THE OLIVE AND ITS PRODUCTS.

A TREATISE ON THE

HABITS, CULTIVATION, AND PROPAGATION OF THE TREE;

AND UPON THE

MANUFACTURE OF OIL AND OTHER PRODUCTS THEREFROM.

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BRISBANE:

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TO

THE HONORABLE ARTHUR HUNTER PALMER,

PREMIER OF QUEENSLAND,

This little work is, by permission, respectfully dedicated, as the testimony of the Author that the Government of Queensland recognise, and are willing to foster Agriculture, as one of the principal sources of wealth to the Colony; and that, by their sanction to the issue, from the Government Press, of this Handbook to the prosecution of a new and important industry connected with the tilling of the soil, they include technological teaching in the boon of free education enjoyed by the Queensland colonist.

L. A. B.

PREFACE.

The following letters will explain the origin of the unpretending work which I now venture to offer to the Agricultural Colonists of Queensland:—

Acclimatisation Society of Queensland,
Brisbane, 1st March, 1872.

Sir,

The attention of the Acclimatisation Society having been directed to the Olive as a production suited to the climate of Queensland, and calculated to vary the products of, and to create a new source of wealth to, the Colony, it has been determined to introduce during the ensuing autumn, from reliable sources, a sufficient supply of plants to place within reach of settlers willing to test the capabilities of the tree, specimens of those kinds which experience has taught to be productive of the best fruit for oilmaking, as well as of the most copious crops.

The arrangements for carrying out this object are all made; and in another month or two the plants will be at the disposal of those who are willing to follow the example, which the society will itself set, of making small plantations, by way of initiating a new and important industry.

Simultaneously, however, with this action, it appears to be necessary that the colonists should have placed within their reach a Handbook containing information as to the planting and cultivation of a tree almost new to the Colony, and which, in Olive oil producing countries, receives exceptional treatment, unlike that of any of the fruit-bearing trees now in cultivation among us. In view of this necessity, I have, for some time past, been engaged in getting together, from various sources, all printed matter published, under the authority of names of more or less weight, in the hope of finding something, the reprint of which might satisfy the want referred to.

I find, however, without venturing to question the dicta of these writers, defects of various kinds in their method of putting together the useful information they afford, which lessens the *practical* utility of their pamphlets. It is also apparent that in some cases important points have been overlooked altogether; while in others a mass of statistical information, of little use to the farmer seeking a cultural and descriptive guide, weakens their value for that purpose.

I have conceived the intention of endeavoring myself to disentangle the more immediately useful and practical information afforded by these and older authorities, and of offering it in pamphlet form to the agriculturists of Queensland. By simplification of arrangement, aided by an index, I hope to place before the beginner in a new

industry, that guide, especially to the earlier operations, the want of which, in a comprehensive and plain form, so often retards in new communities the establishment of industries suited to the climate, and adapted to the means and appliances of the settlers. I now do myself the honor to inquire whether the Government will be willing (presuming that they recognise my fitness for the task) to lend their countenance and aid to the proposal, by having the manuscript printed at, and issued from, the Government Press? Such assistance by a Colonial Government towards the establishment of a new industry is not without precedent; and I may be permitted to urge that I cannot conceive a more useful way in which to apply the Government Press, than in the promulgation of practical guides to the colonists in new occupations, calculated to increase their individual prosperity, and thus aid in the more rapid settlement, and enhance the material wealth of the Colony.

I have the honor to be,
Sir,
Your obedient Servant,
LEWIS A. BERNAYS, F.L.S.,
Vice-President.

The Hon. A. H. Palmer, Esquire, M.L.A., Colonial Secretary.

Colonial Secretary's Office,
Brisbane, 22nd April, 1872.

Sir,

With reference to your letter of 1st March last, relative to the introduction of the Olive tree into Queensland, for the purposes of commerce, in which you point out the necessity of placing within reach of persons interested in its cultivation, a Handbook containing information on the planting and treatment of that tree, and intimating that you are at present engaged in the preparation of a pamphlet on the subject, especially intended as a guide to the Queensland agriculturist, I am directed to inform you that the Colonial Secretary will be happy to advance the object you have in view, calculated to encourage and promote the formation of a new industry likely to be valuable to the Colony, by authorising the printing and publication of your proposed pamphlet at the Government Printing Office.

I have the honor to be,
Sir,
Your most obedient Servant,
H. H. MASSIE,
Under Secretary.

