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H O P S :

FROM THE SET TO THE SKY-LIGHTS.

BY

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P R E F A C E .

As many inquiries have lately been made for a description of the methods of cultivation and management of Hops practised in England, it has been considered desirable to reproduce, with many alterations and additions, a series of articles that appeared in the *Country Brewers' Gazette* two years ago, entitled, "Hops, from the Set to the Sky-lights." There has been no work published giving a full, complete, and reliable account of hop culture since Mr. Rutley's account in the *Journal of the Royal Agricultural Society* in 1846; and all the conditions have been materially changed since then. In 1870, the writer of this series contributed a paper, entitled, "Recent Improvements in the Cultivation and Management of Hops," to the same Journal; but this, as its name implies, was merely a sketch of improved systems and modes of treatment.

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HOPS.—FROM THE SET TO THE SKY-LIGHTS.

CHAPTER I.

THE MODES OF PROPAGATION.

THE hop-plant (*Humulus Lupulus*), belonging to the *Cannabinaceæ*, is the sole representative of the genus. It is a perennial, producing annually long, weak, roughish twining stems, and lobed, coarsely toothed leaves, which bear a general resemblance to those of the vine. The male and female flowers are produced on different plants. The male flowers grow in loose dropping panicles from the axils of the leaves, having five petals and five stamens; while the female flowers form green, scaly cones, which are produced either singly or in clusters, and are composed of a number of broad concave scales partly overlapping, and each having two conspicuous flowers at its base. These cones are the hops used by brewers. The scales become covered with small grains of a resinous substance called lupuline, and the ovary changes into a small nut which is enveloped in the enlarged sepal and is the true fruit. This plant being diœcious, the sexes being borne in different flowers by distinct individuals, its fertilisation therefore is uncertain, and its seeds cannot be depended upon to reproduce the same plants. The pollen is conveyed by insects or by the wind from the wild plants in the nearest hedge, or from the male plants in adjoining hop grounds, planted it may be with entirely different sorts. Many old-fashioned planters regularly cultivated a certain per-centage of male plants among the female strobile-bearing plants, not so much perhaps to secure true seed reproductive of its kind, as to ensure fecundation, which they thought was necessary to the perfect development of the strobiles or flowers. Gilbert White, in his "History of Selborne,"* points out that it is most desirable to

* "The Natural History of Selborne," by the Rev. Gilbert White, p. 353.

“leave purposely some male plants in every garden, that their farina might impregnate the blossoms. The female plants without their male attendants are not in their natural state, hence we may suppose the frequent failure of crops so incidental to hop grounds. No other growth cultivated by man has such frequent and general failures as hops.” Modern hop-planters, however, in spite of the directions of that close observer, finding that no practical good resulted from having one male to 200 or 300 female plants, have remorselessly grubbed the former, and condemned the latter to single blessedness, without any apparent loss of weight or quality, or diminution in the quantity of seed.

Insects and breezes are always at work, and the presence of male plants could not prevent fertilisation by foreign pollen, especially as the pollen of wild plants is prepotent over that of cultivated types, and the fertilising power of pollen from another variety or individual being, according to Darwin, in his exhaustive work on the “Cross and Self-Fertilisation of Plants,”* greater than that of the pollen of a plant of the same variety; so that it is impossible to reckon with the least degree of certainty upon getting any satisfactory results from planting seeds of the hop plants. Now and then a new and distinct variety produced by an accidental and lucky cross, is obtained from seed; but like does not beget like as in the case of corn, and the seeds of most *monœcious* plants, and for this reason hop plants are raised from cuttings, or “sets,” taken from the crown of the “hill,” or plant-centre, as it may be conveniently termed. These invariably reproduce plants similar to the parent stock. So regular is this reproduction, that by a careful and close process of selection certain characteristics, as for example of early and late maturity, and variations in the form and arrangement of the strobiles or cones, have gradually been evolved. White’s Early Goldings were obtained by selection in this manner; Fuggle’s Goldings also, which though coming early into flower may be picked comparatively late.

Sets are cut in the early spring from the plant-centres, when the plants are “dressed:” the plant centres being “earthed” or covered over with a few shovels of earth in July, to cause a strong growth of fibrous substance at the bases of the bines that are tied up to the poles. Lengths of from four to six inches of this fibrous growth are cut and put in a nursery in rows a foot apart, and two inches distant from each other in the rows. These pieces of fibre are sometimes nearly an inch in diameter from Goldings, and from half an inch to a quarter of an-inch in diameter from Grape and Jones

* “For pollen from any other variety is generally prepotent over that from the same flower.”—Darwin’s “Cross and Self-Fertilisation of Plants,” page 392.

plants. They are put into the nursery as soon as possible after they have been cut off and before they have become dry, and are ready for planting out in October. Care must be observed in planting them, and attention must be paid throughout the summer to keep them free from weeds.

Some planters are very particular about their sets, and insist that those that they plant and those with which they fill up the dead hills in the autumn and spring are good and true. This is the only way to ensure a "level growth" and a series of uniform samples calculated to bear the trying ordeal of the "sky-lights."* A few planters still allow the dead hills to be renewed with sets of any kind. Thus Goldings would be filled up with Colegates, Grapes with Jones, and so on, to the great detriment of the character of the "growth." It must be said in justice to the planters that there has been a great change for the better in this direction. It is comparatively exceptional in these days of foreign competition to find planters so blind to their interests as to be careless about the sets they plant. Much money is made by set growing by a few enterprising men, who take pains to grow fine and "true" sets, and have a reputation for such in the various districts. The price of sets varies from 2s. 6d. to £1 per 100. The average price is about 4s. Fancy prices are occasionally given; even as high as 25s. to 30s. per 100 being paid for new sorts. White's Early Goldings, and Fuggle's Goldings, and Bramling's when they first came out were sold at auction sales and made these figures. Planting an acre with sets at this price is a costly process, as there are from 1,031 to 1,210 plant-centres to an acre, according to the distance they are set apart, and two sets are put to form each plant-centre. This at £1 per 100 for the sets would be from £20 to £24 per acre for the sets alone. One set occasionally is put to form a plant-centre if the sets are unusually strong, but this is a dangerous experiment, especially if wireworms, slugs, or other insects are persistent in their attacks. Four or five sets were put in formerly. Mr. Rutley, in an essay on the management of Hops, in the *Royal Agricultural Society's Journal* of 1848, recommends three sets, but it is found that two good sets make a far better stock than three or more. Another writer, in a description of hop cultivation in the same journal in 1870, says that "the fewer the sets the better the stock, and not so liable to decay or rot away *in partibus*."† "Cut sets," or sets planted out at

* In all hop factors' and merchants' show rooms there are series of sky-lights to throw the strongest light upon the samples of hops.

† On Recent Improvements in the Cultivation and Management of Hops, by Chas. Whitehead, in *The Royal Agricultural Society's Journal*, vol. vi., second series.

once into the ground to form plant-centres, without having been bedded previously in a nursery, were very frequently used in old times. As many as five were crammed into one hole to form a hill, and in dry seasons many of them failed to grow. This practice is now happily but little adopted, and planters almost to a man plant bedded sets as good and as "true to sort" as they can get them.

CHAPTER II.

THE DIFFERENT VARIETIES AND DISTRICTS.

IN the last chapter, upon the Modes of Propagation, it was shown that the seeds of hop plants cannot be depended upon to reproduce plants similar to those from which the seeds are taken. Propagation is therefore for the most part effected by means of sets or cuttings. New varieties occasionally are by chance obtained from seeds, and improvements and modifications in existing varieties are made by a process of careful selection, as was pointed out before. No attempts have been made in the direction of artificial fertilisation of the flowers of hop plants, or to obtain new varieties by cross-fertilising the flowers of one variety with the pollen of another variety. Unless artificial fecundation is resorted to, and is most carefully performed, there can be no certainty as to the variety produced from the seeds of hop plants. The Colegate hop was, however, raised from seed by a Mr. Colegate, of Chevening, Kent. Williams' White Bine, which is much grown in Surrey and Hampshire, was also raised quite by an accident from seed by a Mr. Williams, of Farnham. More recently also, the Meopham variety first raised at Meopham, in Kent, and Buss's Golding were obtained in a hap-hazard manner by planting seeds from flowers which had no doubt been cross-fertilised with pollen from a distinct variety. The Jones hop which differs *toto cælo* in shape, size, and habit from all others, originated in the same way. There are many other varieties having a certain resemblance to each other, so that the difference between them might easily have been occasioned by long-continued, careful selection. All the Goldings probably came from one original stock, which it is believed was raised and named after himself by one Golding, in Mid-Kent, where many generations of much respected yeomen hop-planters of the same name have lived and died. Most of the various sort of Grape hops, so called because the cones hang in clusters like bunches of grapes, have one common origin. Certain non-essential distinctions have been developed in process of time by selection, either methodical or accidental, but all the varieties preserve the clustering cones of their prototype.

In Kent, in that part known as the garden, or hop garden, of England, where the lower Green Sand formation affords suitable soil for the growth of hops, the various kinds of Goldings are

largely cultivated. Goldings go very deeply into the ground, and the fissures in the Kentish ragstone and hassock are penetrated in all directions by their far-extending roots. It is owing to this habit that this variety lasts much longer than any other. Many of the Golding grounds in the neighbourhood of Maidstone and in other parts of Mid-Kent are more than 100 years old, and are still vigorous and productive.* Upon the best soils in East Kent, the loams and clays of the Thanet beds, and the Woolwich and Reading beds, Goldings flourish amazingly. East Kent Goldings rank next in brewing value to the choicest sun-dried Bavarians from Spält. The per-centage of essential principles in well-managed samples of these hops has been demonstrated by analytical chemists to be larger than that of any other English hops. Goldings are not grown to any extent in the Weald of Kent, or in Sussex. Heavy, wet clays do not suit their delicate organisation, for though they possess the highest qualities, they are not so hardy as Grapes, Jones, or Colegates, and are more subject to the attacks of blight and mould. They are grown to some extent in North and West Kent upon the best soils, and a variety of the same type as the Old Kent Golding is cultivated upon the lighter land in Worcestershire and Herefordshire with considerable success. This kind of hop is also cultivated to a large extent in the plantations of Surrey and Hampshire, upon the best land, and especially upon that rich tract of soil which crops up in the neighbourhood of Farnham, and is locally known as the "Malm," where it grows most luxuriantly and produces the choicest samples. In Mid-Kent, where the plantations have been to a great extent re-arranged during the last 30 years, a typical plantation of 60 acres would consist of five acres of Bramlings, two and a half acres of White's early Goldings, 35 acres of Goldings, 15 acres of Grapes and Jones', two and a half of late Goldings, such as Buss's Goldings. Or five acres of Meophams or Prolifics, five of Bramlings and White's early Goldings, 40 acres of Goldings, 10 acres of Grapes and Jones. In the best part of East Kent upon this acreage there would be 10 to 15 acres of early Goldings, 45 to 40 acres of Goldings, and the remainder in later sorts of Goldings.

The strobiles of the Golding hop plants are about the size of a Kent cob-nut, somewhat round in shape, and of a pale golden colour. They do not grow in clusters like those of the Grape, but hang more singly.

Poles from fourteen to eighteen feet in height are required for this variety, and it is a glorious sight to see a plantation of

* There is no record of the date of the first planting of some Golding grounds at Farleigh, Barming, Hunton, and other villages near Maidstone.

Goldings in a good year, when the high poles are completely covered from the tops close down to the ground with bine and foliage, thickly interspersed with bright hops glistening in the sun.

As varieties of the Golding, there are Bramblings, so called from a place in East Kent, near Canterbury, which come to maturity about ten days before the ordinary Goldings. Bramblings do not possess the fine character or quality of the old Golding hops, but they are most useful to begin picking with, and every planter should have, say a twelfth part of his acreage planted with Bramblings or White's early Goldings, which latter, though of superior quality are more shy bearers and more liable to blight and mould. Buss's Goldings and Fuggle's Goldings are somewhat coarse in the matter of quality; they are good croppers and come to pick rather later than the old-fashioned Goldings.

Grape hops rank next in quality to Goldings. There are many varieties, or sub-varieties of these valuable hops, which have been modified by selection, or changed in some characteristics by differences of soil and climate. All have the peculiarity of the cones growing in clusters; all are larger than Golding hops, though some kinds are smaller than others, and in this respect have been improved; as one fault in the flower cones of the old-fashioned Grape hops is that they are too coarse and large, and have a thick strig or stem, which shows plainly in the samples. The Whitebine Grape, for instance, which is grown to a great extent in Mid-Kent, and William's White Bine Grape, and the Grape Green Bine cultivated in Surrey and Hants, grow finer and of better quality than the original Grape. Cooper's White is also an improved kind of Grape known in the Worcestershire and Herefordshire hop yards. The Mathon is extensively grown in both these counties, and is a very good sort of hop, having many of the qualities of the Golding. A successful Worcester planter recommended the following varieties for a plantation of 20 acres; viz., "five acres of Cooper's Whites, or three Cooper's Whites and two Jones, six acres of Mathons, six or seven acres of Goldings; and two or three acres of Grapes."* Cooper's Whites are an early sort, Mathons come to pick next, then Goldings and Grapes.

Grape hops of all description are grown in the Weald of Kent and Sussex for the main crop, and give heavy yields upon short poles from ten to twelve feet in length. They are better croppers than Goldings, and are not nearly so liable to be attacked by mould. Jones hops, which were raised from seed by one Jones, are cultivated to a considerable extent in Kent and Sussex, and more particularly in the Weald of Kent. The Jones is a somewhat coarse

* The late Mr. Smith, of Wick, Worcester.

hop with large strobiles, and is a good cropper upon heavy land. This kind of hop is grown in Worcestershire and Herefordshire, and in Surrey and Hants, and yields abundant crops upon very short poles from eight to ten feet in length, the old poles in many cases that come from the Golding and Grape grounds being used up in Jones grounds. The Jones hop plants do not crop so well on the loamy clays of the Green Sand in Mid-Kent as upon the heavy clays of the Weald and Hastings sand, and planters, as a rule, are inclined to grub them and replace them with Goldings, or early hops, or the better sorts of Grapes. It is necessary to pick Jones hops just as they are ripe, when they rustle upon being touched, as they soon "go off," and the petals of the flower cones become disintegrated, or "flyers" in the pickers' parlance.

Colegates are being fast eliminated from the hop plantations of Mid-Kent. East Kent growers will not condescend to grow them upon any consideration. They are mainly grown in Sussex and the Weald of Kent, where they yield wonderful crops in kindly seasons, and come late to pick, growing and sending forth hops when other sorts have finished their work. In years of blight the Colegates in Sussex have frequently shaken off the lice and their exuviae late in the season, and have grown a fair crop of hops. Colegates are cultivated in Worcester and Herefordshire, but not to any extent, as the brewers do not like them. The late Mr. Smith, of Wick, in his Worcester essay, which obtained the prize given by the Royal Agricultural Society of England, wrote that this sort of hop "is a hardy variety and a heavy cropper, but subject to blight, and repudiated by the brewer as a rank, bad hop, yielding a most unpleasant flavour to the beer."*

Poles of from twelve to sixteen feet are used for these hops, which have small strobiles, smaller than those of the Golding hop, growing in clusters, and have, as Mr. Smith justly remarked, a peculiar odour, resembling in a degree that of new American hops.

With regard to Colegates, Jones, and other coarse sorts of hops it is said that they will gradually go out of cultivation if the Americans continue to improve their hops as they have done during the last few years; and if the importations from Bavaria, Bohemia, Würtemberg, Posen and other countries continue to increase, Free trade—the open competition of the whole world—must inevitably in course of time level up the English plantations to the highest pitch, both as regards management, cultivation, and the selection of the best sorts of hops.

* *Royal Agricultural Society of England's Journal*, vol. xxv., series 1.

It does not pay now to farm indifferent hop land, or to grow common sorts. The time is fast coming when it will only pay to farm the land that is thoroughly suited for hop growing, and which will grow the best kinds.

Having given a description of the principal sorts of hops that are cultivated in this country, it will be interesting to give an account of the various districts, and of the soil upon which they are chiefly produced.

Kent is the great centre of English hop-growing, having an acreage of hop land of 42,977 acres, as against 36,367 acres in 1866, and 44,755 in 1876. Sussex comes next with 9,409 acres, as against 8,488 acres in 1866, and 11,000 in 1876. Herefordshire follows Sussex with 5,934 acres, having had only 4,763 in 1866. Hampshire ranks after Herefordshire with 3,038 acres, compared with 2,109 in 1866. Then comes Worcestershire with 2,760 acres, against 2,821 in 1866; and Surrey with 2,328, whose acreage amounted to 1,881 acres in 1866.

The other counties of England have 257 acres only, as against 623 in 1866. Of these Essex has 18 acres, as against 42 in 1866; Shropshire 93 acres, against 90 in 1866; Suffolk 78 acres; Nottingham, 29 acres. There are at present no hops grown in Wales or in Scotland, though in 1866 there were 14 acres of hop land in Wales, and 2 in Scotland.

The Table given herewith shows the Acreage in the various Counties:—

Name of County.	Acreage of Hop Land.		
	1866.	1879.	1880.
Kent... ..	36,367	43,407	42,977
Sussex	8,488	9,979	9,409
Hereford	4,763	5,947	5,934
Hampshire	2,119	3,064	3,038
Worcester	2,821	2,609	2,760
Surrey	1,881	2,376	2,328
Essex	137	35	18
Suffolk	127	71	66
Nottingham	76	35	29
Shropshire	—	90	93
Yorkshire	42	—	—
Berks	36	14	14
Carried forward ...	56,857	67,627	66,666

Name of County.	Acreage of Hop Land.		
	1866.	1879.	1880.
Brought forward ...	56,857	67,627	66,666
Gloucester	29	38	25
Derby	25	—	—
Lincolnshire... ..	24	2	2
Bedfordshire	3	—	—
Buckingham	2	—	—
Cambridge	4	—	—
Chester	6	—	—
Devon	9	1	—
Durham	3	—	—
Hertford	2	3	3
Lancaster	1	—	—
Middlesex	4	—	—
Northampton	1	—	—
Warwick	7	—	—
Wilts	8	—	7
Totals	56,985	67,671	66,703*

The hop-growing parts of Kent are mapped out most accurately by the trade into five divisions, each of which is sharply defined by distinct variations in the quality of the hops produced. 1st, East Kent, which stands at the top of the tree in the favour of brewers; 2nd, Mid-Kent, whose Goldings find much favour in respect of their brewing power and quality; 3rd, North Kent, a small district whose produce ranks between that of Mid and East Kent; 4th, West Kent, which is also a comparatively small district; and 5th, the very large and productive Weald of Kent. There is a subdivision of East Kent known to brewers and merchants as the "Bastard East Kent" district, lying between East Kent proper, from a hop point of view, and Mid-Kent and the Weald of Kent. Good judges can see at a glance the difference between genuine East Kent hops and those grown in the Bastard East Kent area, and there is at least 10 per cent. difference in the value of the hops produced in these two divisions.

* In 1878 the acreage of hop land in Great Britain was 71,789 acres, being larger than in any previous year.

CHAPTER III.

THE HOP-GROWING DIVISIONS OF KENT.

