There are four leading grades of the varieties used for manufactured tobacco, but the "average" quality and the "fine" or best grades only, are quoted. The average quotation for the best quality of each grade is given for January and again for October. Under "lugs," is given a similar quotation for common to good leaf, used for this purpose. Quotations for the fillers grown in that region for plugs and for cigars are also given.

[Quotations in dollars and cents for 100 pounds.]

	Manufacturing Tobaccos.						Filler Leaf.			
	Average.		Fine.		Lugs.		Plug.		Cigar.	
	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.
1853	$4.81	$6.00	$7.00	$9.50	$4.50	$5.00				
1857	10.13	11.46	14.75	17.00	9.00	10.00				
1862	9.25	14.13	13.50	20.00	8.00	13.00				
1863	15.38	14.00	24.00	22.50	14.00	10.50			$13.50	$9.00
1864	16.25	13.75	24.00	22.50	14.00	10.50			11.00	6.75
1865	16.66	15.33	32.50	37.50	10.25	6.13	$13.06	$17.68	6.75	3.50
1866	15.13	13.50	27.50	22.50	9.00	7.75	13.43	11.31	3.00	3.00
1867	13.41	10.58	22.50	18.50	8.00	6.00	10.93	8.87	3.00	2.50
1868	12.50	13.78	22.50	22.50	7.00	8.25	10.93	11.88	2.50	5.50
1869	12.70	10.95	21.50	19.00	8.25	7.00	8.93	9.13	5.50	6.00
1870	11.20	10.22	17.00	22.50	8.25	4.50	8.93	9.81	11.50	5.00
1871	10.04	14.66	17.50	27.50	7.09	9.00	10.00	12.88	8.75	8.75
1872	15.00	13.31	26.50	24.00	9.50	9.00	13.18	12.36	6.25	9.00
1873	16.31	16.33	26.00	27.00	11.00	11.75	14.56	14.56	9.25	11.00
1874	10.75	20.58	16.50	34.00	7.00	13.50	9.50	16.13	7.00	8.50
1875	21.75	19.95	35.00	34.50	15.75	12.50	18.18	16.63	8.50	7.50
1876	17.14	13.00	27.50	23.00	10.38	8.00	13.81	13.18	7.50	6.50
1877	13.06	13.06	23.00	23.00	8.00	8.00	12.28	12.28	5.50	5.50
1878	11.20	12.66	18.00	22.50	7.25	7.75	10.90	12.21	5.50	5.50
1879	14.62	12.01	25.00	20.00	8.25	8.00	12.09	11.25	6.50	6.00
1880	13.91	13.35	22.00	23.50	10.00	8.50	9.96	9.53	4.50	5.50
1881	13.81	16.79	23.50	30.00	9.25	10.00	11.15	13.25	6.50	5.00
1882	19.20	15.50	30.00	27.00	14.75	11.75	12.93	10.75	5.00	4.50
1883	13.93	15.33	23.00	25.50	12.25	12.00	9.71	10.84	5.50	5.00
1884	16.00	11.89	25.00	18.00	12.00	8.88	11.70	9.90	5.50	
1885	11.00	9.20	18.50	15.75	8.12	6.88	10.15	9.00	6.00	4.50
1886	10.75	7.25	19.50	13.50	7.12	5.00	10.00	6.53	5.00	3.50
1887	7.83	17.91	15.00	28.75	5.00	11.00	6.40	15.18	4.75	4.50
1888	19.20	14.83	26.50	22.50	14.00	11.50	17.50	12.50	4.50	5.00
1889	17.08	17.45	24.00	26.00	12.25	12.25	15.18	11.87	5.00	5.00
1890	14.66	14.67	24.00	23.50	9.25	9.75	13.00	12.62	5.00	5.00
1891	13.64	13.83	23.50	24.50	8.75	8.00	11.71	12.87	6.50	9.25
1892*	7.63	11.56	14.70	20.75	5.10	7.30	11.16	13.40		
1893*	11.72	9.25	17.06	14.69	8.72	6.00	13.73	11.50		
1894*	9.06	8.25	13.00	14.22	5.10	5.50	10.20	10.60		
1895*	7.68	8.63	12.94	14.22	4.53	5.45	10.33	10.65		
1896*	8.25		15.50		4.15		10.90			

*Furnished by *Western Tobacco Journal*. It reports total sales at Cincinnati of White Burley as follows: 1892, 109,612 hogsheads at an average of $7.38 per 100 pounds of leaf; '93, 79,886 hogsheads at $9.75; '94, 104,010 hogsheads at $7.81; '95, 103,198 hogsheads at $6.65; '96, from January 1 to August 15, 63,935 hogsheads, at an average of $5.18.

Table XVII.—CONSUMPTION AND TAXATION OF TOBACCO IN THE UNITED STATES.

[Compiled from reports of U. S. Commission of Internal Revenue.]