L. A. Bernays, Esquire, F.L.S., Brisbane.

Had I not felt convinced that without some guide placed within their reach, the farmers of the Colony would be unwilling even to make the attempt to establish the important industry which I am endeavoring

to launch; or, upon looking round me, could I have found anyone else who, having the necessary acquaintance with the subject, would be likely to devote the time to such a task, I should not have presumed to take the lead in an attempt which the Council of the Society were unanimously of opinion should be made.

I wish it to be understood by the Queensland Public that I do not come before them as an Author; but as a fellow-colonist deeply interested in the development of the unrivalled resources of our soil, and willing to devote an experience of some years' growth to the attempt to encourage the establishment of an industry which would utilise many an acre hitherto regarded as useless for cultivation, and which, if once established, would prove a source of great wealth to a country to which I owe a debt of gratitude.

My readers will not fail to recognise gratefully the countenance and aid rendered by the Queensland Government in this important project.

LEWIS A. BERNAYS.

Brisbane, September, 1872.

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Rev. J. J. Bleasdale, D.D., F.G.S., &c., Melbourne.

Abbé Eugenio Ricci, Brisbane.

Mr. W. Cairncross, Farmer, Bulimba.

Messrs. J. and G. Harris, Merchants, Brisbane.

The Hon. Wm. Thornton, M.L.C., Collector of Customs, Brisbane.

Thomas Harlin, Esq., MA., Head Master of the Brisbane Grammar School.

THE OLIVE AND ITS PRODUCTS.

CHAPTER I.

DESCRIPTION AND HABITAT, AND INTRODUCTORY.

Olea Europæa*, The Common Olive, belonging to the natural order of *Oleaceæ*, is, in its wild state, little more than a shrub, thorny and unattractive in appearance; but, by cultivation, has become a tree varying according to species, at maturity, from twenty to forty feet in height, and though sober of aspect, and of peculiar tint, is by no means destitute of beauty. The tree is an evergreen with leaves somewhat leathery in appearance, the upper surface being of a subdued rich green color peculiar to the Olive, which has given its name to the tint; the under side being minutely scaly and of a whitish-grey. This is said to be observed in a remarkable manner when the lightest breeze is passing through the valleys of olive-gardens, the effect being by one author prettily likened to a silver cloud gliding across the landscape. A somewhat similar effect, upon a smaller scale, may be witnessed with the beautiful Silver Poplar; but in a more intensified degree, owing to the dazzling whiteness of the under side of the leaf of that tree. The leaves are opposite, and, in shape, either oblong or lanceolate, and entire. The small white flowers are in axillary bunches, or in thyrsi at the ends of the twigs, drooping when at maturity. The fruit (*see Illustration*

* From the Greek, Ελαια, olive.

A) is a drupe, with a unilocular stone; the pericarp, shell, and kernel each containing, but in different proportions, a fixed oil, the existence of which constitutes the great commercial value of the tree. To the same natural order belong the Lilac, the Ash, and the Privet. The Olive is by some supposed to have been originally a native of Greece, by others of Syria, &c.; but the species is found widely distributed in nearly all the temperate parts of the globe. It will mature its fruit neither in very cold nor very hot climates, although the tree is to be found in both. But, though extremes of temperature are adverse to fruitfulness, the greatest enemy to the Olive-tree is frost; but even this does not inflict material injury unless following immediately upon wet weather. The degree of injury from this cause varies, being influenced to some extent by the age of the tree. Sometimes all the tree above ground is killed, sometimes only branches here and there; but the older the trees, the better able they appear to be to resist the action of cold. The roots, however, are rarely if ever injured by this cause; and the damage can therefore be more quickly repaired, by training a new stem from the old root, than if the tree had to be entirely replaced.

In hot climates the effect of heat may be mitigated, and greater fruitfulness attained, by planting on slopes facing the morning sun, so that the extreme heat of the day may be either entirely shaded from the trees or it may fall with softened severity. On the other side of the world the Olive is successfully cultivated, in all parts of Spain and Portugal, which are not too elevated. It extends over France, south of the mountains of the Cevennes; over Italy, south of the Apennines; and Turkey, south of the Hæmus. It is grown on the northern coast of Africa (in Morocco, Algeria, and Egypt), in Hong Kong, and almost throughout the Republic of Chili. The Olive is the great staple of Corfu; and its cultivation is rapidly increasing in the Southern States of America, where it is stated that a

fair crop of oil is obtained from trees four years from the nursery, and a full crop from trees eight years planted.