ALL Londoners know East Kent because it contains the happy shrimping grounds of cockneys. Margate, the Arcadia of excursionists, Ramsgate, Broadstairs, Dover, Folkestone, whose sands are trodden by legions of Londoners, are all in East Kent. These little think as they are whirled along the London, Chatham and Dover Railway that they pass through the district which produces the hops *par excellence* for their much-loved beer. From Chatham to Faversham, and from Faversham nearly to Canterbury, extending for some miles chiefly below the line of railway, the finest hop land in England is situated, upon various clays, loamy clays, and loams of the Thanet beds, the Woolwich and Reading beds, and the Oldhaven beds which crop up and overlie the chalk on this "backbone of Kent." As the chalk appears again with a surface of loam gradually decreasing in thickness, the hop land becomes less valuable; and at a short distance from this point, hops are not cultivated at all until, *longo intervallo*, the Bastard East Kent district begins, where the hops produced are of inferior quality as compared with genuine East Kents, and are grown upon useful, somewhat heavy soils, lying for the most part upon the belt of gault, alternating with the Folkestone beds which intervene between the chalk and the Weald clay between Lenham and Ashford. Below Canterbury there is a district extending from Chilham to Barham Downs East, where hops of first-class quality are grown upon loams of a somewhat sandy character, on the chalk. The crops in this locality are not so large as those grown on the deeper, richer loams and brick-earth near Faversham and Sittingbourne, and the plants will not take such long poles, but their quality is super-excellent. Bastard East Kent hops form a line of demarcation between East Kents proper and Mid-Kents, and rank next before the latter, which are grown for the most part upon the soils of the Lower Green Sand formation; the loams and clay loams, and hassocky *detritus* of the Hythe beds, the Folkestone beds, and the Atherfield clay, between the chalk and the Wealden formation, running from Lenham nearly to Tunbridge. There is a small portion of the Mid-Kent district upon the Weald clay, but it is Weald clay improved and modified

by admixture with the better soils of the Green Sand. Goldings flourish upon the Green Sand, and are grown next in quality to those of East Kent and the Farnham Town districts; though it is upon the Hythe beds and the Atherfield Clay of this formation that Goldings especially excel, as for example in the fertile Maidstone district. It is most remarkable that, given the very finest land in Mid-Kent and the most scientific methods of cultivation, with the very same climate, hops cannot be grown equal in quality to those produced in the contiguous East Kent district barely ten miles distant. And again, the hops grown in the adjacent Weald of Kent cannot "hold a candle" in the matter of quality to the produce of genuine Mid-Kent land. The distinction in the colour, shape, style, and general appearance of the flower cones are most marked and are discernible by the veriest tyro. The most inexperienced brewer can detect the difference of brewing value in the copper, and the most juvenile merchant can "spot" the Weald of Kent hops by the coarse and large leaves, the thick "strigs," and the comparative want of refinement in their flavour.

The Weald of Kent is a very large hop-producing area, lying between Edenbridge in the west to Ashford in the east of the county, extending southward to Tunbridge Wells, Lambhurst, and Hawkhurst upon the borders of Sussex. The soils are argillaceous clays and sandy clays, more or less tenacious and stiff, with occasional patches of loam and alluvium, upon the Weald Clay, the Tunbridge Wells Sand, the Ashdown Sand, and the Wadhurst Clay, the three last being varieties of the Hastings Sand. Most of this area yields large crops in kindly seasons, and more hops are grown per acre upon an average than in East or Mid-Kent. A ton an acre grown upon short poles is not an uncommon crop, and even 30 cwts. are occasionally grown per acre, an amount not dreamed of in the philosophy of the planters in any other part of the country.

The West Kent hop district comparatively is small, extending from Westerham upon the west on the borders of Surrey, to a little beyond Sevenoaks, and running in a northerly direction to Chelsfield, Orpington, and other neighbouring parishes. The best land is upon the gault of the Upper Green Sand, of which a narrow strip alternates with a somewhat broader strip of various soils of the Lower Green Sand, cropping up between the chalk and the Weald clay. The gault is not wider in any part than five miles, and the Atherfield clay and Sandgate beds of the Lower Green Sand running parallel with it, are no more than seven or eight miles wide. Hops of very good quality are produced here, as well as upon the loams and clay loams of the London clay and brick-

earth, which overlie the chalk in the more northerly part of this district. They rank immediately after Mid-Kents, and in some of the best growths it is difficult to trace any difference in quality, though the "mark" does not stand so high in the Borough.

North Kent is the last Kentish division: this embraces the large expanse of chalk hills between Farningham and Rochester. Its acreage is but small and unimportant, though the extent of the district is very wide. Being for the most part very poor, stiff land, it is only in a few places where the marls on the chalks are somewhat less surly and intractable that hops can be profitably cultivated. In some spots, however, as at Cobham, Fawkham, Ash, Southfleet, Gravesend, and Dartford, there are small outcrops of Thanet sand, whose clay loams suit hops admirably. Hops grown in North Kent rank just after Bastard East Kents, though Mid-Kent planters do not like to confess that their hops are in any degree inferior to these.

CHAPTER IV.

THE HOP-GROWING LIMITS OF SUSSEX, SURREY, HANTS, HEREFORD,
AND WORCESTER.

No hops are grown in the western division of the county of Sussex, which is geologically unsuited for their remunerative cultivation, and the 9,400 acres of hop land accredited to Sussex are in the extreme eastern part. The limits of hop cultivation in this country are, as in all other cases, sharply defined by geological boundaries. For example, in one parish whose soil is upon the Upper Cretaceous formation, either on the Upper Green Sand or Chalk, hops will not do at all, while in the next, where the soils of the Lower Cretaceous formation crop up—either the Tunbridge Wells Sand, or the Wadhurst Clay, or the Weald Clay, or others of the Hastings Sand Group—they flourish exceedingly. Very heavy crops are grown in good seasons upon the more friable or well-drained clays of the Tunbridge Wells Sand which form so great a portion of the Weald of Kent hop land, and are found frequently throughout the eastern part of Sussex alternating with a stiff soil of the Wadhurst Clay, and occasionally with somewhat lighter deposits of the Ashdown Sand. The quality of the hops is comparatively coarse, and none but common sorts are grown, as the Grapes, Mayfield Grapes, Jones and Colegates. These are very strong hops, serviceable for ordinary beers and for beers for quick draught, but will not answer, as all brewers know, for the finer ales or for export beers. As much as a ton is frequently grown, and even 30 cwt. per acre on some of the best of the land in Sussex, and the average yield per acre is considerably higher than that of any other part of the kingdom. During the last three years of blights and attacks of mould the Sussex planters in many instances have grown hops of better quality than those produced in other districts. Mould is not as a rule injurious in the Sussex gardens, but in the last season it was virulent in certain localities. It also often happens in seasons of aphid blight that Colegates, being late, throw off the blight and grow a good quantity of sound hops.

There is also some very good hop-growing land in the valleys by the banks of the watercourses which formerly intersected East Sussex, as at Etchingham, Robertsbridge, Salehurst, as well as by the banks of existing streams, as the Rother, which formerly was

a large river, as is shown by the breadth of alluvial deposit on both sides of its present restricted bed. Near Rye, at Playden, Wittersham, Udimore, there is a deal of alluvium, which is rich and well calculated for the growth of hops. The Sussex hop district extends over a space of thirty-five miles long by twenty broad, over which the hop grounds are scattered, not in masses, as in East and Mid Kent, but in small pieces snugly planted in valleys in the richest land, out of the wind. There are no leviathan planters in Sussex, at least not as compared with some in Kent who hold 300, 250, and 200 acres, and the hop land is far more subdivided, and, it must be said, not so well cultivated as a rule.

The plantations of Surrey and Hampshire are chiefly confined to the western end of the former, in the neighbourhood of Farnham, and extending beyond the town of Alton, in the latter county. The hop land is mainly situated upon the various clay loams and loams containing more or less sand, upon the Upper and Lower Green Sand formations, which alternate curiously in this district; as well as upon the Gault, a narrow strip of which, being a continuation of that passing through the centre of Kent as noticed in the last chapter, runs completely through Surrey and on into Hampshire. Upon the Upper Green Sand near Farnham, as well as in Hampshire in the neighbourhood of Selborne, there is a most peculiar fertile clay, known locally as "malm," called by the naturalist Gilbert White "a white malm, a sort of rotten or rubble stone, which when turned up to the frost and rain, moulders to pieces, and becomes manure to itself."* Hops flourish amazingly upon this exceptional soil. Mr. Wilkinson, in his admirable paper on the farming of Hampshire,† writes that "the malm is suitable for hops, or indeed for any crop requiring a strong soil, not so stiff and tenacious as the preceding gault clays, falling to a fine powder on exposure to the air, running into the fissures of the firestone rock, filling them with a rich, unctuous mould, into which the roots of the hop penetrate 20 feet deep."

The Surrey and Hampshire hop districts, which are contiguous, hardly extend beyond an area of twenty miles long by five or six wide, clearly mapped out by certain geological landmarks. In respect of quality, the hops grown throughout these counties are of a very high class, those of the Farnham town district being considered even better than the finest East Kents. The average quantity grown per acre is about the same as that of East Kent and Mid-Kent, or from $6\frac{1}{2}$ to 7 cwts. per acre per annum.

* Gilbert White's "History of Selborne," p. 15.

† "On the Farming of Hampshire," by the Rev. J. Wilkinson, vol. xxii., *Royal Agricultural Society's Journal*.

The hop "yards" in Worcestershire are for the most part situated upon the better and richer clays and marls of the Keuper and Red Marl division of the New Red Sandstone formation, as well as upon the alluvium near the banks of the rivers Severn and Teme. They lie principally to the west of the city of Worcester, in the direction of Herefordshire, and produce fair average crops of hops of good quality, which are much appreciated by the brewers of the Midland towns.

In Herefordshire the hop acreage is much larger, and is principally confined to the eastern side of the county; though there are some hop yards in the western part beyond Hereford, the bulk of these plantations lie to the east of this city and the town of Leominster. The soil upon which the best hops are grown is a rich clay or alluvial loam in the valleys by the banks of the river Lug, which runs by Leominster, and upon the equally fertile alluvium in the valley of the Wye, passing by Hereford, and upon that of the Teme, which rises in Shropshire and flows through a part of Hereford by Tenbury, or Temebury, into Worcestershire. The "Cornstone" division of the Old Red Sandstone formation furnishes most suitable soils for hops. The decomposition of the calcareous nodules intermixed with the ferruginous and argillaceous particles forms rich red marls and soils on which most luxuriant crops of hops, apples, and pears are grown. Hops thrive especially well by this "calm, deep, and silent river," and the plants last longer than upon the other side of the county, where the soils chiefly are clays, more or less heavy, upon the Old Red Sandstone formation. It is said that in the famous Teme Valley—one of the richest spots in England—the ground will grow hops for ever, such roots as die being replanted. On the uplands, however, it is found necessary to change the hop ground every 14 or 16 years. The hops grown in Herefordshire are very much the same as regards quality as those produced in Worcestershire, and the average return of the hop land is about the same.

Having now concluded the description of the large hop-growing centres of England, it will be convenient to pass on to the methods of cultivation, and the systems of management that are usually adopted.

CHAPTER V.

METHODS OF PLANTING.

It has been shown that hops principally are grown within certain limits defined by geological conditions; but it must not be imagined that they will flourish in every case where these conditions hold. For example, there is a great deal of land upon the Green Sand formation, even in Mid-Kent, upon which hop plants cannot be successfully cultivated. The whole of the land in one parish may be well suited for the production of hops, while in the next parish much of it may be quite unsuited for this purpose. A certain field may produce a large crop of fine hops continuously, while the fields surrounding it will not grow hops so as to be remunerative in any degree. So much depends upon the depth of surface soil, the nature of the subsoil, and the chemical composition of both soil and subsoil. Thus in the heart of the best hop-producing districts in East Kent and Mid-Kent one ground that has a good depth of mould and other essential combinations of soil and stratification of soils, grows the finest Goldings, while it frequently happens that another ground over the next hedge will only grow the more common sorts.

Many experienced hop planters can tell "Golding land" from "Grape land" at a glance, and upon most hop farms there is a tradition concerning each field as to its capabilities in respect of hop-producing which has been handed down through many generations, oftentimes by the bitter experience of some adventurous tenant who believed he was going "to teach his grandmother to suck eggs."

The same remarks apply equally to the soils upon the Hastings Sand in Sussex or to those upon the Gault and Green Sand in Surrey and Hants, or the old Red Sandstone and Alluvium in Worcestershire and Herefordshire. Unless there is a proper amount of superficial soil, and a suitable arrangement of substrata in land designed for hops, and unless its soil contains a due quantity of potash, phosphates, silica, lime, and other mineral constituents, it will not pay to plant hops upon it, though it may be considered from its geological surroundings perfectly adapted for their successful cultivation. On the other hand, there is, without doubt, much land upon other formations besides those upon which hops are usually

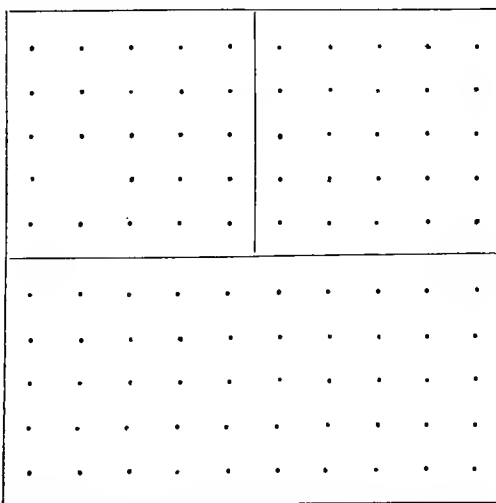
cultivated that would grow hops remarkably well. Mr. Topley, the eminent geologist, says, "Hops take up a large area in Kent; next to which county come Sussex and Hereford. Besides these counties it is only in Surrey, Hants, and Worcester that hops are grown in any quantity. The unequal distribution of this crop is very remarkable, as there appears no sufficient reason why it should not be cultivated in other districts. Everywhere below the Chalk escarpment hops might probably be cultivated with great success, and the Vale of Pewsey, for instance, would seem especially suited for them."* It is very probable that there are many other districts where hops might be grown successfully, but their introduction into new localities is attended with much risk and expense. Oasts and other buildings must be built, and skilled labourers must be imported to cultivate the ground and manage the plants; and it may turn out after all that the soil or the climate is not just suitable. The cultivation of hops has been tried in various counties; but after a short experience it has been for the most part abandoned, and the acreage of all but those that may be called the five legitimate hop-producing counties has rapidly decreased within the last few years. For example, in the "North Clay" or Lincoln district at one time there were as many as 600 acres of hop land, and at this time there are barely a hundred. Again, in Essex in 1840 there were nearly 400 acres, and now there are about forty. An enterprising planter, who had made much money by hop-growing in Kent, took land in Essex, as well as in other places, about the year 1835, and planted a considerable extent with hops, with the result of quickly dispersing the greater part of his capital.

Old pastures or old apple or cherry orchards are eminently suited for planting with hops, as there are rich stores of *humus* in the soil, as well as of the mineral ingredients necessary for the hop plants. Failing these—whose situations and aspect are almost always admirably adapted for hop-growing, as our forefathers always planted their fruit-trees on the very best land and in the most sheltered spots—ordinary land of the best quality then is taken. A practical writer says: "As a general rule, wherever hops are successfully grown, orchards flourish, and either a good luscious cider is produced or excellent table fruit." Either the land is ploughed two furrows deep, with a subsoil plough following to break up and disintegrate the "pan," or hard subsoil, or it is trenched by hand to the depth of fifteen or

* "On the Agricultural Geology of the Weald," by W. Topley, F.G.S., *Royal Agricultural Society's Journal*, vol. viii., second series.

† The "Management of Orchards," by C. Cadle, Gloucester.

sixteen inches. The former method is preferable, and certainly less costly. When land is trenched, unless the superficial soil is very deep, it may happen that a tenacious subsoil is brought to the surface in the process, while the good upper soil is buried, thus spoiling the texture of the soil, and making it “unkindly” and difficult to work. Mr. Lance, in his practical “Hop Farmer,”* published in 1838, has this passage: “There are objections made to the trenching of ground, particularly to the burial of the best soil at the bottom; and the objections are just where the soil is of a stiff clayey character.” It is highly important that the surface soil should be light and friable, so as to allow air and moisture to permeate it thoroughly, and that it should admit of being finely pulverised for the delicate fibres of the plants which run just under the surface in the summer. The land, when ploughed or trenched, is set out for the plants, being carefully measured with a line, in which, at equal lengths, pieces of red worsted are fastened, according to the distance at which the plants are intended to be put. At each point indicated by the marks in the line a small stick is set, to show the centre of the hill. The distance at which these hills are put from each other varies from six feet to six feet six inches apart, giving from 1,210 to 1,031 hills or plant-centres per acre. The annexed diagram illustrates the usual method of planting hops “upon the square,” as described here:—



After the “setting out,” which should be done with accuracy,

* “The Hop Farmer; or a Complete Account of Hop Culture.” By E. J. Lance, 1838.

great care being taken to get the distance exactly equal, a hole of about a foot square and ten inches deep is dug at each point indicated by the sticks, and the "sets," or young plants, are put in, finely triturated earth being firmly pressed round them. Planting takes place, as a rule, in October, in order that the plants may have time to get well-established before the heat and drought of summer. Occasionally plants are put in early in the spring, in March or April, and it frequently happens that many of them die if the spring and summer seasons are unfavourable.

CHAPTER VI.

DRESSING.

AFTER the sets have been planted in October or November nothing is done to them until March in the ensuing year, when the dead tips of the sets projecting above the ground are cut off with a sharp knife, and fine earth is raked over the hills or plant-centres with a small hoe. A small pole or stake is put to each hill, which serves to keep the horses off from the plants, as they work the ground between the rows of hills—"the alleys," as Kentish folks say—as well as to fasten the bines to. Some planters put no pole or stake the first year, but tie the bines in a knot, or let them run over the ground; others put two poles and endeavour to get hops the first year by well manuring the plants. It is considered better not to stimulate the plants to produce hops thus early, as it is apt to weaken them and to stunt their growth afterwards. At the same time it is well to put a small pole to each hill, and to tie the bines to it, "to teach them what they've got to do," as a sagacious labourer once remarked. If any hops are grown upon the plants in their first year the bines are not cut when the hops are picked. The poles being short, the pickers can reach to pick the hops from the poles, and these are left standing until the bine is quite withered up. Mangolds, turnips, or potatoes, are occasionally grown in the alleys between the young hop plants; good managers do not plant any crops between the hop plants, but merely keep the land well cultivated throughout the summer, knowing that there can hardly be too large a supply of manure in the soil for the successful growth of hops.

There has recently been a discussion in the *Agricultural Gazette* as to the policy of growing turnips in hop grounds. A farmer at Tenterden, in Kent, advocated this practice very strongly, but other correspondents of that journal condemn it *in toto*, very justly observing that the land generally has enough to do to furnish organic and inorganic matter for the hop plants without being required to provide food for supplementary crops.