This table gives in column No. 1 the millions of pounds of leaf tobacco manufactured into plug, smoking, fine cut, snuff, etc., each year. Column No. 2 shows the millions of cigars made each year;

No. 3, millions of cigarettes; while column 4 gives the total number of both cigars and cigarettes made each year. Column 5 shows the pounds of leaf tobacco used in making cigars and cigarettes during the calender year ended December 31; and the other data are for fiscal year ended June 30. Under "Internal Revenue Taxation," is first given the average tax (in cents per pound) paid on manufactured tobacco in each year, then the amount of revenue collected from this source, also the amount collected from the internal revenue taxes on cigars and cigarettes. The next column shows the total internal revenue receipts each year from tobacco, this total including not only taxes on manufacturers and on cigars and cigarettes, but also fees for licenses to dealers and manufacturers, and minor items. Import duties paid each year on tobacco imported for consumption are next shown, and the last column of all gives the aggregate of government's receipts from all sources pertaining to tobacco. The notes following the table give particulars about internal revenue taxes on cigars and cigarettes, and also about the duties on imported tobacco.

Y'rs.	Consumption.					Internal rev. tax.					
		Nos. in millions.					Millions dols.				
	Man'f'd tobacco millions of lbs.	Cigars.	Cigarettes.	Total.	Leaf used. Quantity of tobacco leaf consumed in the manufacture of cigars and cigarettes (millions of pounds).	Rate per lb. on man'f'd leaf (cts.)	Manufact'red.	Cigars, etc.	Total.	Receipts from duties on imports.	Aggregate receipts from tobacco.
1863	23.8	199	—	199		11	2.6	0.5	3,098		
1864	64.5	492	—	492		11	7.3	1.2	8,592		
1865	37.6	693	20	713		22	8.3	3.0	11,401		
1866	37.4	347	—	347		35	13.0	3.4	16,531		
1867	47.6	106	378	484		34	16.0	3.6	19,765		
1868	46.7	—	590	590		34	15.6	2.9	18,730		
1869	64.3	991	2	993		27	17.3	4.9	23,431		
1870	90.2	1,139	14	1,153		27	24.3	5.7	31,351		
1871	95.1	1,314	19	1,333		27	25.5	6.5	33,579		
1872	95.2	1,507	21	1,528		26	24.5	7.5	33,736		
1873	114.7	1,780	27	1,807		20	23.3	8.9	34,386		
1874	107.7	1,858	29	1,887		20	21.9	9.3	33,243		
1875	119.4	1,927	41	1,968		21	25.2	10.2	37,303		
1876	110.3	1,829	77	1,906		24	26.7	11.1	39,795		
1877	116.1	1,800	149	1,949		24	28.1	11.0	41,107		
1878	108.8	1,905	165	2,070		24	26.3	11.7	40,092		
1879	120.3	2,019	238	2,257		21	25.6	12.5	40,135		
1880	136.2	2,368	409	2,777	61.2	16	21.8	14.9	38,870		
1881	147.0	2,683	567	3,250	66.4	16	23.5	17.0	42,855		
1882	161.3	3,041	556	3,597	73.6	16	25.8	19.2	47,392		
1883	170.3	3,228	640	3,868	77.2	13	22.8	17.8	42,104		
1884	174.1	3,456	908	4,364	79.4	8	13.9	10.8	26,062		
1885	180.7	3,359	1,058	3,417	76.7	8	14.4	10.6	26,407	7,356	33,763
1886	191.5	3,511	1,311	4,822	84.9	8	15.3	11.1	27,907	8,311	36,219
1887	206.4	3,788	1,584	5,372	82.9	8	16.5	12.1	30,108	9,128	39,235
1888	209.3	3,845	1,863	5,708	83.5	8	16.7	12.4	30,662	9,735	40,398
1889	221.5	3,867	2,152	6,019	83.5	8	17.7	12.6	31,867	11,195	43,061
1890	238.2	4,088	2,233	6,321	91.7	8	19.0	13.3	33,959	13,318	47,276
1891	253.8	4,475	2,685	7,160	94.5	7	17.8	14.7	32,796	16,172	48,969
1892	265.1	4,549	2,893	7,442	100.8	6	15.9	15.0	31,000	10,265	41,266
1893	264.3	4,814	3,177	7,991	96.9	6	15.9	16.0	31,890	14,832	46,722
1894	247.1	4,067	3,183	7,250	89.9	6	14.8	13.7	28,618	13,669	42,286
1895	259.1	4,164	3,328	7,492	*90.4	6	15.6	14.1	29,705		
Total	4,725.6	82,369	30,417	108,536	†1,322.3	13 av	618,9	349.2	998,479		

† Total for 16 years. * Partly estimated.