Ancient writers upon the Olive state that the tree will not thrive remote from the influence of the sea air; and this opinion has been handed down from generation to generation, and is entertained, even at the present day, by men whose authority upon the general subject cannot be lightly regarded. The fact, however, that the Olive forms a staple product throughout Spain, even in those parts which are so remote from the coast as to be quite beyond the influence of the sea air, seems to set the matter at rest. The idea is probably traditional, and takes its origin in the fact that in the early history of the Olive, the countries where it was grown were chiefly maritime. It is still not inconsistent to suppose that sea air is beneficial to the tree; and the practice which obtains among some of the Portuguese oil-growers of using sea sand in making their plantations, may be well worth our attention in considering the suitableness of the Olive for some parts of Queensland. Baron Ferdinand von Mueller tells us that "the Olive is a hardy plant, and "hardly subject to any diseases which might render the "yield precarious;" while it possesses this great advantage, that it will not perish from neglect—at best, it does not require much labor or care; and, unlike the vine, the mulberry, and other trees, if long neglected, will revive again as soon as the ground about it is again stirred and it receives attention, and will respond to the care bestowed upon it by yielding as before. It will be found presently, when we come to deal with the subject of soils, that by means of the Olive much land can be utilised which has been hitherto regarded as comparatively valueless; and when we bear in mind the longevity of the tree, its great productiveness, the manifold uses for food, and in various industries to which its products can be put, it is as undoubtedly the interest of the colonists of Queensland to test, as it is the duty of the Institution of which, as I write, I am the representative,

to point out its importance and usefulness. It is possible that Brisbane may be found to be nearly the northern limit of Queensland for the production of the Olive, as it has been found to be the southernmost, or very nearly so, for the successful cultivation of the Mango, the Jaca, the Alligator Pear, and other trees. Under the auspices of colonists like Bidwell, Sir Robert Mackenzie, and others, and of the Government Gardens, many vegetable products of other climes have been found to succeed in different parts of Queensland; while of late years the well-directed and carefully organised operations of the Acclimatisation Society have introduced into, and distributed throughout the colony, all the trees above mentioned, and many other plants of more or less utility, which are now common in our gardens. I need hardly dwell upon the vastly greater importance to us, than the introduction of mere fruits and vegetables, of establishing in our midst such a source of wealth as the Olive. We know that it thrives in Egypt, a country still hotter and drier than Queensland; and the following letter from an intelligent farmer near Brisbane will place beyond doubt the fact that there is nothing in the climate inimical to success with this valuable tree:—

Bulimba, 28th May, 1872.

Dear Sir,—In reply to your note of 18 May—In 1857 my land was trenched two feet deep, and, on the 10th June, 1858, I planted eight olive trees, all I could get from Shepherd and Co., of Darling Nursery, Sydney, at that time. Six were Spanish two-year-old worked trees; and my trees are planted forty feet apart, and I have always used the land between as flower beds, and for a few pineapples this season. The trees have shed all their olives off the lower branches, only maturing on the top branches. Mr. Hill thinks it was owing to the early rains; I think I am too much exposed to the West for olives.

Yours truly,
W. CAIRNCROSS.

Age of olive trees, fourteen years.
Two-years-old worked trees, Spanish.
Height of trees, twenty-five feet.
Single stem, six feet to branches.
Diameter, ten inches.
Soil—Dark-red sand, and stones.
Sub-soil—Red clay and rotten slate.

I have gathered fruit these eight years.

Fruit appears in September, October, and November, according to the season we may have.

I have had fruit ripen from February to June.

The trees have been well cultivated.

I have made no oil.

I have pickled a good many.

I have given away nearly the whole produce for the same purpose.

W. C.

In South Australia, the production of Olive oil has become a permanent industry; a fact going far to corroborate the opinion of Simmonds, who, writing in 1854, says, "Wherever it has been tried on the sea-coast "of Australia, the success has been most complete. Un- "fortunately no one has attempted to cultivate the plant "on a large scale; but in a few years Australia ought to "supply herself with Olive oil." The Olive possesses one great qualification over almost every other known tree; that is, its permanency—once planted under suitable circumstances, and it is planted *practically for ever*. It attains an almost incredible age, and has been extensively cultivated for an unknown length of time. Many illustrations of these facts, and much that is interesting in the history and mythology of the tree could be afforded; but as I am writing a handbook, I must confine myself as much as possible to the purely practical.