In the second winter larger poles are put to the hills, either 12ft., or 14ft., or 16ft. long, according to the sorts of hops, though, unless the land is very strong, 16ft. poles properly should not be used until the third year. The land is thoroughly well manured

in the second winter, either with twenty-five to thirty loads of rich farm-yard manure, or with one and a half to two tons of woollen rags or shoddy, containing from seven to nine per cent. of ammonia. Men then dig the land with a tool having a handle like a spade, and three tines with broad flattened-out points. This is styled a "spud" in Kent and Sussex, being admirably adapted for turning up hop land. With this tool the soil can be thoroughly moved to a depth of from six to eight inches if the labourer likes to use it properly; good workmen move the soil to this depth, bury the weeds, and cover up the manure, and leave the ground as level as a garden. Ploughing is adopted when labour is scarce or work behind-hand; but it is a most unsatisfactory substitute for digging, and one which no planter adopts if he can get hands to dig for him at a fair rate. About the beginning of March, in the second year, the young plants are "dressed" by a man accompanied by a woman or a boy. The latter "opens" the plant-centre, or in other words removes all the earth from between the projecting tips of the plants, as well as that close round about them with a long-handled, pronged hoe, so that the man may be



enabled to cut off the dead bine and the fibrous growth level with the ground. He does this with a peculiarly-hooked, sharp, thin-bladed knife, taking care not to cut deep until the plants are three or four years old, and his companion covers the plant-centres over with fine earth. After a fortnight, or longer if the weather is cold, the small red heads of the shooting bines begin to appear, which grow rapidly if the early spring is mild, and soon require to be tied to the poles.

If there are sharp white frosts after the young bines are far out of the ground they receive a serious check to their system, from which in some cases they do not recover throughout the season; therefore it is not advisable to dress the plants too early or to encourage the forward growth of bine.* If the dressing is completed by the end of March it will be found to be better than to have this operation finished by the beginning of that month, as some planters prefer.† When the plants have been dressed very

* Plants of a delicate nature like the hop plants no doubt also suffer from radiation. Mr. Darwin says, in his recent elaborate treatise "On the Power of Movement in Plants," "All gardeners know that plants suffer from radiation. It is this and not the cold winds which the peasants of Southern Europe dread for their olives." It is therefore advisable not to get hop plants to shoot until cold nights have passed.

† It was found, in the terribly mouldy season of 1880, that hop plants which had been dressed exceptionally late escaped mould to a great extent, and the planters who adopted the late cutting are convinced that it was the cause of their immunity, or their comparative immunity, from mould.

early it frequently has happened that frost has cut up the young vines so that they have to be pulled out; and occasionally vines tied up to the poles have been cut up by frosts and so injured that it has been found necessary to take them down. Frostbitten vine becomes hard and sticky. Its tissues are changed, and the composition of its juice is altered. It is more liable to be attacked by blight (*Aphides humuli*) and by mould (*Sphaerotheca pannosa*), both of which are most disastrous in their effects; and in nine cases out of ten frost-bitten vines had better be pulled down. The French wine-growers dread the influence of the early white frosts upon the tender shoots of the vines, which is most fatal, especially if the sun shines directly upon them while they are still covered with congealed dew.

White frosts sometimes cause injuries to the vines upon the fertile banks of the Loire and other rivers in the wine-growing districts of France, where they are of more frequent occurrence than upon higher ground, and the careful *vignerons* protect the young shoots with mats and extemporised screens, placed to keep off the early rays of the morning sun.* There is an old adage in hop-growing districts that "May vine is the best"—that is, vine that is tied to the poles early in May—as it usually then grows away without let or hindrance from frost. It is certain, if the vines are too forward and exposed to the fickle temperature of the early spring season, that they run much risk either of being cut down by frosts, or injured by radiation, and rendered liable to blight and mould.

* "Seedlings are often protected from radiation by a very thin covering of straw, and fruit trees on walls by four fir branches, or a fishing-net suspended over them."
—Darwin, "On the Power of Movement in Plants," p. 204.

CHAPTER VII.

THE MANURES USED FOR HOP LAND.

"CAPARISONS are odorous," as Mrs. Malaprop remarked. "Caparisons" of manures must of necessity be "odorous," but at the same time it will be useful and instructive to compare the qualities of the various substances used by hop-planters and to show which are the most valuable. The hop-plant requires an enormous amount of manure to fully develop its bine, leaves, branches, and flower cones, as has been clearly proved by analyses made by various eminent agricultural chemists. Mr. Nesbit gave the results of his analytical experiments in a series of tables published in the *Royal Agricultural Society's Journal* in 1846, which are most elaborate and interesting, and show that very large quantities of mineral elements of fertility are taken from the soil by a crop of hops. Of these silica, lime, potash, phosphate of iron, phosphoric acid, and magnesia are the most important. Mr. Nesbit's conclusion is: "It will be seen from the preceding tables that a large amount of inorganic or mineral matter is removed annually from the soil by the hop-plants. As the produce is almost wholly exported from the farm, it must be evident that unless the mineral matter is replaced, the richest soil would eventually be impoverished by the growth of this plant. This undoubtedly is one of the chief causes of the necessity of manuring this plant so highly."

The following tables give the results of careful analyses, made by Professor Brazier,* of Kent Goldings grown by Mr. Lovett, of Shepway Court, near Maidstone. The bines were cut when fully ripe, and the vine leaves and flowers were separated. After being dried in an air-oven at 212° Fahr.,

The bine yielded	...	5.75	per cent of ash.
The leaves	23.45	" "
The flowers	8.38	" "

* Professor of Chemistry, at Marischal College, Aberdeen, who writes that the specimens which he analysed were cut from the ground when fully ripe.

The ashes of these being respectively analysed after the deduction of carbonic acid, sand, and charcoal accidentally present, gave the following results :—

TABLE I.—KENT GOLDINGS.

	Bine.	Leaves.	Flowers.
Chloride of Sodium ...	5.75	2.08	2.31
Chloride of Potassium ...	4.25	7.00	1.90
Potash	16.79	2.36	25.53
Lime... ..	43.66	54.63	21.73
Magnesia	10.12	7.16	7.14
Oxide of Iron	1.04	0.86	1.81
Phosphoric Acid	11.26	4.24	18.16
Sulphuric Acid	2.61	3.51	5.31
Silica... ..	4.52	18.16	16.11
	100.00	100.00	100.00

Hops grown in Sussex, treated precisely in the same manner as the Kent Goldings, gave the following results upon analysis :—

TABLE II.—SUSSEX HOPS.

	Bine.	Leaves.	Flowers.
Chloride of Sodium ...	5.07	4.79	3.08
Soda	2.00	0.20	—
Chloride of Potassium ...	—	—	0.34
Potash	31.66	12.95	38.26
Lime	35.46	44.97	15.10
Magnesia	6.59	7.60	6.49
Oxide of Iron	0.82	0.81	1.51
Phosphoric Acid	10.10	5.86	18.71
Sulphuric Acid	2.55	3.09	3.67
Silica... ..	5.75	19.73	12.84
	100.00	100.00	100.00

These and other analyses, made by Professor Brazier, prove that

there is considerable variation in the composition of the ashes of different kinds of hops and of hops grown on different soils.

Professor Way calculated that by an average crop of hops of 7 cwt. per acre, about 11 lbs. of silica, 10 lbs. of phosphoric acid, 16 lbs. of potash, 5 lbs. of lime, and smaller quantities of other mineral matter are taken from an acre of land.* This mineral matter must be returned to the soil by means of various manures containing it. Some soils have a larger natural supply of certain of the essential constituents than others, and the manures therefore must be suited to the special composition of the soil. For example, clay soils contain a larger quantity of potash than calcareous soils; while calcareous soils contain a larger quantity of phosphoric acid than clay soils. The quantity of phosphoric acid contained in the soils in the Green Sand district makes them so peculiarly suitable for hop growing. It requires great discrimination and judgment, not only to know what manures to apply to hop land, but also to know in what proportion they should be applied. Besides the mineral or inorganic elements that must be put back in the soil, large supplies of organic matter are necessary to make the plants luxuriant, and to stimulate their growth to the fullest extent. This organic matter principally is conveyed in the shape of ammonia, which may be termed the stimulant of plants, and carbonic acid. The application of ammonia to plants at the present time is somewhat like the system of giving drams or tonics to human beings, to revive, to refresh, to impart *vis*, or 'go,' or energy. Hop planters and corn farmers in many cases endeavour to force the plants almost to unnatural exertions by large and frequent dressings of nitrogenous manure, chiefly of a purely ammoniacal nature; somewhat disregarding the fact that many other essential manurial constituents are wanted. Brewers complain that the hops grown in these days are light and deficient in quality, and that in each succeeding year they get worse in this respect. Old-fashioned farmers say that the hop plants are more liable to blight, mould, and other affections than they were in the days when the number of manures might be told on the fingers of one hand; and they hold that the reason why the hops now do not "keep well" on the poles, but "go off" directly, or even before they are ripe, is that they are immoderately forced by "artificials." "Give us good farm-yard dung," say these patriarchs, "that'll stand by 'em and always be there when they want it. What's the good o' that stuff they put on in pinches like snuff? It's here to-day and gone to-morrow. It drives 'em for a time, and then leaves 'em in the

* "Report on the Analysis of the Ashes of Plants," by Professor Way, *R.A.S.E. Journal*, vol. ix.

lurch." There is a good deal in what the patriarchs say, but they would stare to see their "good coat" of farm-yard manure—say of 23 to 28 cart-loads per acre—reduced to its equivalent in actual manurial constituents, comparatively to a mere handful. The patriarchal mind scoffs at chemistry and believes solely in quantity. *Punch's* picture of Farmer Mangel Wurzel asking for "Some o' that stuff in a moog," exactly represents its state in this respect. Modern bucolics educated at Cirencester, or sitting at the feet of Voelcker and Lawes, on the other hand incline, perhaps, a little too much to the inordinate use of highly-concentrated manures which force a rank growth, deficient in stamina and liable to disease. Nature requires rest; soils cannot go on perpetually developing and building up continuous series of vegetable tissues; nor, in the case of the perennial hop plant, can its system bear a constant high-pressure strain upon its powers.

The chief manures used in hop cultivation are—farm-yard manure made with fattening animals and applied at the rate of 20 to 30 tons per acre, costing from 6s. to 8s. per ton; woollen rags, costing from £3. 10s. to £5. 5s. per ton, put on at the rate of from 1 to 2 tons per acre; and shoddy, therewith of cloth manufactories, costing from £3 to £5.5s. per ton, and containing from 5 to 9 per cent. of ammonia, of which from 1 to 2½ tons are used per acre. Fur waste from furriers' shops is also considerably used; this manure costs from £5 to £8. 8s. per ton, and from 8 to 15 cwt. is put to an acre. All these bulky manures are put on early in the winter, because they are slow in action, especially in the case of the waste substances, in which the ammonia is slowly evolved. Fish, such as sprats, five-fingers, and mussels, form pretty good manure for hops, and are applied during the winter at an expense of from £4 to £6 per annum. Rape dust is a fine manure, almost always put on in the spring or summer, at from half a ton to 1 ton per acre, and is hoed in, or dug in round the plant centres, or is nidgetted in with nidgetts, or horse-hoes, drawn by horses. Rape dust costs from £5. 15s. to £7. 10s. per ton, and is a rich nitrogenous manure, forcing a deal of bine and doing its work quickly.* Nitrate of soda, guano, and sulphate of ammonia are very quick in their action upon hop plants, and care must be taken not to put too much of these manures on at once, nor to use them too frequently. Superphosphate of lime, ground bones, and kainite of potash are also employed in some districts where the soils are deficient in phosphates or in potash.

* It is by no means unusual for hop-planters to put a dressing of rape dust round the hills, within a few weeks of the picking season, and this frequently has a marked effect in preserving the colour of the cones.

After the hops have been manured in the winter with, it may be, 20 tons of farmyard manure at a cost of £7 or £8 per acre, or with shoddy or rags at a cost of £5 or £6 per acre, it is the practice of some of the most enterprising farmers to put half a ton of rape-dust round the hills, or $2\frac{1}{2}$ cwts. of nitrate of soda, or 4 or 5 cwts. of guano, or other stimulating manures. It very frequently happens that the manure put on an acre of hops in one season has cost from £10 to £12.

Besides the bulky manures and the "artificial," there are many manufactured manures of which it behoves the planter to beware. Fearfully and wonderfully are these compounds made, and most of them emit the most horrible stench—a sure indication of virtue and power in the opinion of some tillers of the soil. As the *Hop Journal* pointed out in a recent series of articles upon hop manures, this "villanous odour" is chiefly obtained by pouring a little sulphuric acid upon triturated shoddy or other absorbent substances, and is more or less a delusion and a snare. The planters are getting more wary of the agents for these "patent hop manures," and give them and their stinking, tin sample boxes a wide berth. They are getting into the good habit of having all doubtful manures analysed before they buy them, and pay more attention to the composition of their soils as well as to the composition of their manures. There are many different practices with regard to the application of manures—as to the time, the methods, and the quantities. In the case of farm-yard manure, which invariably at one time was put on in the winter, being carted on to the ground in frosty weather, and dug in wet and cold, many planters now prefer to put it on in the early summer, by means of narrow trollies drawn between the rows of poles. The manure is spread at once, and is nidgetted into the soil, keeping it cool and retaining moisture in seasons of drought, and affording happy hunting-grounds for the innumerable fibres that run a few inches below the surface from each plant centre. Sometimes rape dust, guano, and other artificial manures are spread over the ground, but more frequently these are "chopped" in round the hills. Occasionally rape dust is dug in during the latter part of the winter or in the early spring.

CHAPTER VIII

METHODS OF POLING.

THE ordinary method of poling hops is the placing of two, three, or four poles to each plant-centre in the early spring, after the plants have been cut or "dressed." These are taken down at the hop-picking season, and are afterwards stripped of the bine and set up in conical stacks, at regular distances apart, upon the hop-grounds. Some sorts of hops require longer poles than others; thus, for example, Jones and Grape hops never take 16 feet poles, which are reserved for Goldings and Colegates, though in some districts, upon land that is not strong, these sorts require to be poled with poles 12 feet and 14 feet in length. In the best Golding grounds of East and Mid-Kent and Farnham 16-foot poles are generally used; and sometimes 18-foot poles are put in the very best Golding grounds on strong land. For Grape hops in these districts poles 12 feet and 14 feet long are chosen; and for Jones the poles usually run from 8 feet to 11 feet in length, often being old poles that have been gradually reduced in length by use. In the Weald of Kent, in Sussex, Worcester, and Hereford it is quite exceptional to set up 16 feet poles: the lengths there range from 9 feet to 14 feet, and in the two former districts they are principally from 9 feet to 12 feet. Nothing tends so to weaken the plants or to check their growth and progress for several years as over-poling. The young bines, which only take short "turns," and whose "axial twistings," as Mr. Darwin terms the revolutions of the internode directly from its own axis, are also circumscribed, and cannot lay hold of and get round supports which are stout at the base. The longer the poles are the stouter generally they are in proportion at their bases, but it is not so much the length of a pole that does injury as its girth at the base. Therefore, when hop plants are young, they are poled with small poles which are taken away and replaced by longer poles, according to their vigour and capacity. Frequently the poles that are deemed suitable to their fully developed requirements are put to them in the second year, and the plants are "helped" by short, slight pieces of old poles put close to the stouter poles, up which the bines are trained to go until they reach the more easily surmountable part of the main poles. Where no expense is spared, Golding hop-plants in the

first year have small 10 feet poles put to them ; in the second year 12-feet or 14-feet poles are set up ; and in the third year 16-feet poles are substituted for these. With regard to Grape and Jones hop plants, their customary poles are generally set up in the second year, as their butt-ends are not nearly so stout as those of 16-feet poles ; and it frequently happens that the young bines of these kinds of hops are more vigorous than those of the delicate Goldings.

The number of poles put to each plant-centre varies according to the quality of the land and the fancy of the planters. Golding plants are never poled with more than three poles to each plant-centre. In some cases only two poles are put, and occasionally one row is poled with two poles, and the next with three, and so on. Some planters hold that they can grow as many Goldings on two as on three poles. It is certain that if only two poles are put, the air and light can circulate more freely and the bines do not grow together in such masses as when three poles are put up. When only two poles are used they are set in the ground so that their tips are as far apart as possible from each other, thus giving the hops that grow between the poles as much opportunity of getting sunshine and air as those that grow on the other side. With 1,210 plant-centres to an acre poled with three poles "to a hill," it will be found in "biny" years that many of the hops are light and "white-livered" from sheer lack of sunshine ; at the same time the ground is overshadowed by the bine-laden poles, so that it does not receive a proper complement of warmth necessary to promote the growth of roots and fibres, nor of air to dry up excesses of moisture.

Grape and Jones hop-plants occasionally are poled with four poles. The same arguments used against the multiplication of poles for Goldings apply to this case with even more force. Three poles generally are put up to these kinds of hops, and even then, especially in the case of Jones, unless the tips are very wide apart the bines grow together in hopeless confusion between the poles, and only those hops that grow on the outside of the poles are fully developed.

Poling is commenced directly dressing is finished. Women and boys take the poles from the stacks where they have stood during the winter months, and lay them out to each plant-centre. Men pitch holes close to the plant-centres with a pointed iron bar, and ram the poles down into them with a well-directed effort. Ash, fir, and chestnut poles are the best and most durable. Next come oak, maple, beech, willow, hornbeam and alder. Large plantations of the three first-named woods have in parts of Kent and Sussex been formed upon land that is unsuitable for ordinary crops, for the purpose of supplying hop-poles.

These are planted in equidistant rows, and are cut at intervals ranging from seven to fourteen years, when the fall is frequently worth £60 per acre upon the best land.* All the woods in these counties are so cut as to yield the greatest number of poles, regardless of other considerations; in late years these have been kept well filled up with plants, and timber trees have been carefully thinned out to allow the underwood to grow properly. There are also capital plantations of fir and other best sorts of wood for hop-poles in Hampshire, and in Worcestershire some landowners have recently devoted hill-sides and other comparatively unprofitable land to the growth of underwood.†

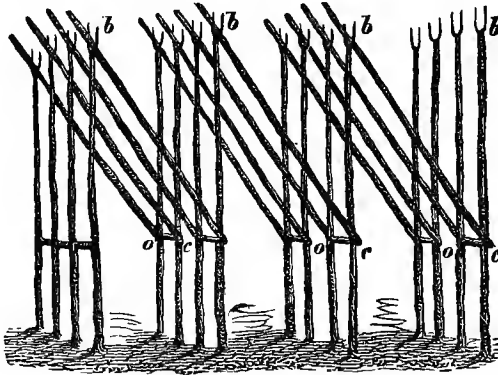
Prices of poles vary much, being fixed to a great extent by the state of the hop trade. Four years ago these were as high as they had ever been. Poles 16 feet long made from 40s. to 55s. per 100; 14-foot poles were worth from 29s. to 40s. per 100; and those 12 feet long made from 16s. to 30s. per 100. At this time they are not worth so much by 50 per cent. from the above figures, and it looks at present as if there would be a still greater reduction in their values. Poles have been a very costly item in the expenses connected with hop-growing. For example, an acre of Goldings requires at least 2,500 16-foot poles, which, until lately, would have cost £60 before they were set up. The practice of creosoting the butt-ends of poles preserves them from decay, and has caused a great saving to the planters. Before poles were creosoted they gave way at "the feet," just above where they stood in the ground. Creosoted poles never decay in this part, the wear-and-tear takes place in the upper part of the poles.