The United States internal revenue tax for the two years ended June 30, 1864, was $1.50 per thousand on cigars valued at not over $5 per M, increasing to $3.50 on cigars valued at $20, an average of $2.37 per M on cigars of all descriptions. After June 30, 1864, the tax was increased, for war purposes, to $3 per M, on cheroots and cigars valued at not over $5 per M; valued at over $5 and not over $15 per M, $8; valued at $15 to $30, $15 per M; valued at $30 to $45, $25 per M. Cigarettes valued at not over $6 per 100 packages of 25 each, $1 per 100 packages; valued above that sum, $3; cigarettes made wholly of tobacco, $3 per M. By the act of March 3, 1865, cigars, cheroots and cigarettes made wholly of tobacco, or any substitute therefor, were taxed $10 per M, and cigarettes, valued at not over $5 per 100 packages of 25 each, were taxed 5 cents per package, and if valued above that, 5 per cent. These war taxes were reduced by the act of July 13, 1866, and March 2, 1867, and again July 20, 1868. Under the latter act, cigars and cheroots of all descriptions were taxed $5 per M; cigarettes weighing not over 3 pounds per M, were taxed $1.50, and heavier than that, $5. These rates prevailed until March 3, 1875, when cigars and cheroots were taxed $6 per M and cigarettes $1.75. These rates were again reduced March 3, 1883, to $3 per M for cigars and cheroots of all descriptions and 50 cents for cigarettes weighing not over 3 pounds per M. These latter rates are still in effect.

The tariff on tobacco imported into the United States on leaf, or manufactured, was 6 cents per pound and on snuff 10 cents per pound from 1789 to 1794, when it was advanced to 10 and 12 cents respectively, and remained there until 1846, except that it was 20 and 24 cents from 1812 to 1816. In 1846, a tariff of 30 per cent ad valorem was imposed on leaf tobacco, which was made 24 per cent in '57 and 25 per cent in '61, but in '62 was raised to 25 cents per pound, and in 1866 to 35 cents per pound, continuing at that rate until 1874, when it was made 30 per cent ad valorem. From 1866 to 1883, the duty on snuff and manufactured tobacco was 50 cents per pound. The import duty on cigars and cheroots was $2.50 per thousand until 1842, when the rate was fixed at 40 cents per pound, which was changed to 40 per cent ad valorem in 1846 and 30 per cent in '57, but in 1866-7 was $3 per pound and 50 per cent ad valorem. This was changed to $2.50 per pound, and 25 per cent ad valorem, in 1868, and continued at that figure until 1883.

The United States tariff of 1883 imposed a duty on cigar wrappers of 75 cents per pound, if unstemmed, and $1, if stemmed. Other tobacco in leaf 35 cents per pound, stems 15 cents per pound, snuff or manufactured tobacco 50 cents, cigars, cheroots and cigarettes $2.50 per pound and 25 per cent ad valorem. These rates were greatly changed by the McKinley act of 1890, which imposed a duty of $2 per pound on cigar wrappers if not stemmed, and $2.75 if stemmed. Other leaf tobacco 35 cents unstemmed and 50 cents stemmed; snuff, etc., 50 cents per pound; other manufactured tobacco 40 cents per pound; cigars, cigarettes and cheroots $4.50 per pound, and 25 per cent ad valorem. Under the Wilson tariff of August 28, 1894, the rate on wrapper leaf was reduced to $1.50 per pound, or $2.25 if stemmed, on filler leaf 35 cents per pound and 50 cents if stemmed, other leaf 40 cents, cigars, cigarettes and cheroots $4 per pound and 25 per cent ad valorem, snuff 50 cents, all other manufactured tobacco 40 cents per pound. The high duty on wrapper leaf, in the act of 1883, was evaded by the loose construction of the law; the act of '92 was ironclad in this respect, and the act of 1894 was very specific, and stood the test of the highest courts. The Dingley tariff of 1897 increases the duty on wrappers, and possibly on fillers, but makes no other changes in rates.

Besides these duties, imported tobacco has to pay the same internal revenue taxes that are imposed upon domestic tobaccos of like grade.

Books on Tobacco Culture.

The student is referred to the wonderfully complete *Bibliotheca Nicotiana*, compiled by William F. R. Bragge, published at Birmingham, England, in 1880.

United States reports from the internal revenue and agricultural departments contain much on this subject. The Department of State's consular reports, especially since 1880, give many reports on tobacco in other lands. Several of the State agricultural experiment stations have printed bulletins on the subject.

References to works on tobacco, [dates of whose publication are lacking: Kissling, Tabakkunde; Bere, Le Tabak; Nessler, Der Tabak, seine Bestandtheile und seine Behandlung; Hofmann, Die Cultur des Tabakes in Oesterreich; Nessler, Landwirthschaftliche Versuchstationen; Krafft, Lehrbuch der Landwirthschaft; Blomeyer, Die Culture der landwirthschaftlichen Nutzpflanzen.

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