"If you want to leave a lasting inheritance to your "children's children, plant an Olive," is a common saying in Italy; and an Italian authority describes an Olive plantation as "a mine on the surface of the earth." In Olive countries, the tree forms almost the entire support of the population—the present generation living with little trouble upon the fruits of the industry and intelligence of their ancestors. For the same reason that I assigned for omitting other interesting matter, I purposely avoid a vast amount of Statistical and other information about oil countries, from which, in the course of my researches, I myself derived much instruction To the experimental grower of the Olive, this information is not necessary; while to those who care for it, it is available without much trouble. To shew how com-

pletely in oil countries the population becomes absorbed in this one industry, I quote the following experience of a traveller. He says, "I have stood on the terrace of "an old baronial castle, at the town of Parobita, and "seen the Olive groves spread around me on every side "for many miles, like a dull sea of leaves. As the "whole wealth of the country consists in Olives and oil, "and as all hands are employed or interested therein, it "is amusingly curious to observe what frequent allusions "are made to it in popular parlance. A man who is in "a gay humor is said to be merry as if he had a good "year (of Olives); and so with the reverse, when he is "in a bad humor. An improvident person who dies, and "leaves his family badly provided for, is said to have "left a fortune of Olive trees past bearing; or that he "has consumed all the good years, and bequeathed the "bad ones." One of the chief features of the Olive as a staple product, is the increasing and enduring character of the yield. With the commonest care and intelligence, the returns are sure and progressive. Nor need the farmer be deterred by the not unnatural dread of plunging into a new industry, the fruits of which cannot (like the favorite corn and hay crops) become available for turning into cash in a few months. Let those who do not care to expend what is necessary for the establishment of a plantation, plant Olive trees on the boundaries of their cultivation paddocks, just inside the fences. By this means, they occupy no ground available for more immediately profitable crops; and, while putting in a few score of trees in this way, farmers may try the experiment without risk of loss. When they discover that they are able to manufacture oil enough for the many uses to which it can be put on a farm, for family consumption, and as a lubricator, they will require no persuasion to plant on a large scale; and will regret the half-heartedness which prevented their doing the same thing years before.

As in the case of sugar, it is by no means necessary that each grower should possess his own crushing mill and press. The Olive can be grown and sold for crushing,

or be crushed on shares. Unlike sugar-cane, the crop is compact and portable; and with common precautions, can be kept without deterioration for a considerable time after gathering—the great advantage of this last-mentioned qualification being, that the farmer, after harvesting his crop, could cart it to the mill and convert it into money or money's worth at his leisure.

Sir William Macarthur, in advocating the cultivation of the Olive for New South Wales, says—"If our agri-"culturists generally, our smaller farmers even, did but "know what a comfort it is to have in a family a good "supply of fine Olive oil—how palatable and nourishing "it is—how it ought, and in many countries does, supply "the place of fat, lard, and butter, in cookery—how "much more wholesome it is, and withal how simple "and inexpensive is the cultivation of the tree, and the "preparation of sufficient oil for home use—it would "soon become plentiful in the farm-house, instead of "being looked upon with at best but a momentary "curiosity."

The popular belief that the Olive is a slow growing tree, and that it takes many years to come into bearing, must be considerably modified by facts deducible from the experience of modern growers. By careful selection of variety to suit climatic and other considerations, and with intelligent cultivation, the Olive has proved itself to begin to be productive as early as the orange, although it takes a few more years than the orange before reaching the limit of productiveness. There need be no discouragement to the grower from the slowness with which his Olive trees arrive at maturity, unless he plants indiscriminately as to variety, and does not pay reasonable attention to aspect, character of soil, and other considerations, which would be allowed to have their full effect in the planting of bananas, peaches, and other fruits of ephemeral value.

CHAPTER II.

VARIETIES.

As far back as Pliny's time it was held that different soils suited different varieties of the Olive, and this opinion has been more or less entertained to the present day. In selecting varieties for planting, we may concede to climate an influence certainly not less important. A mere list of varieties would be neither interesting nor useful, especially as, like many other trees with numerous varieties, there is some confusion of nomenclature.