By far the larger portion of the plantations is poled with upright poles in the manner that has been described. There are, however, other methods adopted to a small extent, the best of which is believed to be "Coley's Patent Vinery System." As may be seen from the illustration, stout poles 14 feet to 16 feet long are pitched to each plant-centre as fixtures, east and west. These have two pieces of wood lashed to their tips at the point *b*, to form a fork to receive diagonally inclined poles of from 12 feet to 14 feet in length, which rest in staples fixed 3 feet from the ground to the upright poles at the point *c*. The great advantage of this mode of poling is that the wind, which often does infinite mischief to hop plants poled in the old way, by bruising and discolouring the flower cones, cannot do much harm, as the

* During the last three years there has been a great decrease in the value of wood land, owing to the failure of the hop crop, and in this last winter it has been difficult to find buyers for the falls in many places. Directly hops pay well again prices will revert to their former standard.

† This has been done on the estate of the Duc D'Aumale, near Evesham.

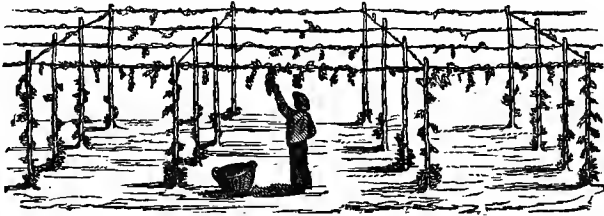
poles remain firm and are not blown about. Coley's system is expensive at first, costing from £70 to £90 per acre, and the expenses of tying and keeping the bines to the diagonal poles are somewhat larger.



COLEY'S PATENT VINERY SYSTEM.

Mr. Farmer, of Kyrewood, Tenbury, has patented a plan of training hops on wire, by an arrangement of vertical wires communicating with horizontal wires. Large posts, stouter than telegraph posts, are fixed at the end of each row of hops, to which wires are fastened to the top and bottom. Many other arrangements of wire have been devised; none perhaps is so perfect as a system carried out by Mr. Butcher, of Selling, in East Kent, which is at once simple and comparatively economical. With regard to training hops on wire, it is thought that the bines require too much tying, and that this being a somewhat unnatural support, they would be constantly getting away from it. This is remarked upon in a paper on the cultivation and management of hops, in the 7th vol. of the *Royal Agricultural Society's Journal*, as follows:—"In the case of vertical wires, it is believed that the bine would require constant tying, as its reflexed hooks would not have a firm hold upon the smooth wires, and that 'short turns' would be general, which are usually thought to be indicative of want of vigour in the plant and fatal to the chances of a good crop." Still, training hops upon wire is adopted to some extent in England, and very extensively in all parts of Germany where poles are dear. In the latter country there are at least twenty different modes of using wire as a substitute for poles for hops. String also is used for training the bines along. This method

was introduced from America, and has been adopted in a few instances in this country. It has not given satisfaction, because the leading shoots require frequently to be tied to the strings, as it is against their nature to climb laterally.



THE STRING SYSTEM.

CHAPTER IX.

TYING.

AFTER the poles have been set up, which operation is usually concluded by the end of April, the work of tying the bines to them commences, and is almost always carried out by women and girls, because the "horny-handed sons of toil" have not sufficiently nimble fingers to tie the rushes round the bines. In very growing seasons the planters often are obliged to set all their men tying, in order to get the bines up to the poles before they have become hopelessly intertwined upon the ground. It need not be said that this is a very expensive process, and costs at least twice as much as if it had been done by women in the ordinary way. The time for tying usually is between the 20th April and the 15th May. The poles ought to be well furnished with bines by the latter date, and the "old ladies" ought quite to have finished this work by the beginning of the last week in May.

After the hops have been poled, and when the bine is a foot or a foot-and-a-half in height, careful men are sent to pull out the most forward and rank-growing shoots, termed "pipy," that they may not be tied up, as these are not so productive as the smaller and less luxuriant bines. If they are not taken out, the old ladies are sure to tie them up, because they come first to their hands. Two or three bines are tied to each pole. Where only two poles are set to each plant centre, three bines generally are tied up. In three, pole-work, two bines are often tied to each pole, or two to one and three to the others; or two bines to two of the poles, and three bines to the other pole, according to the fancy of the planter and the quantity of bines available. The habit of the hop-plant, unlike that of many other twining plants, is to climb with the sun, from right to left. French beans, and all the twining Convolvulaceæ, climb against the sun. In common with other twining plants, the shoots of the hop have a peculiar, revolving movement, as to which Mr. Darwin has thus written in his interesting work on "The Movements and Habits of Climbing Plants:"* "When the shoot of a hop rises from the ground, the two or three first formed joints or internodes are straight, and remain stationary;

* "On the Movements and Habits of Climbing Plants," by Charles Darwin, F.R.S., p. 3.

but the next formed, whilst very young, may be seen to bend to one side, and to travel slowly round towards all parts of the compass, moving like the hands of a watch, with the sun. The revolving movement continues as long as the plant continues to grow, but each separate internode, as it becomes old, ceases to move." From seven observations made by Mr. Darwin, he found that the average rate of these revolutions in hot weather was two hours eight minutes. It must be borne in mind, that this revolving movement is quite independent of, and unconnected with the ordinary "axial twistings" of the shoots. Mr. Darwin has remarked as to this: "The first purpose of the spontaneous revolving movement, or more strictly speaking, of the continuous bowing movement, directed successively to all parts of the compass is, as Mohl has remarked, to favour the shoot finding a support. This is admirably effected by the revolutions carried on night and day, a wider and wider circle being swept as the shoot increases in length. This movement likewise explains how the plants twine; for when a revolving shoot meets with a support, its motion is necessarily arrested at the point of contact, but the free projecting part goes on revolving." This curious fact in natural history explains how it is that the vines find the poles so quickly, and keep to them after they have been once tied to them, unless they are blown away by the wind. When once the support has been found by the leading shoot in its wanderings and revolvings in search of something to lean upon, the reflexed or recurved hooks with which the vine is furnished lay hold of it and keep hold of it with tenacity. In most seasons, and when the plants are perfectly healthy, the women have but little trouble to keep the vines in their places after they have been tied to the poles, on account of this admirable provision of nature. They fasten a rush round the group of vines—two or three, as the case may be—about a foot from the ground. In a week or so another rush is put round each group, a foot or a foot-and-a-half from the first. After this, unless the vine is unusually "sticky" from white frosts, or the "heads" are blown away from the poles by a persistent wind, but little attention is necessary until the vines reach the tops of the poles, when ladder tying is commenced. As soon as the vines are out of reach, the plant-centres are cleared out of all the vines but those that are ascending the poles, in order that all the strength and vitality of the stock may be concentrated upon them.* Later on, when a new growth has appeared, it is checked by a few shovels of earth put over the

* This is the ordinary practice, though there are planters who think it better not to pull away the useless vines, or, at least not all of them, preferring either to twist them up in a knot and earth them up in the plant-centre, or to let them run over the ground.

plant-centres, between the poles, which effectually stop it. This covering with earth, as has been shown previously, encourages a fibrous growth, from which sets for propagation are taken in the following spring.

Much depends upon the manner in which the tying is done. Great care is necessary to prevent inexperienced or slovenly tyers from tying up rank, "pipy," unfruitful bines, and to see that each pole has a proper complement of bines, as uniform in size as possible. In seasons when there is a great deal of bine, young and careless tyers tear out large handfuls of bines, without considering what they will require to furnish the poles with, and are left at last with an insufficient number of short, uneven bines. Many planters set a man specially to look over the tyers, and see that they do their work judiciously. This is money very well spent.

After the bines have grown beyond the reach of the women, and have gained the summit of the poles, a chosen few of the hands go forth with folding ladders, eight feet long, to tie those bines to the tops of the poles which show signs of falling away or slipping down. This is a somewhat perilous task, requiring skill, strength, and, above all, the operators must not be "swimmy-headed." To stand on the topmost "rung" of a rickety eight-foot ladder, in a gale of wind, under a full sail of petticoats, with both hands engaged in tying recalcitrant bines, is a feat not unworthy of an acrobat. Therefore a ladder-tyer requires extra pay, and receives the handsome remuneration of eighteen pence or twenty pence per diem. Cherry-picking is held to be dangerous work by the Kentish maids and matrons, but ladder-tying hop-plants is more fraught with difficulty, and there is not the occasional solatium of a juicy Black-heart or a luscious Bigarreau.

With regard to tying, in the case of hop-plants poled according to the Coley system, or with a combination of poles and strings, or of wires, the work is more troublesome and expensive. In the Coley system it is found that the bines, which are led on to the diagonally inclined poles, do not like to twine in that unnatural direction, and require tying down, at intervals. In the case of wires and string, the supports are not stout enough for the proper action of the axial twistings and for the full play of the internodal revolutions, the bines are continually getting away from the supports, and require constant attention.

Well-harvested rushes are generally used for tying hop-bines to the supports, being supple, soft, and elastic, and allowing room for the bines to grow. String and other tying materials are too readily affected by the weather, frequently contracting and expanding, and therefore are likely to fetter and restrain the swelling bines.

CHAPTER X.

CULTIVATION.

It has been stated that the hop-land is dug in the winter and early spring, before the hops are dressed and poled. This operation is performed by men with a tool called a "spud," having three tines, flattened out at the ends as shown in the illustration. If this is thoroughly well done all the ground is moved and turned over, the weeds are buried, and the manure is covered. It is very hard work to move all the soil in this way, and it is very often shirked and done in a slovenly manner in these days. The modern diggers too often merely push large "spits" of soil over, and do not lift each "spit" up on their spuds and throw it over, as the old-fashioned workmen did in other days. It is better to have hop land dug even in this perfunctory manner than to adopt any other method of cultivation. Some planters plough it. Some wait until the poles have been set up, and then cultivate it deeply with nidgetts, or small cultivators, but the ground does not lie so well, nor does it work so well as that which has been hand-dug. Where labour is plentiful, therefore, all planters prefer to have their hop-land dug, and usually begin towards the end of November, or the beginning of December. The price given for hop-digging varies from 18s. 6d. to 23s. per acre. An able-bodied labourer can earn 3s. per day at this work, and will dig an acre a week without difficulty, weather permitting, in the short days of the winter months. A hop-ground that has been really well dug looks as neat and lies as even as a garden, and represents the *beau ideal* of cultivation. To get a large plantation dug in the winter requires a large staff of labourers, who expect to be employed during frost, snow, and wet weather, when it is impossible to dig. Now that the "patriarchal" system is fast vanishing on the various farms, and the men are becoming independent, and the employers think that in self-defence they are obliged to look to themselves, and will not "make bad weather jobs," it is considered desirable not to keep a single labourer more than is absolutely necessary. Thus the digging is frequently much behind-hand, and the ploughs are put on to make up for lost time.



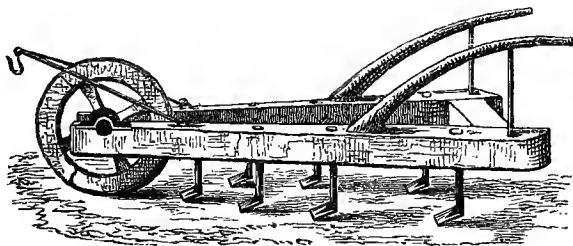
Ploughing hop-land always is, and always must be an unsatisfactory process. Less than three-fourths of the ground can be ploughed to begin with, because of the arrangement of the plant-centres, which renders it impossible for the plough to go in the spaces between them, at right angles with the furrows in the central alleys. The spaces between the rows of pole-stacks at right angles with the furrows also must be dug by hand. With the utmost care and the best plough and ploughman the work never looks neat and finished. Manure and weeds are not completely buried, and the ends of the work, in the absence of proper "headlands," are necessarily untidy; while in wet weather the horses' feet make a great stodge, and do much harm to the stocks. The cost of ploughing hop-land is much the same as that of digging. The sole advantage gained by adopting the former process is that the planter is to an extent independent of the labourers, in the winter at all events. Upon large hop farms, where the land is conveniently arranged, it is moved in the winter by a cultivator worked by steam-engines, or after the poles are up in the early spring. The soil can be well and deeply disintegrated by this means, but the appearance is not so good, neither are the weeds and manure put out of sight. Cultivating by steam in this way can be done more quickly than ploughing, at a cost of from 12s. to 15s. per acre. It is not much practised at present, though no doubt it will be more extensively adopted if the wages of labour increase in any important degree.

Mr. Knight, of Farnham, has patented a hop-digging machine which is very ingenious, inasmuch as by an arrangement of a crank shaft working three vertical connecting rods, into which rods tines, resembling those of a "spud," are fixed, the action of the human arm in the process of digging is marvellously imitated. This machine is driven by a steam-engine with ropes and pulleys, and will dig from three to four acres per day to a depth of from eight inches to twelve inches, at a cost of 16s. or 17s. per acre. Mr. Knight exhibited this machine some time since in Kent, near Maidstone, to a large company of planters, who were much pleased with it, and the work done by it. Though the soil is not absolutely turned upside down as it is when well dug by hand, it is, nevertheless, thoroughly moved by the tines, and is left in a finer state, which perhaps is not any advantage. This machine is the best of the kind that has ever been produced, and will, no doubt, come largely into use if the supply of human diggers becomes much more limited. Like ploughing and steam cultivating, digging by steam will only be generally adopted by hop-planters when the labourers demand exorbitant rates. At the Wolverhampton show in 1871, the Royal Agricultural Society of England offered prizes for the best machine to supersede digging hops

by hand. There was nothing at all novel, and nothing that had any merit.* Mr. Knight's machine had not then been invented, or it would doubtless have received a prize.

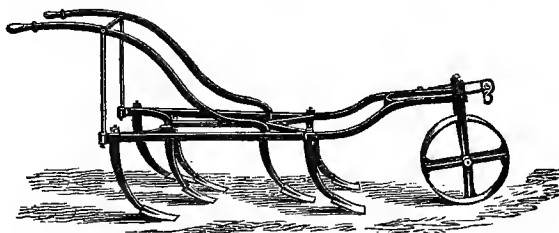
After the poles have been put up, the land is cultivated with an implement called a "nidgett,"—a large horse hoe with seven or

No. 1.



nine tines—drawn in the alleys each way between the rows of poles, by one or two horses according to the depth required. The nidgett has been very much improved during the past 25 years, and illustrations are appended, showing in No. 1, the old nidgett, and in No. 2 the new and improved implement. Two horses

No. 2



usually are put on to the nidgetts at first, as the ground is hard and beaten down after the winter rains, in order that the soil may be deeply stirred. After this one horse is sufficient. The ground is kept stirred to a good depth until the first week in July, by which time there should be a tilth, or "crumb," as the Kent planters say, at least a foot deep all over the plantation. Good managers do not nidgett the hop-land deeply after the first week in July, because by this time the fibres have commenced running all over the ground, a little way below its surface, and it is thought to be wrong to disturb them, because they are sent out from the parent

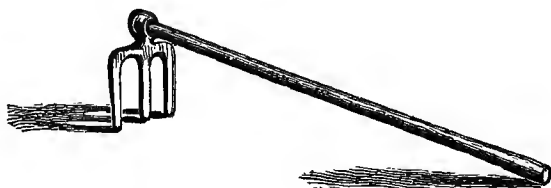
* See Report of the Judge on the Trials of Hop Machinery at Wolverhampton, in vol. vii., 2nd series, *R.A.S.E. Journal*.

stocks as foragers to scour the country and to supply them with food. There are, however, some planters who hold that it is right to disturb these lions' providers, and forthwith cause the nidgetts to be put into the soil as deeply as possible, so that they tear away large masses of the fibres at every step. They first of all carefully prime the plants with manure, which is spread over the surface and dug in, and then, just when the fibres are assimilating the manure, so that it may be conveyed through their long arterial systems to the plants, they are ruthlessly torn away by the nidgetts.

Unless the soluble elements of the manure are washed down to the very roots of the plants, they are wasted entirely if the fibres are destroyed or interrupted. No one who has not seen the enormous quantities of these delicate fibres, mere filaments, that form a close network of communication between the rows of plants in a flourishing, well-manured hop plantation, would believe how extensive their ramification is, or fail to be astonished at this wonderful provision of nature.

After this important season in July, when the "fibres are running," most planters have the ground merely skimmed with the nidgetts, the tines of which are set square and made broad and sharp in order to cut off the weeds. This is done up to the eve of hop-picking, so that the land may be clear of weeds through the autumn and winter.

The nidgetts can take much of the ground, but not all of it. They obviously cannot get at that part which lies between the poles put up to each plant-centre, nor can they be drawn close to the poles. A space round the plant-centres of about nine inches to a foot must be tilled by hand. This usually is dug round with a spud directly after the poles have been put up. About a month afterwards it is hoed with the "Canterbury" three-pronged hoe,



as shown above, which is an admirable tool, and raises a fine crumb. Later on in the summer this space is hoed with an ordinary plate-hoe to remove the weeds which accumulate and grow most rapidly in the rich soil, in the shade of the bine-covered poles. "Digging round hills," or plant-centres, costs from 8d. to 10d. per 100. There are, it will be remembered, about 1,200 of these per

acre. "Prong" hoeing and "plate" hoeing cost from 3d. to 6d. per 100 hills.

In the best managed plantations frequently it is difficult to find a handful of weeds per acre at the beginning of July, while almost in every part a man may easily thrust his foot at least eight inches into the finely triturated soil. This is the best possible condition for hop-growing.

CHAPTER XI.

THE ENEMIES AND DISEASES OF THE HOP PLANT.

NUMEROUS are the enemies and diseases to which the hop-plants are liable from the very earliest down to the last stages of their growth. The skill of the hop-planter is exercised continually, either to prevent the attacks of insects, blights, and mould, or to cure the plants when attacked and affected by them.

The first enemy that appears upon the scene is the wireworm, the larva of an insect known to entomologists as *Agriotes Lineatus*, or, familiarly, as a "click beetle." This larva, which is long, yellowish, and horny coated, and furnished with large mandibles, or jaws, well fitted for gnawing vegetable substances, attacks the fresh-planted sets which are put into the ground to form new plantations, and frequently causes great injury to them by exhausting their juices and eating away the young shoots as fast as they are formed. Curtis, and other entomologists, have pointed out that wireworms remain in the ground in their larval state from four to five years, and feed upon roots and tubers wholly during this stage of their existence. Therefore it can readily be imagined how difficult it is to raise hop-plants in land infested with them, for, being under ground, and clad in armour, it is most difficult to destroy them. The only way of circumventing them is to put traps of small pieces of turnip, carrot, potato, or mangel, close to the hop-plants, just under the ground. The wireworms burrow into them, and may be caught *flagrante delicto*, if the pieces are taken out and examined twice a week. As many as two hundred have been caught in one plant-centre in a single season by these traps. In old meadow land it is sometimes most difficult to get hop-plants to take well, by reason of the quantities of wireworms which are harboured in the decaying sward.