After a careful comparison of the lists given by different authorities to whom I have referred, I believe that the end in view will be best served by quoting the selection made by Mr. Davenport, for the purpose of his paper read before the Chamber of Manufactures at Adelaide in July, 1870:—

"Of the departments of Var and the Alpes-Mari-
"times, the neighborhoods of Grasse and Cannes give
"preference to a variety, variously called the 'Caillet,'
"'Cayou,' 'Olivier de Grasse,' 'Olivier Pleureur,' from
"the gracefully weeping aspect of the tree. This grows
"best in strong soils. It needs air and sun to fructify
"its flowers. To secure all the oil, its fruit should not
"be gathered until quite black.

"2. The 'Blanquette.' This grows best in dry
"grounds. Its fruit is round, little colored when ripe.
"Its leaves are shorter and less drooping than those of
"the Caillet. Its oil is sweeter, whiter, and more deli-
"cate; but keeps badly. It is chiefly grown about
"Antibes, under the name of Blanquetier.

"3. The 'Roubeirou' variety grows tall, and has
"few branches. Its leaves are rounded. Its fruit is
"oval and small, and yielding little oil, but of a charac-
"ter superior to any other.

"4. The 'Plant d'Entrecasteaux' is of rapid growth, "cares little for the nature of the soil, but prefers stony "ground. It requires little manure. It ripens its fruit "early, yielding large quantities; but, dreading the cold, "must be planted in sheltered situations, and should be "frequently pruned.

"5. The 'Curnet' gives an abundance of excellent "oil, and succeeds in all exposures.

"6. The 'Caillet-roux' yields much excellent oil, "and succeeds in low bottoms.

"7. The 'Redounaou' stands the cold, gives ordi- "nary oil, but is much esteemed for the conserve of its "olives.

"8. The 'Arabon,' very productive of good oil. "Among other choice varieties of the Var are the "'Picholine,' for conserves; and the 'Salouen,' the "'Blanquet,' the 'Verdale,' and the 'Bouquettier,' for "oil."

In addition to these, the same gentleman, elsewhere, quoting an eminent French authority, names the "Colliasse," "Pointire," "Rougette," "Clermontais," "Grosse Cornialle," as among the most productive kinds. The Verdale, Colliasse, Clermontais, and Gros Cornialle, appear to possess the additional advantage that they never grow large, and thus their fruit is easily gathered. They may be planted sixteen feet apart, instead of the traditional forty feet; an immense advantage, as thus each acre of land may grow many more trees. The Verdale is specially recommended, as bearing fruit in the third year.

The fact, that there is a great difference in the period at which different varieties of the Olive come into bearing, is beyond doubt. This appears to have been clearly proved in South Australia; where, among some valuable seedlings raised, some have proved much earlier bearers than others.

I think that in our early operations we shall do well to plant those kinds which have been proved by the nearest

of our neighbors* who have grown the Olive to be early and abundant bearers. After that, we may with great advantage avail of the experiences of South Australia; although we may, perhaps, sooner or later select some other kinds as better adapted for our warmer climate: and this, if there is anything in the theory of the acclimatisation of plants, will probably be a locally raised seedling from locally grown fruit.

* Camden Park, the estate of Sir Wm. Macarthur, in the county of Cumberland, N. S. Wales, is the nearest locality to Brisbane where the Olive has been grown to an extent sufficient for the manufacture of oil, and for testing different varieties of the tree.

CHAPTER III.

SOIL.

As the Olive will thrive, and be most prolific in dry, calcareous, schistous, sandy, or rocky situations, it is obvious that, by its means, much land at present regarded as valueless for agriculture, and comparatively so for horticulture, may be utilised, under proper conditions of climate, for the production of a staple of commerce, certain in its annual return, and for which there is an unfailing market. Let the free selector of Queensland, who, by an error of judgment or want of experience, finds himself possessed of land of this character, take comfort. Not only can he get a certain return for his labor; but he is actually better off than his neighbor, who, desirous of entering upon this industry, has nothing but rich alluvial bottom lands for his plantation. The Olive will undoubtedly flourish, even to luxuriance, in such lands; but the man whose possession has hitherto been regarded as poor, and who has begun to get accustomed to be pitied by his neighbors for having made such an unfortunate selection, finds himself now in command of the position. His Olive trees will bear sooner and be more prolific than those grown in the rich soil; and should he have the additional good fortune to have some limestone ridges, by all means let him select these for his plantation; and thus, in addition to his other advantages he will be able to produce a finer oil.

In thus comparing the suitability of various soils for the Olive, I must not be supposed to advocate absolute poverty as a desirable qualification. There are few examples of plant life for which a certain degree of fertility is not necessary; and in the case of the Olive, if the soil is too poor it must be enriched artificially.

With this, however, I shall deal elsewhere. In South Australia "she-oak" soil it is thought would be good for Olives, but I am unable to say if this has been tested. It is, however, found that any good vine soil is also good Olive soil.

In recommending dry soils, I have of course implied that they must be well drained. If nature has not already done this, no pains must be spared to secure the result by artificial means The Olive will not thrive in ill-drained situations; and nothing but disappointment can result from carelessness of this condition. Nor does it like clays, even if drained. For successful cultivation, the soil must be loose and permeable; and, as a general rule, the deeper the better.

Although excess of moisture is one of the enemies of the Olive tree, it must not be supposed that dryness of the soil in immediate contact with the roots is desirable. A certain amount of moisture is very necessary to maintain the health of the tree and for the formation and maturing of the fruit; and this affords the principal reason why deep cultivation is desirable when it can be obtained. Where, however, this is impracticable, mulching the surface of the soil, and occasional waterings (especially during the first two or three years) in very dry weather should be resorted to.

The sunny slopes of hills are stated by authorities on the other side of the world to be best suited to the natural habit of the tree; but, for the reason which I have before given, in Queensland it is the morning rays which should be courted and not the fiercer ones of noon. Such situations would possess the additional advantage of protection from the westerly winds of winter, which, though not too cold, are sometimes very boisterous.

CHAPTER IV.

PROPAGATION.

The great facility with which the Olive tree can be propagated is not the least of its good qualifications. In fact you may choose, among almost every conceivable method by which plants are increased, the way that takes your fancy or suits your requirements best. This phase of the subject is well illustrated by the origin attributed to a plantation in Morocco, where the arrangement of the trees was observed by a traveller to be somewhat whimsical. It was said that these trees sprung from the pegs used by a squadron of cavalry, accompanying the Emperor on a journey, for picketing their horses; and that, being left in the ground, they took root, and were afterwards utilised as a plantation. Whether this story be true or not, there is no doubt that cuttings of the Olive root with the greatest freedom. If intended for a nursery, and the soil is not naturally sandy, some sand may, with advantage, be put along the spade cut as you stick your cuttings in. For this purpose they need not be more than from eight to twelve inches long, should be neatly trimmed with a sharp knife, so as not to bruise the bark, and only one good bud left above ground. The cuttings may be either from the branches or roots. Root cuttings are best planted entirely under ground; but there is no special advantage in taking cuttings from the root, and the practice is not advised unless you are removing or thinning out your trees, or are at a loss for material from which to raise a large nursery stock of any particular variety. Of course a tree reproducing itself so readily from cuttings will grow from layers; but in adopting this method of increase, it must be remembered that the form and general well-being of the tree, branches of which are laid, are pre-

judicially affected by the process until the layers are detached and the sap again allowed free and natural circulation.

Suckers, which often rise from the roots of old trees, if strong, and carefully and neatly detached with a heel, make good trees, as they afford a well-formed stem to begin with.

Seedlings can be raised by tens of thousands in a light and well-drained soil; but, before being sown, require to be subjected to some preparatory process, which will decompose the oily pericarp, and allow the moisture to get to the kernel. This is done in various ways. The seed may be steeped for twelve hours in hot water or yeast, or immersed in an alkali which, by combining with the oil, converts it into soap which is readily soluble in the moist earth.

Mr. Duncan gives the following description of the method of raising seedling plants, practised by M. de Gasquet, on his estates at Lorgues :—

"Take, in the month of March (*Queensland*, "September), some very ripe Olives, produced by the "finest and best varieties, deprive them of their "pulp, and soak the stones for twenty-four hours "in a strong lye, which will clean them perfectly. "This being done, these stones are sown pretty closely "in a sheltered place, in little furrows about half-a-foot "apart, and about two or three inches deep. The ground "should have been trenched beforehand to the depth "of three feet, and strengthened with good manure. "During the spring and summer it is necessary to "water it carefully from time to time, and to pluck "up all the weeds as soon as they make their appearance. "The little Olive plants begin to shoot about the month "of October (*Queensland*, April). It will then be proper "to drive into the ground, between the furrows, small "green branches, in order to shelter the young Olive "plants, which continue to shoot during the rest of the "autumn, and even during nearly the whole of the winter, "unless it be cold. If frosts are expected, the young

" plants are covered with dry leaves, straw, or litter. As " in this seed bed, the young Olive plants, when they have " succeeded, will have grown close upon one another; " the feeblest plants are plucked up during the second " spring, or if it is wished to preserve them, they are " taken out of the ground during the month of March, " (*Queensland*, September), and replanted elsewhere."