Some persons confound wireworms with centipedes, a species of the genus *Scolopendra*, which is not in the larval state like the wireworm, but is a perfect insect. Thus, Mr. Lance, otherwise a correct and careful observer, in his "Hop Farmer,"* actually calls the wireworms *Scolopendræ*, when, as a fact, they are as different as sheep from tigers. The former feed wholly upon vegetables; and

* "The Hop Farmer." By E. J. Lance (1838).

have their jaws specially formed for biting and chewing, while the latter are insectivorous, having jaws adapted to this end alone. Mr. Lance, in common with many other persons not well versed in the natural history of insects, not only confounds the species of centipede known as *Grophilus Unicornis*, found in decaying fibres, with wireworm, but also with the species of millipeds—"thousand-legs"—*Julus terrestris*—of the Julidæ family, which are destructive to vegetation. Those who know the habits of these insects would remorselessly slay the wireworms and the "thousand-legs," and preserve the "hundred-legs," as they are vulgarly styled, to feed upon their neighbours.

The larva of the ghost moth—*Hepialus Humuli*—a long white caterpillar, causes considerable injury to the hop stocks, but fortunately it is not very common, and, as Curtis has pointed out in his "Farm Insects," does not solely confine its attention to hop-plants. The flea—*Haltica Humuli*—is most destructive in the hop-plantations. It is of the same genus as the turnip flea—*Haltica Nemorum*—but is more oval in shape than this species, and is of a greenish black colour, tinged with a bronze or copper hue. The transformations of this insect are not so well known as in the case of its congener, the turnip scourge, but it is supposed that the perfect beetles hibernate and deposit their eggs either just under the cuticle of the hop-bine, or under the cuticle of the leaves. The eggs are hatched in about a week, and the maggots or larvæ thus produced remain in that state for about six days. There are five or six broods between April and September; and during the whole of this time the fleas, in a long succession of generations, are sucking the sap from the bine and leaves, following the bine up the poles, and finally getting into the flower cones, whose juices they exhaust and pierce their stems, causing them to wither up, or to lose weight and condition. In the last four seasons the hop cones in many grounds in various parts of the country just before picking time became red or dusty-coloured, and prematurely decayed. Upon examination it was seen that the stems, or "strigs," of the cones were pierced by the snouts of insects, and that in many cases the holes were filled with tiny white maggots or larvæ, which, no doubt, were those of the fleas—their last brood. Very much loss was occasioned last year by these insects. Fleas are very troublesome to hop planters in dry seasons, in the early spring, especially where the ground is rough and unkind, when they check and do serious injury to the young bines. There is no effectual preventive against their attacks. Some planters sprinkle soot and lime over the hills, but this merely checks them temporarily. Care should be taken to cut off and clear away the dead bines before the spring season, as it

is thought the beetles hibernate in their cavities ; and to get the ground well stirred and triturated as soon as possible.

But the attacks of wireworms, millipeds, and fleas are insignificant indeed in comparison with those of the *Aphis Humuli*, or "hop fly," called by Lance "the barometer of poverty," which often have changed in a few short weeks the appearance of the whole of the plantations in the United Kingdom from the prospect of a plenteous crop to the blackness of utter blight.

There are many species of aphides, peculiar to certain plants. All the species differ in degree, but all possess the same extraordinary power of reproduction. The eggs deposited in the autumn are hatched in the early spring. Winged females are the produce of these eggs, which bring forth larvæ. These larvæ are parthenogenetic, and bring forth larvæ, which, in their turn, also give birth to viviparous larvæ. This process is repeated throughout many generations. Professor Owen, in his interesting work on Parthenogenesis* says on this point: "The first-formed larva of early spring procreates not one, but eight larvæ like itself in successive broods, and each of these larvæ repeats the process ; and it may be again repeated in the same geometrical ratio until a number which figures only can indicate and language almost fails to express is the result." Practically, in favourable weather the increase of aphides upon hop-plants is past all calculation. Soon the plants begin to droop from the exhaustion of their sap by the innumerable lice ; they change colour, and the leaves quickly shine from the viscous excretions of the insects, and finally get black with filth. This shining liquid is called "honey-dew," and is popularly supposed to be, as Mr. Lance says, a particular juice emitted from the antennæ of the lice. Mr. Rutley, however, accurately describes it, in his practical paper in the *Royal Agricultural Society's Journal*,† as their excrements, which, mixed with the juice of the bine and the morning dew, fall on the leaves below and form that shining, sticky moisture called "honey-dew."

Aphides appear upon the hop-plants in greater or smaller numbers during each spring season. If the plants have been checked by frosts or are in any way unhealthy, so that the aphides find their juices grateful to their tastes, they remain, wax fat, and multiply exceedingly. When the bine is in a normal condition, the aphides do not increase after their kind, but disappear as quickly as they came.

* Owen on Parthenogenesis. Van Voorst, London, 1849.

† "On the Best Mode of Managing Hops in its Various Branches," by Samuel Rutley. *The Journal of the Royal Agricultural Society*, vol. ix.

Until about 1860, there were no means known of checking the progress of flies and lice, and the planters until that date bore the infliction of periodic blights without seriously attempting to avert them. A system of washing the plants with soap and water, squirted over them from garden engines with hose and spray-jets, was introduced about eighteen years ago, and now is regularly adopted by many planters when there are signs of blight. This operation must be performed by careful men, and the bine and leaves on each pole must be thoroughly washed so as to dislodge every winged aphid and every louse. If all are not removed, the plants will be just as foul in a few days after as they were before the process. It is not always efficacious, even if thoroughly well done, but there are many and wonderful instances where hop plants that have been washed have grown plenty of good hops, while those in neighbouring grounds that have not been washed have produced a small crop of rubbish. It is, however, worse than useless to wash hops after they are in burr or blossom, therefore washing is of no avail as against a late blight, like that of 1878, when lice swarmed in the flower cones and ruined the samples. The best mixture for washing hops is, 100 gallons of water and 20 lbs. of soft soap, with a quarter to half-a-pound of tobacco, for one acre. The cost of once washing varies from 35s. to 45s. per acre, and it often happens that the process must be repeated two or three times before the last louse is driven from the field.

Since the beginning of this present century, the worst blights have occurred in 1823, when only 1 cwt. 1 qr. 5lbs. were grown per acre; and in 1825, when only 1 cwt. 8 lbs. were grown upon each acre in the United Kingdom, which is by far the worst blight upon record. The blights of 1829 and 1840 were also very disastrous, as only 1 cwt. 2 qrs. 25 lbs. were produced per acre in the former, and 1 cwt. 2 qrs. 8 lbs. in the latter year. In 1854, 1 cwt. 2 qrs. 15 lbs. were grown per acre; and in 1860, the average yield of the plantations was 2 cwt. 17 lbs. The lowest return per acre since the year 1860 was 3 cwts. and 7 lbs. in 1863.

It is upon record that the worst blight during the preceding century was in 1725, when only about 13,000 cwts. were grown as against 125,000 cwts. in 1724 and 165,000 cwts. in 1726. Again in 1764 and 1793 blight caused failures in the crops.

CHAPTER XII.

THE ENEMIES AND DISEASES OF THE HOP-PLANTS FURTHER
CONSIDERED.

IN the last chapter the chief insect enemies of the hop-plants were described in detail. Besides these there are others more or less injurious, but not so persistent in their attacks nor so much dreaded by the planters. Among these is the red spider, a tiny species known as *Tetranychus Telarius*, of the order *Acarina* (genus *Tetranychus*), which does infinite harm in very hot and dry seasons. This insect spins an almost invisible web of the most delicate texture on the under surface of the leaves of the hop-plants. Protected by this gossamer covering its numerous eggs are hatched, and a colony of all ages and stages is quickly formed, which derive their nourishment from the sap of the plants. Mr. Andrew Murray, in his "Economic Entomology,"* has graphically described the influence of these Acari upon plant-life. "The plant," wrote Mr. Murray, "soon shows the influence of their presence in its sickly yellow hue; the sap is sucked by myriad insect mouths from the vessels of the leaf, its pores are choked by excremental fluids, and the planter mourns the inefficiency of his remedies. The leaves attacked have a languishing air, they are yellowish or greyish above, their edges are slightly folded back, and as if they were rolled on the under side—the lower side is whitish and shiny."

In very hot summers, red spiders increase and multiply in a marvellous manner, and their work of destruction goes on most rapidly, so that its progress can almost be traced from day to day. The planter notices at first a small patch of yellowing plants upon a shallow moulded spot, or in "pinnocky" or unkindly soil, which spreads and increases if the weather is dry until the whole of the plants in the ground have become yellow, and look as if they were dying away. Heavy thunder showers, a wet day, or two or three cold nights, however, completely check the ravages of the spiders and arrest the premature sere and yellow changes of the leaves. In 1868, and again in 1872, thousands of acres of hop-plants were utterly spoiled by these insects; their juices were dried up, their leaves fell off, they could not develop hops, and they

* "Economic Entomology" (*Aptera*). Reprint of a series prepared by Andrew Murray, F.L.S., at the request of the Lords of the Committee of Council on Education.

looked as if a hot wind—a very Simoom—had swept over and blasted them with its fiery breath. The Germans call this effect, Kupfer-brand—copper brand—and until recently did not connect it with the action of the red spider, but attributed it to atmospheric influences or to unhealthy conditions of the soil. Even now some English planters call it “fire-blast,” and will not believe that tiny mites can cause such wholesale destruction. Anyone who has a microscope may quickly discover the cause of the evil, and can see for himself the fine network of the countless webs spun across the under-surface of the leaves, and the little red specks actively moving about, with eggs, larvæ and pupæ in innumerable quantities. No efficacious method of staying the advance of the *Tetranychus Telarius* has yet been discovered. Gardeners manage to check the progress of its congeners, *Tetranychus vitis*, and *Tetranychus ferrugineus*, by means of fumes of sulphur in the confined spaces of green-houses and hot-houses, and by applications of Gishurst Compound, soft soap and water, and other things. Hop-planters have tried syringing the plants with water without much effect, and have used sulphur without the slightest apparent good. Fortunately, as has been remarked above, a change in the weather or fall of the temperature serves to put an immediate stop to this most dangerous pest.

During the last few years planters have noticed a new enemy in the shape of a prettily-marked bug, about the fifth of an inch in length, of very active habits, running from leaf to leaf and up and down the vines of the hop-plants, injuring the bine, leaves, and fine terminal shoots by puncturing them and sucking their juices. The leaves and shoots that have thus been punctured curl and dry up, being evidently poisoned by these insects, which are very numerous in hot seasons, and do much harm by crippling many of the leading shoots after this manner. Specimens were sent to Mr. Carruthers, the consulting botanist of the Royal Agricultural Society, who obtained the opinion of Mr. Waterhouse, the eminent entomologist of the British Museum, and reported that they were evidently the larvæ of an Hemipterous insect, a species of the genus *Lygus-phytocoris*, or plant-bug. Curtis, in his “Farm Insects,” describes several species of *Lygus*, especially one known as *Lygus solani*, which injures the haulm of potato plants and causes the leaves to shrivel up and fall off, but he does not say whether it is in the larval or the perfect state that it does this mischief. Mr. Harris, a distinguished American entomologist, gives an account of various species of *Lygus*, particularly of one called by him *Lygus lineolaris*, or “little plant-bug,” which is most destructive to potato haulm and leaves in the United States. From his description of this insect it appears to resemble almost exactly the species which infests the

English hop plantations, being marked or spotted in the same way, and is most abundant in the months of June and July, and hibernating in the perfect state. At present the attacks of this *Lygus* have not occasioned serious injuries, except in isolated cases, though it is conceived that it might prove very troublesome in seasons when the bine is weak, or slack and backward.

Passing from the insect enemies of the hop-plant to the diseases which befall it, the first to be noticed in this latter category is "mould," or mildew, which has proved even more disastrous to hop-planters than the blight caused by aphides. This disease is due to an insidious parasitic fungus, known to mycologists as *Sphaerotheca Castagnei*, of the group *Erysiphe*, allied to the fungus which causes the mildew in vines. These species are known as incomplete fungi, "not perfect plants in themselves," as Mr. Cooke, who has written an able treatise upon fungi, remarks, "but merely conditions of fungi of a higher order, little differing, it is true, in external appearance, to the naked eye, but offering material difference in structure under the microscope."* The potato fungus, known to scientists as *Peronospora infestans*, is a perfect or complete fungus, whose life history has recently been traced throughout by Professor de Bary and Mr. Worthington Smith; but the fungus that attacks the hop-plant has not as yet been proved to be peculiar to it, and it is supposed that its spores may be wafted from maple trees, or meadow-sweet, or other media. However, its life history has not yet been made quite clear, so that no definite precautions can be taken by the planters to prevent the spores, or seeds, from being conveyed to the plant. But it may be said that, reasoning by analogy, it is likely that the resting spores of this fungus, like those of the *Peronospora*, remain on the bine and shoots and fibres of the hop-plants. Planters should be very careful to burn, or otherwise destroy, all bines, fibres, and shoots when the plants have been attacked by this fungus, and especially at dressing time to remove every particle of old fibre. The practical result of the discoveries with regard to the potato disease is to warn potato growers to destroy every particle of haulm and all diseased tubers, or those that have been in contact with affected tubers, in order that the resting spores may be destroyed. No doubt, before long, discoveries will be made with regard to the life history of the individuals of the *Erysiphe* species, by which hop-planters may know more accurately what steps to take to prevent their propagation.

* "Fungi: their Nature, Influence, and Use." By M. C. Cooke, M.A., LL.D.

CHAPTER XIII.

THE ENEMIES AND DISEASES OF THE HOP-PLANT (*concluded*).

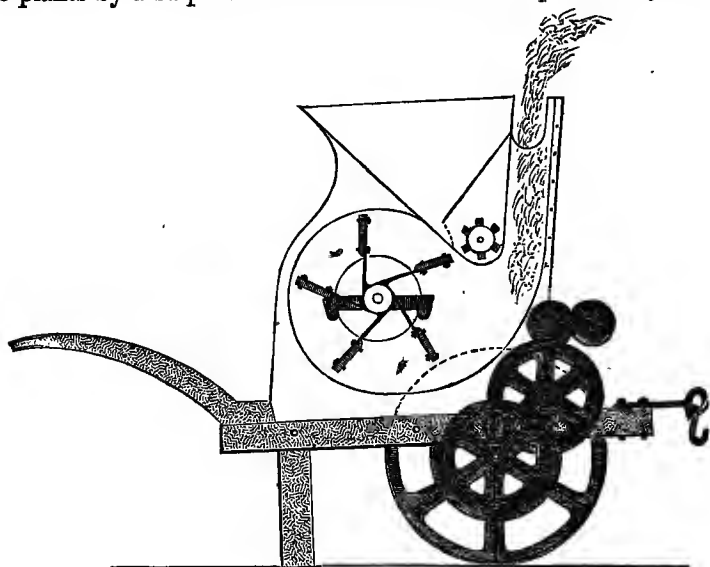
It is commonly believed that the hop-plant is predisposed, by an unhealthy and abnormal condition, to be affected by mildew* or mould; or, in other words, that its tissues, in certain circumstances, offer a suitable nidus for the spores of the fungus. A sudden check, caused by spring frosts or cold weather, may bring about this predisposition, and it frequently happens that mould spots appear upon the large leaves, and do not spread to the burr † and flower-cones. When the mould or fungus attacks the burr, it arrests its growth at once, and prevents its development into a perfect flower-cone. If it attack the cone, the mycelium, a tubular root thrown out by the spores, pushes its way into the delicate tissues of the leaves of the flower-cones, causing decay and putrefaction, and utterly spoiling them for brewing purposes. A few hops injured in this way by mould serve to spoil a sample, as they impart a bad flavour as well as unwholesome qualities to beer; therefore, planters have much reason to dread the appearance of the familiar white spots upon the leaves and burr. Unlike the potato mould, which is more virulent in wet seasons, and often manifests itself immediately after heavy thunder showers, the hop mould sometimes "runs" as quickly in dry as in wet seasons. Mould has been fearfully virulent in the last three seasons, and thousands of acres of plants have been utterly spoiled by its action. In districts where mould has hardly ever been known before, it has caused great destruction. Some kinds of hops, such as Grapes and Jones, supposed to be proof against mould in certain localities, have been attacked. No locality, no kind of hops, has been exempt of late.

Sulphur is the only known means of checking the ravages of this fungus. It was asserted that it not only checks its progress, but prevents it from appearing; and it is a fact that many hop-grounds which were particularly liable to be mildewed before sulphur was applied as a means of prevention, were comparatively free till the last two or three years; but lately, owing to the fearful virulence of mould and the apparent inability of sulphur to check its course, many planters have had their faith in its efficacy somewhat rudely shaken, though it must be said that even in these last years there have been remarkable instances where a judicious, thorough, frequent,

* Mr. Cooke, in his "Microscopic Fungi," says, "mildew" and "mould" are terms that represent very different ideas to different individuals; but every hop-planter knows what mould means.

† "Burr" is the incipient cone.

and well superintended application of sulphur has enabled planters to produce a capital crop of bright sound hops, in the very heart of districts sorely vexed by the fungus. Many planters sprinkle the hop plants with sulphur, as a matter of ordinary routine, just as they dig, or pole, or manure them, whether there are indications of mould or not, in the same manner as the French wine-growers sulphur their vines to prevent the *Oidium* from coming. About 50 lbs. of sulphur—either “flowers” of sulphur, sublimated sulphur; or sulphur vivum, known as black sulphur—are thrown up over the plants by a sulphurator—a machine drawn up the alleys, fitted



SECTION OF A SULPHURATOR.

with a revolving fan like a winnowing machine—early in July.* This is repeated once or twice, or even three times, until the burr is formed. After this stage the best managers do not apply sulphur, in order that there may be no possibility of any particles being conveyed in the cones to the beer. In cases where the mould appears on the cones, the planters sometimes apply sulphur, regardless of consequences, and it must be said that a few put quantities of sulphur indiscriminately upon the plants when in “full hop” that give no indications of mould, to prevent it, as well as to make the cones keep bright till picking time. This late application of sulphur makes brewers object to sulphur being used at all, as

* Mr. Watt, of Southampton, lately has patented a sulphurator having a furnace for heating the sulphur, so that sulphurous fumes are emitted and thrown up over the hop-plants.

the dust is retained by the sticky farina in the cones, and must go into the beer; though it is utterly impossible that any of the particles can be taken to the beer by means of hops whose plants only have been sulphured before the cones were developed. The force of the objection in the former case is manifest, and all reasonable persons must see it; but it is unreasonable to protest against the use of sulphur under all circumstances, because some planters use it inordinately and too late. Sulphur has been of enormous benefit to planters and brewers, and its proper and legitimate use to counteract mould should not be tabooed.

Its use undoubtedly has been of very great advantage to hop-planters during the last twenty-five years. Before that date mould ravaged the plants unchecked, and periodically caused great losses in all parts of the plantations, although it must be said that brewers did not so positively set their faces against "mouldy" hops as they do at the present time, when colour and quality are essential. In former days diseased hops of this description and brown hops were put into "bags," made of the coarsest fibrous material possible to conceive, containing two-and-a-half cwts., and were by no means difficult to sell at certain times in the season, especially if a short crop came. But now brewers will not look at mouldy samples, and therefore they should not protest obstinately against the use of sulphur under any circumstances in the cultivation and production of hops. They might, if they were assured by scientific demonstration that sulphur acts prejudicially to beer, draw a line at its application to hops in the burr stage, and require a guarantee that it had not been used when the flower cones were developed.