The seeds used should be the *finest fruit* from the *healthiest trees;* and, being some months in germinating, should be sown as soon as ripe. The object of raising seedling plants is two-fold; the primary one being to obtain stocks on which to graft. A second one, and of great importance in a climate like that of Queensland, which is not so well assured for the cultivation of the Olive as many other parts of the world, is the chance which it affords of obtaining new varieties suited to the climate. For this purpose it will be desirable to use seed, the produce of trees grown in the colony; and a piece of ground should be set apart for the purpose of testing the seedlings, which (for similar reasons to those for which I have recommended careful selection of seed), should be the strongest and healthiest plants in the nursery beds.

This experimental ground should be deeply worked, well drained, and generously treated.

*Grafting** the Olive is much practised, and is among the most certain methods of securing strong trees of approved varieties. The " Shield," " Cleft," and " Crown " grafts are all used and variously recommended; but I am disposed to think that it is immaterial which method is adopted if the scion and stock suit each other in point of age and size. Underground grafting in this climate is decidedly preferable, not more than two eyes of the scion being left above ground; and the union will be better ensured by the point of junction being carefully bound with a strip of calico which has been steeped in a mixture of mutton fat and beeswax, after which the earth should be heaped into a mound above the graft. The operation should be per-

* See also Appendices I., II., and III.

formed in Spring when the sap is rising, the scions being of two-year-old wood.

Seedling stocks may be successfully grafted at from two to six years old; but in using two-year-old wood for scions it is as well that the stock should be not much more than the same age, in order that there may be not more sap than is sufficient to effect the junction, thus saving the trouble of keeping down suckers and surplus shoots. It is well known, by those who have intelligently studied the practice of horticulture, that the stock is sometimes affected by the scion; and it would appear that the ancients applied the knowledge of this fact by grafting, upon decayed or worn-out Olive trees, branches from a vigorous wild tree, thus infusing fresh vitality into the old stock. This process is described by Pliny as making a new tree "bloom "forth in youth from an old one"; and he states that this is done "again and again as often as there is need, "so that the same Olive plantations last for ages." In these more advanced days, however, the same effect may be more naturally and easily produced by securing the tree from decay by high cultivation, pruning, and perfect drainage. From the same authority, we learn that the ordinary processes of grafting and budding were practised on the Olive.

Truncheons are very stout cuttings, varying in length from one foot to ten feet, and in diameter from one and a-half to six inches, according to the method adopted in planting them. Truncheons are planted in two ways, each having its advocates. Under one method the pieces might with more propriety be called "poles" when they reach the length of eight and ten feet. But while the advocates of this method give the range of length from four up to ten feet, they have a corresponding difference in the depth to which they open the holes to receive them, which ranges from twenty inches to four feet. It is probable, therefore, that where the soil is deep and well drained, it is found preferable to plant deep; and then in order to have sufficient height above

ground to form a good stem, you require a longer piece to start with. Keeping then the above considerations in mind, the process is as follows :—In early spring open the holes to such depth within the above limits as the nature of the soil admits. I may here say, that should the ground and the labor have been available, it would be better that the holes should have been opened during the previous summer, and the soil left in the rough around each to mellow. Next plant the truncheon or pole upright, taking care to throw in a good layer of chopped turves and leaves, decayed stable manure, or any fertilizing matter which has thorougly ripened and is not too hot, and filling in *firmly* with the soil which was taken out of the hole. Leave the ground round each plant slightly hollowed to facilitate watering, which, unless the ground is in a moist state, should be done at once, and repeated from time to time when the weather is dry. The object of enriching the bottom of the hole is twofold. It stimulates the truncheon to send out roots from the bottom end, and so ensures a well and deeprooted tree; while it also assists mechanically in retaining moisture where it is most needed.