To show that mould was considered to be an incurable malady, it will be sufficient to quote a passage from the "Hop Farmer," written in 1838 by Mr. Lance, an eminent authority in those days, which runs as follows:—"This disorder once commenced, there is no remedy except what nature affords by the weather as a preventive to the increase. To overcome this, as well as other attacks, the best way is to have healthy plants, tillage the ground, an open aspect to the east, south, and west." Mr. Rutley also wrote upon hops ten years later, alluding to its extremely malignant effects upon hop-plants, but offered no remedy against its action. In short, until sulphur was introduced the planters had to fold their hands in despair and await the issue of an attack of the insidious fungus.

It has not yet been made quite clear in what way sulphur acts as a preventive of and a cure for mould. Some hold that it operates as an escharotic, and that any other fine powder would be as effectual in absorbing the moisture from the mycelium and thus destroying it.* In the essay on the cultivation and manage-

* Professor Brazier, of Aberdeen, inclines to this theory.

ment of hops quoted before, the writer says:—"It must be confessed that it does seem more feasible that the sulphur combining with moisture and oxygen gives off fumes and vapours of sulphurous acid which are prejudicial to the development of fungi, at the same time being so gradually evolved as not to injure vegetation."* It is well known that sulphurous vapours not only are destructive to fungoid and other parasitic growths, but also that they prevent the spores from becoming established upon their accustomed media; and it is believed that this is the reason why sulphur, if put on the plants in the early summer, prevents the appearance of mould, and that if it is applied to plants that are actually mildewed it arrests the further progress of the parasite.

Besides this fungus which attacks and destroys the tissues of the burr and of the developed flower cones, there is another which effects the rapid and premature discolouration of their delicate leaves, and causes their quick disintegration and decay. This is a fungus belonging to a group of dimorphic habit—that is, as Mr. Cooke has explained, "the same fungus appears under two or more distinct forms, not necessarily mere differences of age, but so distinct that they have been regarded as different species belonging to different genera †." There are special forms of these fungi, commonly known as "rust," or "brand," which appear upon cereals, grasses, and many of the leguminous and other plants. It is not known what form that which attacks the hops comes in, but it is probably of the same species as the *Puccinia Graminis*. As in a very short time whole fields of wheat are affected by this parasite, so whole plantations of hop-plants are changed in a few days by the action of its congener. In the last season the flower cones of thousands of acres were turned from a delicate golden hue to a dull creamy colour in the course of forty-eight hours by its operation. Many hold that this change of colour is due to an unhealthy state of the plants, or to the sun shining directly upon the flower cones when bathed in dew. Probably the plants are in an unhealthy state, and thus are predisposed to receive the spores of the fungus, but there is no doubt that these are the primary causes of this great evil. Sulphur, to some extent, will avert this. Planters have stayed the progress of the "rust" by this means, at the risk, of course, of having their hops refused by the brewers as having been sulphured in "full flower." Plants that have been sulphured in due and proper season seem to resist its attacks far better than those that have not been treated with sulphur, but it seems that a direct application of sulphur is the only certain means of stopping its progress.

* "On Recent Improvements in the Cultivation and Management of Hops," by Charles Whitehead.—*Journal of Royal Agricultural Society*, vol. vii., second series.

† "An Introduction to the Study of Microscopic Fungi," by M. C. Cooke.

CHAPTER XIV.

PICKING.

HAVING now traced the progress of the hop-plants through the various stages of their growth, and described the practice of cultivation adopted by the most advanced planters, and having also brought their history up to the date of harvest, it will be convenient to give an account of the processes of picking and drying, and of all the details connected with these.

Hops are not, as some suppose, distinct flowers, but are strobiles or collections of imbricated scales (bracts), under which are yellowish, aromatic, lupulinic glands. These strobiles are like the cones of a fir-tree, being in reality the fruits of the hop-plant rather than its flowers, which are represented at an earlier stage by the burr. The time at which these fruits or strobiles are fit to pick is indicated by their change of colour from a light golden to a somewhat deeper hue; also by their closing up at the tips, and making a rustling sound when touched. Their seeds, or glands, should be firm and dark in appearance, and should "cut hard" before the hops are gathered.

Before the introduction of the many varieties of early hops, some of which are ready for picking a fortnight previous to the ordinary, standard sorts, the picking season did not begin on an average of years until the 8th or 9th of September; now it often happens that the earliest hops, as the Prolifics, Meophams, and White's Early Goldings, are ready for picking by the 26th of August. Planters do not let the hops get fully ripe in these days when bright, pale-coloured hops are required by the brewers, and all begin to pick directly the hops will "take the fire," though by this they sacrifice a deal of weight and quality. In late seasons, and especially the last, the hops have "gone off," and have lost colour prematurely, so that it has been necessary to pick them before they were fully ripe, and their valuable qualities thoroughly developed. As has been pointed out before, this premature ripening and unnatural change of colour are in some degree due to excessively high manuring, especially with forcing, artificial manures which have tended to increase the quantity grown per acre at a very considerable sacrifice of valuable constituents.

However early the picking has been commenced, latterly it has

been found impossible to get anything like the whole of the crop picked while the hops were fairly bright, though every planter has set on as large a staff of pickers as he could get, and has loaded his drying kilns beyond proper limits.

The picking season is a great harvest for all the labourers who live in the hop districts. Life with them and their wives and families is at this time a series of pleasant picnics. The work is easy, and the weather is generally peculiarly favourable for *al fresco* operations, without being too hot or too cold, as a rule. All the occupants of the villages where hops are grown turn out with one accord into the hop-gardens. The lame, the halt, and the blind, find their way thither somehow; while the sick and diseased are carried there to get health from inhaling the aromatic odours wafted from the ripening cones. Not only do all the inhabitants of the villages find full and remunerative employment throughout the hopping, but many immigrants also, who come from London into Kent, and from Birmingham, Wolverhampton, and other large towns to the hop yards in Worcestershire and Herefordshire. In years when there is a full crop of hops nearly 100,000 strangers come into Kent for hop-picking. The greater part of these come from the courts and alleys of London, being conveyed there and back by very cheap excursion trains. Many of these go to the same farms year after year. Successive generations of "hoppers" have in frequent instances "hopped" on the same farms almost from time immemorial, whose members, particularly those of Irish nationality, have, or profess to have, a great regard for the "master" and the "missus," and are loud and voluble in their greetings and valedictions. A greater part of the immigrants are engaged beforehand, and come down when they receive marching orders. There is a contingent who are not regularly engaged, but come down on speculation and roam as casuals from union to union until the picking commences. There is a society in Kent established to provide agents in London, to select suitable pickers and to make arrangements with them for the planters. This society has also been most instrumental in causing improvements to be made in the lodgings provided for the immigrant pickers. At its instance, the Local Government Board has sanctioned a code of bye-laws in the various rural sanitary districts in hop-growing counties for the regulation of their lodgings and general accommodation, which were for the most part until recently unsuited in every respect for human beings. Many were mere extemporised hovels built with hurdles and straw, or heads of barns, or cart and cattle lodges, into which men, women, and children were crowded indiscriminately, without respect to sex or age, without any regard to

decency and sanitary laws. Now it is forbidden to put more than a certain number of pickers into an apartment with less than a proper amount of cubic feet of air, while the lodgings must be so constructed as to be capable of being washed, or white-washed, and properly deodorised. Though vast improvements have been effected in these respects, there is still too much huddling together and disregard of decency and sanitation, and in some cases the strangers prefer these conditions, in spite of the attempts of the planters to alter them.

Very many of the inhabitants of St. Giles', St. George's-in-the-East, and the purlieus of the Mint, Seven Dials, and the New Cut, come into Kent for the "hopping," just as regularly as dwellers in the great city in a more elevated sphere betake themselves to Margate and Ramsgate, and for the same purpose of getting an outing and change of air. Some go forth simply and solely for the sake of the money to be earned, and work hard and steadily, and carry back well-filled purses; but many look upon the outing as a time to enjoy themselves amid rural scenes—a time to indulge in copious libations of beer.

Upon the greater part of the hop farms in Kent at least 80 per cent. of the pickers are "strangers," for whom provision of lodging and fuel is regularly made. One planter near Maidstone regularly employs from 1,100 to 1,200 "strangers" every season and finds them habitation and firing. The farms near Rochester, Canterbury, Maidstone, and other towns in Kent are supplied with pickers from thence, who go out to work in the morning and return at night to their own homes, being in many cases taken out to the gardens and brought back in large trucks drawn by traction engines.

The pickers are divided into "companies" of ten, which are put under the charge of a ganger or binsman, who pulls the poles down for the pickers and holds the "pokes," or sacks, for the measurer when he comes round to measure out the hops that have been picked. The hop-garden is parcelled out into "sets;" before work is commenced each ganger or binsman draws lots on behalf of his company for a "set," so that there may be no wrangling as to good or bad sets. This drawing is repeated when a garden or part of a garden, or a "drift," is finished. In Mid and West Kent, and Sussex, the hops are picked into "bins," long, light, wooden frames with sacking bottoms. In East Kent large baskets containing from fifteen to twenty bushels are used. At certain times in the day a measurer, armed with a bushel basket, goes round to each company and measures the hops from each bin or large basket into long sacks, called "pokes," held up for him by the binsman. Ten bushels of green hops are put into each poke, and the number of bushels taken from each picker is generally entered in a book

by a booker, who follows the measurer whithersoever he goeth. Tickets representing the number of bushels are given to the pickers upon some farms instead of booking. In some cases the very old-fashioned method prevails of cutting notches upon wooden tallies, one part of which is kept by each picker, the counterpart being retained by the measurer. When the pokes are full they are carried to waggons by the binmen and taken to the oast-houses. Much care and supervision are required to get the hops picked singly and free from leaves. Unless they are well looked after, the pickers, especially the children, are apt to tear off the cones in bunches, and to let many leaves fall among them. Leaves show in the sample, and buyers naturally object to buy them at the price of hops. Picking hops is paid for at from three half-pence to sixpence per bushel; the average price is about two-pence per bushel, taking one year with another. At this price very good money is earned. Some pickers will pick from twenty-five to thirty bushels per diem, working from 7 a.m. till 6 p.m., with an hour or so for meals. Upon a farm with fifty acres of hops about 200 pickers would be employed. The average duration of the picking season is about three weeks. Before colour was considered essential the picking often lasted five or even six weeks. After three weeks of this open-air work the women and children begin to get nearly tired of it, particularly if the weather should become wet and cold.

CHAPTER XV.

DRYING.

THE green hops are taken from the grounds in the "pokes," or long sacks upon waggons to the oast-houses, and either are put at once upon the kilns for drying if these are clear, or, if they are not clear, the pokes are laid upon temporary scaffolds, so formed that the air may permeate through and all round them, in order that the green hops may not heat, and that the moisture may drip away from them if they are wet from rain. As it takes from ten to thirteen hours to dry hops, it follows that each kiln can only be loaded twice in a day and night. The hops picked after twelve o'clock at noon must therefore remain in the pokes until after twelve o'clock at night. Some, in fact, must be kept in the pokes for twelve hours. If they were laid on the ground, or in a lump, they would heat and become "foxy" in colour, and would not make a brilliant sample. It is the practice to load each kiln in the morning between nine and twelve, and to get off the hops then put on them between nine and twelve at night, thus allowing about an average of twelve hours for each separate drying. All calculations as to the number of pickers required are to a certain extent based upon the amount of kiln accommodation upon each plantation, and upon the assumption that each kiln takes a load in the morning and in the night. Drying hops thoroughly in twelve hours necessitates the maintenance of a high temperature, equal to at least 125 deg. Fahrenheit, throughout the process. In the opinion of those who have studied this subject, a great waste of valuable essential principles is caused by the system of drying hops at such high temperatures. The hops that are dried by sun and air in Germany have a much higher percentage of essential oil and other principles valuable in brewing than the finest East and Mid-Kent hops that have been subjected to great heat. Spält hops do not naturally contain a larger proportion of these principles than those of East and Mid-Kent; but in the former case the method of desiccation preserves their valuable qualities, while in the latter the merciless treatment of stewing or baking to which they are subjected causes an absolute visible loss of lupulin or gold dust, besides the loss of invisible essences.

Analyses made of various samples by Mr. Porter, the analytical

chemist, showed most conclusively that Spält hops partially dried in the sun, and brought to England and dried again at a comparatively low temperature upon Hopkins' patent kilns, contained a larger per-centage of oil, resin, and bitter principles, than various samples of Kent, Sussex, Bavarian, Belgian, and American hops, dried in the usual manner, quickly and at a high temperature. A sample of Worcester hops, dried slowly and at a low temperature upon Hopkins' patent kilns, was proved by Mr. Porter to have a somewhat larger per-centage of oil, resin, and bitter principle than the Spält hops, with a considerably smaller amount of moisture. For example, the Spält sample contained 14.08 of oil, resin, and bitter principle; and of moisture, 6.96, while the Worcester sample contained 14.98 of oil, resin, and bitter principle; and only 4.92 of moisture.

The samples of East and Mid-Kent, Bavarian, and American hops, showed per-centages of oil, resin, and bitter principle, varying from 8 to 13.27; and of moisture, from 6.15 to the high figures of 9.87 in the Sussex, and 10.25 in the Belgian samples.

These experiments demonstrated scientifically what practical brewers had long perceived, that the generally adopted system of drying hops causes great waste of "ethereal residues," with a corresponding diminution in their actual brewing value. According to Hopkins' method, which is the invention of Mr. Hopkins, the well-known hop-merchant and hop-planter of Worcester, the temperature to which the drying hops are exposed never exceeds 100 degrees. That they are thoroughly desiccated, or in other words, that the moisture is driven off, is proved by the analyses given above; at the same time, the essential and useful properties are retained. All the other samples dried quickly at high pressure showed, curiously enough, more moisture and less of the desiderated principles.

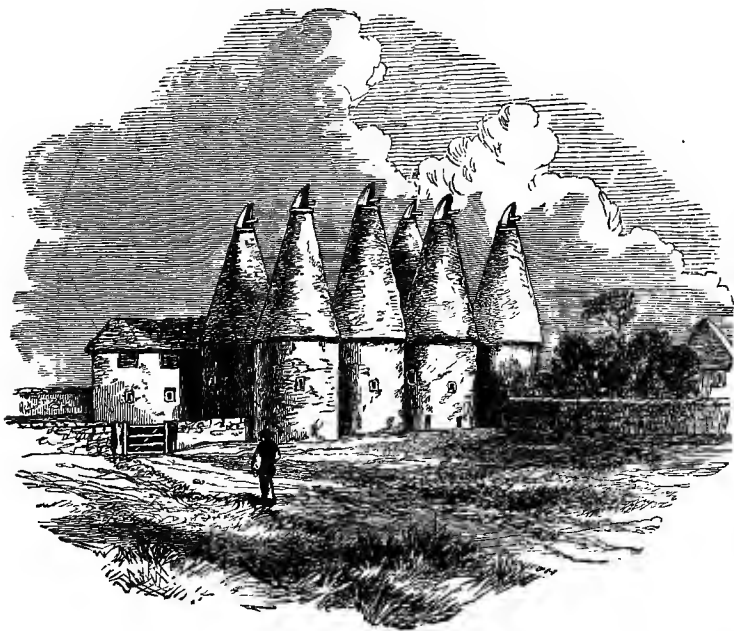
Mr. Hopkins' kilns are of a rectangular or square shape, having two floors instead of one as in the ordinary hop kiln. The lower floor is about eighteen feet from the fires; the upper floor is placed near the roof, in the apex of which a fan is placed. By means of this fan, kept continually revolving, a current of air, heated by the fire below is passed perpetually through the green hops in the upper floor, and their "reek" is carried quickly off. After a time they are let down from the upper to the lower floor, where the drying process is finished. When they are dried they are drawn out upon a tray from the lower floor to the spot where the pressers are, not having been trodden on nor turned, and as whole as they were picked, and without loss of lupulin and volatile aroma. A duplicate tray is run into the lower floor, the hops from the upper floor are let down into this, and so the process goes on.

The objections to this system are, the expense of the necessary

buildings, and that a far larger amount of kiln room is required, because two loads of hops cannot be dried in twenty-four hours. The revolving fan must be worked by steam, or hand, or horse-power, continuously throughout the hopping, entailing a considerable outlay.

Landlords object to spend money upon kilns for drying hops, as hop-growing is a speculative business, and the kilns can hardly be turned to other purposes*. The amount of kiln room upon most farms is therefore generally insufficient. Unless the tenants themselves made the alterations required in the adaptation of the present kilns in accordance with Hopkins' patent, they would not be carried out; and tenants, as a rule, naturally object to improve other persons' property unless they are sure of adequate compensation.

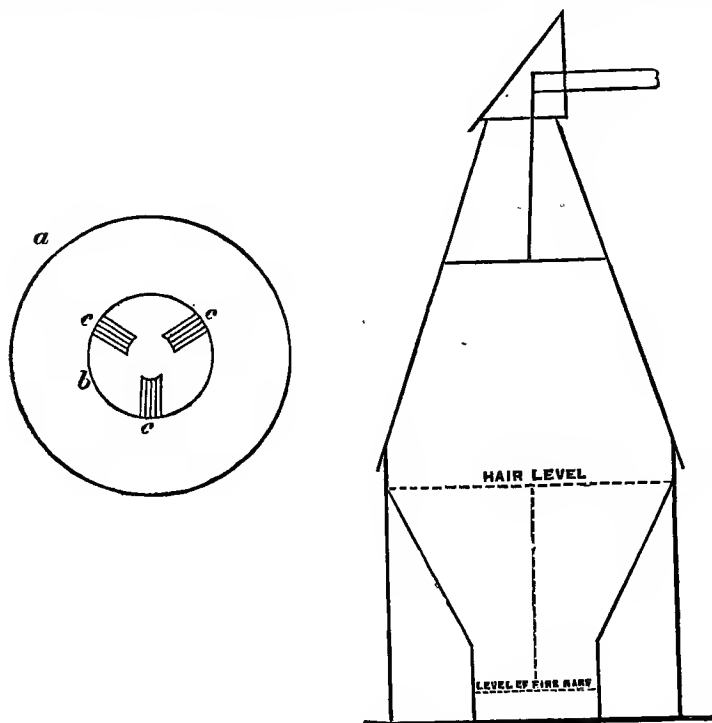
The ordinary "oast-houses," of which an illustration of a



picturesque group is given here, consist of one or more kilns, with stowages or cooling rooms attached. In some cases there are as many as five or six kilns in a group, communicating with a spacious apartment in which the hops are cooled and pressed up. The usual form of hop-kilns is circular, they are built of stone or brick, with a

* Since the repeal of the malt duty, hop-kilns have occasionally been used for malting inferior barley for feeding cattle.

long, conical roof of tiles, surmounted by huge wooden cowls for the escape of reek and sulphurous and other vapours. These kilns are from sixteen to twenty feet in diameter. At about thirteen to sixteen feet from the ground a floor is introduced, from which point the sharply-sloping roof begins, which, with the cowl, is usually from fifteen to eighteen feet in height. Upon this floor of



joists at the hair level, as shown upon the annexed section of a typical kiln, a hair cloth is stretched, upon which the hops are dried, the hot air coming up from the chamber below through its interstices. This chamber either is open with an iron stove or stoves in it, or it has an "inner circle," in which fireplaces are set in brickwork, as shown upon the ground plan at *c*, so that the hot air may be concentrated and carried up through the hops more quickly. Holes for the ingress of cold air are arranged in the external walls of the kiln chamber, according to a scale recognised by the builders, with due regard to the situation and other circumstances. The floor of the stowage or cooling room usually is "flush" with the hair level, or rather below it, in order that the dried hops may come off the hairs

easily. In these floors round holes are made to receive the pockets, into which the hops are pressed by means of lever presses worked by hand.

Welsh anthracite coals principally are used for drying hops, kindled and kept alive by means of a good deal of charcoal. Coke is burned with Welsh coals in some cases, but many planters prefer to use Welsh coals without coke, and with a good deal of charcoal. Five or six pounds of sulphur—"best virgin roll brimstone"—are burned on the fires with each kiln load, whose fumes pass quickly up through the drying hops; and, as it is said, bleach those that are discoloured, and impart a brighter hue to all samples. The sulphur is burned on the fires just after the hops have got into a reek or "sweat;" sometimes also when they are turned on the hairs.

Formerly the dried hops were spread all over the floors to cool, and were not packed up for twelve or eighteen hours or even longer, in order that the hops should not be brittle and get broken up by the feet of the men who trod them into the pockets, by jumping violently upon successive layers raked into these. Now they are put in lumps, and pressed up at once while hot and before they absorb moisture from the atmosphere.

CHAPTER XVI.

PACKING, SAMPLING, AND SELLING.

Hops are always put into pockets, or very coarse canvas bags about 3 feet in width and 7 feet 6 inches in length, containing from one and a-half to one and three-quarters hundredweights, according to the amount of pressure used in packing them. Fifty years ago low-coloured and diseased hops were put into "bags," which were huge receptacles made of "cloth," composed of hemp, hay, and tow woven together, being 4 feet wide and 7 feet 6 in. long. Concerning these monstrous packages Mr. Lance naively remarks that "there are some advantages attending bags, as they preserve hops better than pockets when kept over a year; there is less expense in packing, the article is cheaper, and the *bag, which is heavy, is weighed in with the hops.*" Those were halcyon days for hop-planters when "brown bags" were most acceptable to porter brewers, and the question of tare was not considered. As the cloth of one of these bags weighed twenty pounds, and cost only 2s. 9d. per bag, it was a profitable transaction to sell it at the current price of hops, especially if that price were £20 per cwt.

Treading the hops into pockets by men's feet is but little done now, being very hard, unhealthy work, and breaking the hops too much unless they are perfectly cool. Here and there this process is still adopted, but only upon small holdings, and where it is impossible to fix pressing machines to existing stowages. Pressing machines, or "pressers" as they are commonly called, are now formed upon one principle, and differ only in details. A wooden circular "foot," just large enough to go into a pocket 3 feet in diameter, is fitted to a ratchet lever, which is worked up and down by handles. This is fixed immediately over a "pocket-hole" cut in the floor of the stowage, which, as has been pointed out before, is from 13 to 16 feet from the ground. The empty pocket is fastened to a movable frame or collar, so as to keep its mouth firm to the floor while it is being filled, suspended in mid-air. Usually there are two posts set up below, into which two rods connected with a wooden stand run to hold the pocket up and to keep it straight. In place of these guiding rods some modern pressers have circular iron cases to surround the pocket to keep it from bulging. Pressers cost from £18 to £27; with the most improved machines two men can pack a pocket in ten to fifteen minutes. After the pocket is pressed up, the collar is taken off its mouth, which is sewed up most artistically by the

workmen. A "lug" or "ear" is left on each side of the mouth; at the lower end of the pocket there are two "corners," made by putting a few hops in before the pocket is pressed up, and tying them firmly with string. These "lugs" and "corners" are to facilitate the removal of the pockets.

Where planters have stowage room enough they keep their pockets until after the picking season is over, and have them sampled at home directly they are advised that there is a trade for hops. In most cases, whether they are sold or not, they are moved to London, to the factors' warehouses, by Michaelmas, as but few planters have stowages good enough or large enough to keep their growths properly beyond a few weeks.*

Some planters having but scant accommodation, send the pockets up to the factors' warehouses as fast as they get a load, and have them sampled there.† Since early hops have come into vogue it is the common practice to sell these off as soon as possible. Under these circumstances the hops are sent up at once, either sampled or unsampled, as may suit the planter's convenience. It must be said with regard to this practice that it has not a good effect upon the market. Quantities of low-class rubbish, of which many of these early sorts unfortunately consist, are crowded upon the market before the merchants have had time to look about them, or to gauge in any way the quality or the quantity of the crop. Generally there is comparatively a large yield of early hops, and planters accept comparatively low prices. The merchants naturally regard their readiness to sell and to take low figures as indices of a large crop, and consequently hold back in the coming legitimate season. Most persons who know the trade believe that the promiscuous planting of common, abundantly-cropping, early kinds, such as Meophams and Prolifics, and the eagerness to sell the produce of these in the first week of September, have very much tended to unsettle the hop trade, and to lead buyers astray.

Sampling is a delicate operation, requiring much care and nicety. A clumsy sampler will soon take off many shillings per cwt. from the look of samples by want of skill in his manipulation. A good sampler will, on the other hand, give a good "face" to the samples, and make as much of the hops as possible. The *modus operandi* is as follows: the pocket is laid down with the seam side uppermost; the seam is cut about a foot and a half towards the middle, the edges of the seam being fastened back

* Hops that are kept in barns or ordinary farm stowages soon become "crusted" from the damp, which causes a kind of mildew. This frequently penetrates far into the pocket and quite spoils the hops.

† Much of the produce of the Hants and Surrey hop plantations is sold at Weyhill Fair, in October. A percentage of pockets representing each growth is "pitched" in the fair, in barns.

with iron pins.* An extractor with sharp knives and lever handles then is thrust in, and a wedge of hops from eight inches long to four-and-a-half inches wide is drawn out; the sampler reduces the length of this, with a sharp knife, so as to form a square, taking care to leave a smooth "face." All the perfections or imperfections of management, colour, and character can be seen from the "face," while the "thickness," quantity of seed, and state of maturity at picking time are predicated from the appearance of the sides of the sample, cleanly cut by the knives of the extractor. After the samples have been "faced," they are carefully wrapped in brown paper and put into circular bundles containing twenty-five.

In a perfect sample the cones as seen on the "face" should be whole, with the strigs completely free from moisture, and the lupulin, or gold dust, adhering to the bracts. But very few leaves should be seen, and the cones should be single and not in bunches, and of a brilliant, pale gold colour. A pungent, aromatic odour should proceed from the sample, without the slightest *souppçon* of the peculiar sweet, "gingerbready" smell, as of heated clover hay, indicative of too much heat having been employed in the drying process. Upon "rubbing down" some of the sample in the hand, there should be no residue of fibrous substance, but the whole should chaff finely, leaving a yellowish, resinous deposit upon the fingers, necessitating the use of much soap to remove it. Good judges can determine at a glance by looking at the sides of a sample as to the "thickness" or "condition" of the hops, and the state of maturity at which they were picked, by the colour, quantity, and general appearance of the seeds, whole or cut through by the knives. If hops have been scientifically dried and well managed, the sample will be most elastic and may be compressed easily into a small compass, and upon the pressure being removed will spring back to its former size. This is a most valuable index of thorough and judicious desiccation.

Almost all the planters sell their hops through factors. A few sell directly to the merchants, and a very few indeed directly to the brewers. Until recently by far the greater part of the hops were sold in "growths," which were taken by the merchants as a matter of course at market price when the trade began. In very many instances particular growths had been taken by the same merchants' houses from time immemorial, and had been passed on to the same brewing firms. Since early hops have been largely grown, the planters have felt inclined to offer some or all of these directly they have packed them. Their old friends have not felt disposed to buy these early in September, and they have been taken by other merchants. The spell of old associations has thus been broken, and the long-accustomed buyers do not feel bound to purchase the remain-

* Every pocket has a sample taken from it.

ders of growths unless it suits their purpose in every way. There are, however, still a good many growths which go regularly year after year into the same channel. The mode of procedure in these cases is as follows. Messrs. Wey and Tear, the well-known merchants, indicate to Messrs. Hopp, Skyp, and Jumpe, the equally celebrated factors, that they should not mind looking at Mr. Goldingsett's growth. A day is accordingly fixed to "open out" the samples, and Mr. Goldingsett is invited up to the Borough to see them on the boards, under the trying glare of the "sky-lights" of Messrs. Hopp and Co.'s show-rooms. He comes up with an intensely anxious mind, as his countenance discloses, and is taken to see his samples ranged in order according to colour, with every imperfection brought out in prominent relief by the "fierce light beating" on them. He is then ushered into a tiny room to wait for the bid of Messrs. Wey and Tear, who are mysteriously concealed in another part of the offices, which resemble rabbit-earths in their many intricacies and "bolt-holes." After a long suspense and time of mental torment, like the agony felt by one waiting for his turn in a dentist's ante-room, either a bid for the hops is brought by one of the firm of factors, or the pleasant information is imparted that the merchants will not make an offer to-day. In the former case Mr. Goldingsett is much exercised mentally as to whether he should take the bid. If he accept it he is a miserable man for many weeks after, and harassed by remorse, as he is sure to hear that his neighbour has got some shillings per cwt. more than he has made of his hops. If he do not sell he goes home with a heavy heart, like the pious *Æneas, multa revolvens*, believing that the "trap will shut down" before he has sold his hops.

After hops are sold it is customary for the merchants to weigh and pay for them within a fortnight from the date of sale. This custom has lately been more honoured in the breach than in the observance, especially when the crop has been heavy and the trade slow, and credit for two or three months is often given in respect of a moiety of the amount. During the weighing, always performed under the strict surveillance of the agents of the merchants, every pocket is carefully examined, probed, and unsewn in various places to detect "crust" or "false packing."* Occasionally a pocket is stripped off and weighed to test the weight of the cloth. The tare allowance in respect of the cloth now stands at 6 lbs. per pocket,† according to an arrangement made between the planters and merchants in 1878. This scale applies to Kent and Sussex hops. The Farnham and Worcester planters would not agree to this arrangement, and adhere to the old scale of 4 lbs. per pocket as the tare.

* "False packing" is when hops of different descriptions are put into the same pocket, so that the bulk or any part of it does not agree with the sample.

† The weight of the cloth of each pocket must not exceed 8 lbs.

CHAPTER XVII.

THE POSITION OF PLANTERS.

It will be seen that the cultivation of hops requires much skill and energy on the part of the planters, and is attended with much risk and great expense. No plant that is cultivated is so delicate or so liable to disorders. There is no produce that is exposed to so many changes and chances and sudden fluctuations in value as hops. There is no product of the soil that has made some individuals rich and others poor so quickly as hops. They are rightly named "hops," say the rustics in hop districts, "they hop up and down all of a sudden." All agriculturists have many cares and anxieties throughout the year, but hop-planters are especially tormented above other tillers of the soil. Hop-plants, as has been pointed out, are peculiarly liable to be affected by climatic influences, and from the time the first shoots appear above the ground until the cones are picked, there is constant fear in the planter's mind as to what the weather may be, or what the next day may bring forth. White frosts, too much wet, absence of sun, too much sun, and high winds, are all dreaded in turn, as there are many bitter reminiscences of much harm done, even of crops utterly blasted, by these and kindred influences.

The anxiety of hop planters may be understood better when it is stated that from £50 to £60 of capital is required per acre upon hop land, varying in the different districts, and that an average crop of 7 cwts. per acre costs very close upon £40 before any profit can be made.* It is clear that before this can be done the hops must have been sold at over £5. 15s. per cwt., or above the average price that has been realised for them in some of the last seasons. With competition from many countries and the largely extended area of hop land in this country, it seems probable that moderate prices will continue to rule for hops, and that the excessively high prices that have prevailed in some former years, and have made the fortunes of a few planters who were lucky enough to grow hops in seasons of almost general blight in this country, will never come back again. The competition of the whole hop-producing world will prevent

* This figure of £40 is explained in detail in the next chapter. It is assumed, of course, that the style of cultivation is thoroughly good, and such as is adopted by the best farmers.

this, and will bring the prices of hops down practically to a dead level. At least, there will be no more of those extraordinary variations in values chronicled in the annals of the hop market, while America, Germany, and Belgium send hops in to our ports free of duty. It happened frequently before foreign competition changed all this, that a blight, or a very small crop, was the best possible condition for English planters. In the former case all the old stocks were cleared off at high figures; in the latter, with a growth of three or four cwts. per acre, the expenses attending the picking and management of it were much reduced, and the price was generally from £15 to £25 per cwt. Old planters, waxing garrulous after dinner over their port, tell marvellous tales of golden opportunities seized by men who were content to take £20 per cwt. for their crop of 3 cwt. per acre; and of opportunities lost by grasping individuals who meant "to have £25 all round," and were obliged to take what they could get at last, or to throw their hops away. Wonderful legends are current also as to the rises and falls in the hop market in the days when foreign competition was unknown; as to how the price in certain years rose as high as £10 per cwt. in one short week,—"just about Maidstone May-fair time,"—when there were signs of a blight. Hops were then bought as a speculation by merchants as well as by other persons, and it frequently happened that a very great rise in values was established without the slightest action on the part of the brewers, the actual consumers; without, in short, any actual direct demand for the article. The home duty upon hops served as a fine peg to hang bets upon, and was a cause of great gambling, not only among those connected with hops as planters, merchants, and factors, but also among outsiders, who would bet upon horse racing, hops, and every other uncertain thing under the sun. The glorious uncertainty of hops afforded great opportunities both for betting and speculating in buying and selling, and large sums of money were lost and won every season. It is held by a few that this unhealthy excitement and fictitious impetus to values were good for the planters as well as for the trade. They who hold this opinion remember only the cases of those who succeeded under the old régime. They have clean forgotten, or perhaps never heard of the numerous instances of those who lost all by speculation, or were ruined by persistently backing or betting against the duty. The present is a far more natural and simple state. There is no wagering of any kind as to the probable amount of the crop; there is no excitement. Prices do not ebb and flow *pari passu* with the betting as they invariably did before the duty was repealed in 1860. The report that Mr. Bearaman had backed the duty at £300,000 made the market flat, stale, and unprofitable, while his anxiety to

take odds against £100,000 duty at a critical period in the season, made prices go up with a run. There is but little speculation in these times. Even the signs of an imminent black blight do not disturb the equanimity of merchants, nor incite brewers to go into the market. The trade is altogether more healthy, and the range of prices is pretty well decided by the *bonâ fide* demand for consumption and the supplies. During the few past years there has been some degree of disorganisation in the hop market, but this has been due in a degree to the unfortunate circumstance of successive crops of most indifferent quality having been grown in this country, which has caused prices to fluctuate in an extraordinary manner, and given foreign producers an opportunity. Planters despair of ever seeing better times, but surely there is not much fear that those who grow the finer sorts of hops upon the suitable soils of East Kent, Mid-Kent, Surrey, and Hants, will not be able to hold their own against any foreign invaders, at all events for some time. Probably the cultivators of the inferior kinds will not be able in the long run to compete with the producers in America, Belgium, Bavaria, Baden, France, and Bohemia, but it is thought that they will hold their own for a time, at least if they take pains with their cultivation and management. The expenses, however, are very great. Rents are still far too high. Labour, though somewhat cheaper than it was three years since, is still costly and not of high quality. Rates and taxes increase and multiply exceedingly. Before the end arrives, and before the cultivators of the second-rate soils are forced to throw up their cards, rents will of course come down in proportion to the decrease in the demand for hop land, and the diminution in the value of its produce. The wages of labour, probably, will also fall, though not to any great extent, as emigration will carry off surplus hands when the home demand for labourers slackens, as it has deported them from Kent, though there has been plenty of work to be done, if only the farmers had had plenty of capital. There also is the tax of an extraordinary tithe rent-charge upon hop-land, as upon fruit-land, and market-garden-land, varying from 10s. to 20s. per acre. This was put on at the time of the commutation, to make up the aggregate sum required in certain parishes, and to some extent in respect of the supposed greater value of the produce of such land. Much agitation has taken place lately concerning the charge, and a bill is to be brought into Parliament to free all land that may be planted with hops, as well as with fruit and vegetables, except in those parishes where this extraordinary charge is now payable. This is obviously an injustice to the hop-planters *in esse*, though for the sake of the general community, it is most desirable that it should be abolished.

CHAPTER XVIII.

CONCERNING THE COST.

SOME details of the cost of raising a hop plantation, and of the cost of cultivating it when in full plant, will, perhaps, be interesting to many, and full estimates giving the various kinds of expenditure are herewith submitted.

I.

Average Cost of Raising an Acre of Hop land.

	£	s.	d.
Ploughing, subsoiling, and preparing the land ...	3	5	0
Manure, 30 loads at 5s. 6d.	8	5	0
Setting out hills and digging holes	1	5	0
2,400 sets at 4s.	4	16	0
Planting	0	8	0
Nidgetting and summer cultivation	2	0	0
Stakes, or poles, and putting up... ..	1	10	0
One year's rent, tithes, and taxes	5	0	0
Total cost of raising an acre of hop-land ...	£26	9	0

The expense of raising a plantation may be somewhat less than this in some districts. On the other hand, if the land is trenched instead of being ploughed, at least £2 per acre must be added. It is true that some planters put mangels, swedes, or potatoes in the first year, and so recover part of the outlay. They do not however reckon the injury caused to the young hop-plants by double cropping the land, nor what they have ultimately to return in the shape of extra manure. It is believed that, taking all the hop districts, the average cost of raising an acre of hop-land is at least £25 per acre.

Messrs. Lance, Rutley, and Buckland, in their treatises before alluded to, give estimates of this first outlay. The estimates of the two first, made in 1838 and in 1847 respectively, are considerably less, while that of the last named, made in 1845, is slightly less than those now given. But these differences are easily accounted for by the advance that has been made in rents, rates, labour, and all items of agricultural expenditure during the past twenty years.

The expense per annum in connection with an acre of hop-land in full plant—that is, after the second year, is given in the following table.

II.

Showing the Ordinary Outlay upon an Acre of Hop-land in full plant, and properly farmed.

	£	s.	d.
Manure, carting and spreading	8	0	0
Digging, or ploughing and digging	1	1	0
Dressing	0	6	0
Poling	0	15	0
Tying	0	14	0
Pulling bines, earthing, &c.	0	4	0
Ladder tying	0	8	0
Keeping land clean round hills	0	8	0
Nidgetting and harrowing	1	17	6
Annual average supply of poles	5	5	0
Stripping, stacking poles, and making bines	0	9	6
All expenses of picking, drying, selling an average crop of, say, 7 cwts. per acre	12	15	0
Rent, rates, tithes, taxes, and repairs of oast, &c.	5	5	0
Interest on capital, say	3	0	0
	<hr/>		
	£40	8	0
	<hr/> <hr/>		

If sulphuring is done, from 30s. to 40s. extra must be charged per acre. If washing is done, from £3 to £4. 10s. should be put to the annual cost.

Mr. Buckland in 1845 estimated the cost of cultivating an acre of hop-land in Kent and of getting to market a crop of 10 cwt. per acre, at £43. 17s. 10d. Mr. Smith stated in 1864 that the cost of cultivating an acre of hop-land in Worcester was £22. 10s., not including rents, rates, taxes, interest of money, picking, drying, packing and selling,* and since that time expenses have increased.

It may fairly be assumed that an average crop of hops of 7 cwt. per acre cannot be produced much under £40 per acre, taking the country throughout. Those persons who are wholly ignorant of hops and their culture will wonder at the exceeding cost of producing hops. Many hop-planters also will be surprised to see in black and white that they have to pay so much, for, like many other farmers, they are not as a class in the habit of keeping very elaborate accounts. Indeed, some hop-planters say, "It does not do to count the cost."

* A Worcester Prize Essay on Hop Cultivation, by J. P. Smith, *R.A.S.E. Journal*, vol. xxv.

CHAPTER XIX.

FOREIGN COMPETITION.

SOME idea of the nature and extent of the importation of hops from foreign countries will be gained from the returns given in the accompanying tables:—

I.

Imports of Foreign Hops, with Values.

Year.	Cwt.	Value.	Year.	Cwt.	Value.
1840 ...	107		1860 ...	68,918 ...	£568,901
1841 ...	34		1861 ...	149,176 ...	657,763
1842 ...	—		1862 ...	133,791 ...	723,034
1843 ...	28		1863 ...	147,281 ...	626,660
1844 ...	267		1864 ...	98,656 ..	549,863
1845 ...	726		1865 ...	82,479 ...	459,157
1846 ...	3,283		1866 ...	85,687 ...	567,760
1847 ...	1,471		1867 ...	296,117 ...	1,626,941
1848 ...	385		1868 ...	231,720 ...	689,383
1849 ...	5,265		1869 ...	322,515 ...	1,098,475
1850 ...	6,479		1870 ...	127,853 ...	428,525
1851 ...	462		1871 ...	218,664 ...	895,895
1852 ...	309		1872 ...	135,965 ...	679,276
1853 ...	42,344		1873 ...	122,729 ...	602,914
1854 ...	119,040	£1,133,644	1874 ...	145,994 ...	929,641
1855 ...	24,662 ...	171,955	1875 ...	256,444 ...	1,188,054
1856 ...	15,987 ...	39,967	1876 ...	167,366 ...	763,440
1857 ...	18,711 ...	54,965	1877 ...	250,039 ...	1,170,621
1858 ...	13,000 ...	36,618	1878 ...	168,834 ...	631,567
1859 ...	2,220 ...	4,991	1879 ...	262,765 ...	4,217,938

II.

A RETURN showing the various countries from which hops have been imported during the five years ending with 1879, and the quantities from each country.*

Name of Country.	1875.	1876.	1877.	1878.	1879.	Annual Average Amount from each Country.	Total Annual Average Amount for 5 years.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	
America ..	42,405	67,752	116,888	96,603	108,306	86,391	
France	3,862	2,021	3,404	4,161	9,234	4,536	
Belgium ..	95,557	46,543	58,991	29,124	63,485	58,740	
Holland ..	22,598	9,541	11,801	15,954	26,796	17,338	
Germany ..	91,752	40,761	55,821	21,866	50,567	52,153	
Other Countries, including British N. America	270	748	3,134	1,126	4,377	1,931	
Total of each Year ..	256,444	167,366	250,039	168,834	262,765	..	221,039

From the above statistics it will be seen that there was no importation of any importance until 1853, when there was a large growth on the Continent, and an under average crop in England of about 5 cwts. per acre, upon an acreage of only 49,000 acres. The general blight in the English plantations in the next year, 1854, when little more than $1\frac{1}{2}$ cwts. per acre were grown, and the very high prices paid for foreign hops, gave an enormous stimulus to importation, so that 119,040 cwts. were imported of the value of £1,133,649, or about £9. 10s. per cwt. This encouraged planting abroad; but in the succeeding five years very large crops were produced in England, equal to an average of 10 cwts. per acre upon a plantation of 50,000 acres, and prices were very low, so that there was no encouragement for foreign importations.

In 1860 another blight occurred, and hops again were poured in from the Continent during the next three years. The duty upon foreign hops was taken off in 1862, but it was not until 1867 that the importation became very large, amounting in that year, as shown in Table I. above, to 296,117 cwts., and valued at considerably over one and a half million sterling. Though the abolition of the duty upon foreign hops undoubtedly gave a stimulus to the production of hops, it is evident that there was a large foreign plantation so

* The return for 1880 has not yet been published, but Mr. Clements, of the Board of Trade, has been good enough to inform me that 196,688 cwts. of hops were imported in that year.

far back as 1854, long before the duty was taken off, and that quantities of foreign hops were poured into England when there was a short crop or an opening for them in this country. No doubt the removal of the duty upon foreign hops encouraged hop-planting abroad to some extent. At the same time, the enormously increased consumption of beer in all foreign countries also tended in a great degree to cause the extension of the hop plantations. It is the fashion to regret the abolition of the duties upon foreign hops, and to say that it would have been better to let them remain, as well as the duty paid by English growers, which nearly amounted to £1 per cwt. upon all hops grown in this country. If this duty had been chargeable during the last three seasons, in which short crops of very poor quality have been yielded and prices have been very low, it is not too much to say that a large proportion of the planters must have been ruined. Prices have not been low because of the importations, but because the hops have been very badly grown. During the past season especially, though fine hops have made comparatively high prices, competition from abroad with these has been most limited, and hops of colour and quality in all foreign markets have been as dear as, or dearer than, the same class of hops in England. Twenty-five years ago, blighted, brown, and mouldy hops occasionally made high figures, but the conditions of brewing have been wholly changed, and bright, sound hops are considered essential in the production of beers suited to the present tastes of the public, and up to the present time hops of this character have always been in demand at fairly remunerative prices.

CHAPTER XX.

THE SUPPLIES AND CONSUMPTION OF HOPS.

AN account of hops hardly would be complete without some statistics as to the quantities that have been produced in former years, and as to the consumption of hops in this country.

The returns of the amount of the duty levied upon hops in 1711 supply reliable data as to the quantities grown in each year up to 1807. These returns are given in the appended Table A and indicate that there was a considerable acreage throughout the whole of the last century, which gradually increased towards its close.

From 1808 the annual acreage of hop-land was ascertained by the officers of Inland Revenue employed in supervising the hop duty. The amount of this for each year, from 1808 to 1862, is shown upon Table B, together with the old duty paid; and the total yield of hops per acre for certain periods, and the annual average yield per acre during these periods. From these returns it will be gathered that there were 38,436 acres in 1808 and 47,941 acres in 1861, showing an increase of about 9,500 acres, which appears to be a small addition, considering the increase of the population and of the consumption of beer in the country. But upon examination of this table it will be found that so far back as 1820 the acreage of hop-land amounted to 50,068 acres, and was reduced again to 41,458 acres in 1823. It is most curious to notice this and other equally striking fluctuations in the acreage during this period. For instance, from 41,458 acres in 1823 it had advanced again to 50,471 acres in 1826. In 1837 it had reached 56,323 acres, and fell again in 1843 to 43,720 acres. Again, in 1847, it had mounted up to 52,328 acres, and was reduced to 43,127 acres in 1850. Not the least remarkable of these changes is the reduction of the plantation between 1855 and 1859 by more than 12,000 acres. All this was caused by the heavy duty on home-grown hops of nearly £1 per cwt.,* which sorely pressed upon the unfortunate hop-planters in seasons of large crops and low prices, and compelled them to reduce their acreages materially and quickly. In some years applications were made by the hop-planters of the kingdom

* The original or "old duty" was 10s. 8 $\frac{1}{2}$ d. per cwt. In 1802 it was increased to £1. 3s. 4d. per cwt. In 1805 it was reduced to 19s. 7 $\frac{1}{2}$ d. per cwt. and remained at this figure until its repeal.

for the postponement of the payment of this onerous impost upon the produce of the soil: many could not sell their hops before the duty was payable, and buyers of course made use of this liability to strengthen their position. Rents, tithes, bills for poles, manures, and other things, and half the hop duty, were due at Michaelmas, and the growths of hops were frequently sacrificed to the imperative necessity of getting money to meet those demands. Directly this tax upon production was removed the acreage gradually increased. Since the repeal of the duty there have been no spasmodic rebounds like those chronicled above. The diminution in the last two years has comparatively been trifling, and occasioned by losses due to the bad quality of the hops, caused by mould, blight, and bad weather. The extraordinary increase in the consumption of sugar, malt, and of hops, in the same ratio, as may be presumed by the malt consumption from 1855 to 1879, is shown on Table C, on which also appears the quantity of hops annually imported into this country, as well as the estimated amount of each crop of hops, calculated, as still is the fashion, as representing so much old duty.

From the time of the repeal of the duty in 1862, unto this year, 1879, 3,254,899 cwts. of hops were imported. In this same period, according to the estimates of old duty, 7,500,000 cwts. of hops were grown in England, making a total of 10,754,899 cwts. available for use during the 18 years; while the quantity of hops consumed during this same time—taking the standard of 10 lbs. to each quarter of malt—was 10,606,265 cwts. The excess of hops as shown by these figures is by no means large, and will somewhat surprise many of those who continually have held, since the foreign duty was taken off, that the supplies of hops were overwhelming and far in excess of the actual requirements of the trade. If the estimated supplies of the ten years ending with 1879 be compared with the estimated consumption during the same period, it will be found that they balance as nearly as possible.

These figures, as well as those referring to the prices that have ruled for English and foreign hops demonstrate that foreign competition has not as yet ruined the English planters. With a revival of trade the consumption of hops will again steadily increase; and if hops of good quality are produced they will certainly pay for growing, at all events, until the conditions have materially been altered.

A.

The Amount of Old Duty paid from 1714 to 1807.

Year.	Acres.	Old Duty.	Old Duty. Average.	Year.	Acres.	Old Duty.	Old Duty. Average.
1714....	No RETURN.	£ 14,457	Average Duty during 10 Years, £41,908. Equal to an average growth of 77,391 cwt. per ann.	1760....	No RETURN.	£ 117,992	Average duty during 14 Years, £74,694. Equal to an average growth 136,790 cwt. per ann.
1715....		44,975		1761....		79,776	
1716....		20,354		1762....		79,295	
1717....		54,669		1763....		88,315	
1718....		15,005		1764....		17,178	
1719....		90,317		1765....		73,778	
1720....		38,169		1766....		116,445	
1721....		61,362		1767....		25,997	
1722....		49,443		1768....		114,002	
1723....		30,279		1769....		16,201	
1724....		61,271		1770....		101,131	
1725....		6,526		1771....		33,143	
1726....		85,013		1772....		102,653	
1727....	69,409	1773....	45,847				
1728....	41,494	1774....	138,887				
1729....	46,441	1775....	41,597				
1730....	44,419	1776....	125,691				
1731....	22,600	1777....	43,581				
1732....	35,135	1778....	159,801				
1733....	70,000	1779....	55,800				
1734....	37,416	1780....	122,724				
1735....	42,745	1781....	120,218				
1736....	46,462	1782....	14,895				
1737....	56,492	1783....	75,716				
1738....	86,575	1784....	94,359				
1739....	70,742	1785....	112,684				
1740....	37,875	1786....	95,973				
1741....	65,222	1787....	42,227				
1742....	45,550	1788....	143,168				
1743....	61,072	1789....	104,063				
1744....	46,708	1790....	106,841				
1745....	34,635	1791....	90,059				
1746....	91,879	1792....	162,112				
1747....	60,000	1793....	22,619				
1748....	87,000	1794....	203,663				
1749....	36,305	1795....	82,342				
1750....	65,000	1796....	75,223				
1751....	73,954	1797....	157,458				
1752....	79,000	1798....	56,032				
1753....	81,000	1799....	73,279				
1754....	112,000	1800....	72,928				
1755....	82,157	1801....	241,227				
1756....	48,106	1802....	15,463				
1757....	69,713	1803....	199,205				
1758....	72,896	1804....	177,617				
1759....	42,115	1805....	32,904				
		1806....	153,102				
		1807....	100,071				

B.

The Acreage of Hop-land and Average Yield from 1808 to 1861.

Year.	Acres.	Old Duty.	Average yield per acre.			Year.	Acres.	Old Duty.	Average yield per acre.		
			£	cwts.	qrs.				lbs.	£	cwts.
1808	38,436	251,089	13	2	23						
1809	38,357	63,952	3	1	17	1836	55,422	200,332	7	1	26
1810	38,265	73,514	3	3	25	1837	56,323	178,578	6	2	6
1811	38,401	157,085	8	1	24	1838	55,045	171,556	6	1	22
1812	38,700	30,561	1	2	15	1839	52,305	205,556	8	0	15
1813	39,521	131,482	6	3	15	1840	44,085	34,091	1	2	8
1814	40,575	140,292	7	0	17	1841	45,769	146,159	6	2	11
1815	42,150	123,878	6	0	9	1842	43,720	169,776	8	0	4
1816	44,219	46,302	2	0	19	1843	43,156	133,508	6	1	16
1817	46,293	66,522	2	3	25	1844	44,485	140,322	6	2	3
1818	48,593	199,465	8	1	27	1845	48,058	158,003	6	3	6
1819	51,014	242,076	9	3	8	1846	51,948	242,929	9	2	20
1820	50,048	138,330	5	3	25	1847	52,328	215,805	8	2	6
1821	45,662	154,609	7	0	14	1848	49,232	212,416	8	3	20
						1849	42,798	79,791	3	3	12
1822	43,776	203,724	9	2	15	1850	43,127	232,576			
1823	41,458	26,057	1	1	5	1851	43,244	129,580	11	0	18
1824	43,419	148,832	7	0	11	1852	46,157	244,866	6	0	22
1825	46,718	24,317	11	0	8	1853	49,367	152,677	9	3	15
1826	50,471	269,331	1	0	5	1854	53,825	47,369	5	3	1
1827	49,485	140,848	5	3	14	1855	57,757	398,635	1	2	15
1828	48,365	172,027	7	1	12	1856	54,527	266,899	12	3	12
1829	46,135	39,866	1	1	25	1857	50,974	228,294	9	0	16
1830	46,726	88,047	3	3	17	1858	47,601	254,001	8	1	12
1831	47,129	174,864	7	2	20	1859	45,665	328,070	9	3	19
1832	47,101	139,018	6	0	12	1860	46,271	53,485	13	1	15
1833	49,187	156,905	6	2	11	1861	47,941	114,701	2	0	17
1834	51,263	189,713	7	2	18				4	1	23
1835	53,816	235,207	9	0	5						

Total growth per acre during 14 years, 87 cwts. 2 qrs. 11 lbs.; annual average, 6 cwts. 1 qr. 0 lbs.

Total growth per acre during 14 years, 85 cwts. 3 qrs. 15 lbs.; annual average, 6 cwts. 0 qrs. 15½ lbs.

Total growth per acre during 12 years, 94 cwts. 3 qrs. 17 lbs.; annual average, 7 cwts. 3 qrs. 17 lbs.

Annual average growth per acre during the 54 years, from 1808 to 1861, 6 cwts. 2 qrs. 26½ lbs.

Hops.—From the Set to the Sky-lights.

C. Account of Hops grown and imported, with Estimates of annual consumption of Sugar, Malt, and Hops in England.

Year.	Acrcs.	Old Duty of 10s. 8 ¹ / ₂ d. per cwt.	Foreign Hops imported.	English, average prices per cwt.	Foreign average prices on declared value.	Lbs. in Sugar equal to Qrs. in Malt.	Qrs. Malt.	Sugar and Malt equal to Qrs. in Malt.	Hops used Yearly in England, reckoning 10 lbs. to the Qr. of Malt.
1855	57,757	398,635	cwts. 24,662	...	145/	lbs. 1,790,529 = 8,526	3,243,931	4,251,727	343,208
1856	54,527	266,899	15,987	...	50/	2,114,056 = 10,067	4,243,201	4,566,710	379,618
1857	50,975	228,294	18,711	...	58/6	3,885,626 = 18,503	4,548,509	4,567,012	407,742
1858	47,661	254,001	13,000	...	56/6	2,886,076 = 13,743	4,866,402	4,880,145	407,769
1859	46,665	328,070	2,220	...	45/	9,670,876 = 46,051	5,075,807	5,121,858	435,727
1860	46,272	53,485	68,918	200/	176/6	9,365,236 = 44,596	4,995,169	5,039,765	457,308
1861	47,941	114,701	149,176	160/	87/6				449,979
		Estimated duty*							
1862	No return†	160,000	133,791	120/	106/6	8,846,515 = 42,126	4,946,027	4,988,153	445,370
1863	"	150,000	147,281	140/	111/6	9,365,681 = 44,598	5,066,914	5,111,512	456,385
1864	"	180,000	98,656	147/	105/6	5,274,746 = 25,118	5,481,006	5,506,124	491,618
1865	"	300,000	82,479	140/	109/6	5,246,027 = 24,981	5,899,557	5,924,538	528,976
1866	56,576	160,000	85,687	160/	137/6	10,340,887 = 49,242	6,380,338	6,429,580	574,069
1868	64,488	180,000	296,117	160/	130/	41,134,016 = 195,876	5,960,367	6,156,243	549,664
1869	61,790	95,000	322,515	95/	65/6	37,611,106 = 179,100	6,027,902	6,207,002	554,196
1870	60,594	380,000	127,853	Average	67/	41,980,949 = 199,909	6,077,145	6,277,054	560,451
1871	60,030	130,000	218,664	price for	82/	29,017,271 = 138,177	6,209,118	6,347,295	566,722
1872	61,927	320,000	135,965	these seven	82/	32,500,763 = 154,765	6,453,175	6,607,940	589,994
1873	63,278	320,000	122,729	years.	100/	29,398,957 = 139,995	6,927,633	7,067,628	631,038
1874	65,805	150,000	145,994	126/	98/	63,111,229 = 300,529	7,155,717	7,456,246	665,736
1875	69,971	350,000	256,444	127/	92/6	86,018,397 = 409,611	7,257,909	7,667,520	684,600
1876	69,999	220,000	167,366	150/	91/	99,756,898 = 475,032	7,278,562	7,753,594	692,285
1877	71,239	240,000	250,039	100/	93/6	98,148,732 = 467,351	7,602,514	8,069,865	720,523
1878	71,789	320,000	168,834	84/	74/6	90,509,449 = 430,997	7,566,250	7,997,247	714,039
1879	67,671	80,000	262,765	168/	92/6	125,441,391 = 597,342	7,423,613	8,020,955	716,156
1880	66,703	235,000	...	95/	...	116,927,019 = 556,795	6,884,973	7,441,768	664,443

* The duty on English hops was abolished in this year, and that on foreign hops was repealed.

† After the duty was taken off, there were no means of ascertaining the acreage until 1866, when it was given in the Agricultural Returns.