The first object is sometimes endeavored to be effected by cutting near the bottom of the truncheon four or five nicks about one-third of an inch deep, which are filled with grains of barley, a handful of which is also thrown in; but there is no magic about this method, while the recommendations above given are more simple and intelligible. In transplanting rooted trees from the nursery, or to relieve too thickly planted rows, the same precautions should be adopted.

When the wood left above ground is long, the soil is sometimes heaped round it in the form of a cone, to mitigate the drying influence of the air before the plant has rooted, a hole, which is kept open by a wisp of straw, being made on one side to facilitate watering in dry weather.

The advantage of planting truncheons in the way described (in the position which the tree is to occupy

permanently), is that you thereby save a whole year, and commence with a good stem to form the trunk of the future tree; but I need hardly say that there must be no scamping of labor or slurring of the work, which to effect these objects with certainty must be thoroughly and intelligently done.

I come now to the second method of propagating by truncheons. In this case they are cut from *one* foot to *three* feet long, the short lengths being, I am disposed to think, preferable. They should be cut neatly, without any bruises or ragged edges in which moisture could lodge and do mischief; and are bedded *horizontally* four or five inches beneath the surface. The soil for this purpose should be fine, and be kept moderately moist. By this method also, the plants may be at once put where they are permanently to remain; but, as sometimes two plants will come from the same truncheon, and in order to secure exactly suitable soil for starting the plants into growth, this system of propagation is better adapted for the nursery. The grower must not be impatient if the shoots are long in making their appearance, as much depends upon the season. In two years, however, you will have trees four to six feet high, with stems from one to two inches in diameter, according to kind, which are fit for planting out, and from which you will be able to take strong scions for grafting your seedling plants. These, of course, you have been growing in the meanwhile, if you want any considerable stock of trees for sale or for making a plantation for yourself. Keeping carefully in mind the heat of our climate and the dryness of our spring, I would recommend this method of burying truncheons in preference to the other for beginners in this important industry. The other may with advantage, and of course will, be tried; and with some additional protection to the exposed stem from the drying influence of the air, may answer as well in Queensland as elsewhere.

The distance at which the trees should be apart will be dealt with elsewhere, under the head of "Cultivation."

Propagation by Uovoli.—This method of increasing good varieties of the Olive is both curious and interesting. The word is Italian, and means literally, "little eggs." These are small knots or excrescences which form, often in some numbers, on the bark, especially of the upper roots. They are easily detached with a sharp penknife; but care must be taken not to injure the tree. This should be at least ten years old, both because before that age it is not worth while examining for *uovoli*, and because the tree should be mature, deep-rooted, and strong before such liberties are taken with its bark. When removed, they are planted like bulbs; and, by much the same process of nature as in the case of the propagation of the vine and the potato by eyes, in due course become young trees. These uovoli are, in fact, embryo buds, or what are technically known as knaurs *(see illustration B, "Knaurs or Embryo Buds")*, the theory of which is that they have been adventitious buds, which, by pressure of the surrounding growth of bark, have been forced into woody excrescences.

CHAPTER V.

CULTIVATION.

In describing the methods adopted of propagating by truncheons, I have of necessity somewhat anticipated the subject, in some of its phases, of this chapter. The importance of thorough drainage for the Olive has been already pointed out; and the intending cultivator, bearing this well in mind, will, of course, understand that the digging of holes is not to imply that the intervals are to be left without being broken up. Where a depth of four feet is used, it would be impossible, without artificial drainage, to prevent the wet from hanging about the roots of the trees, unless the soil were naturally deep and very porous. It must be remembered that one of my objects in urging the cultivation of the Olive is, that thereby the slopes of our hills, the soil of which is unsuited for general cultivation, may be utilised. In these situations any considerable depth of soil will not be found; and twenty-four inches will, as a rule, be the maximum depth attainable. If this be the case, holes will have no advantage in point of economy over continuous trenching, say to the width of eight to ten feet; with the additional facilities for drainage, afforded by the latter mode of preparing the ground, thrown into the balance. While such trenches will afford sufficient room for the health of the trees, these will still benefit by the breaking up, at some subsequent period, of the intervening spaces, either by the hoe or plough.

Cultivation between the trees should be practised with caution. There is no mistake so great as to suppose that you are exercising economy by taking out crops from between the trees, unless you are quite certain that the latter are not being robbed of light, air, or nutriment. When the trees are quite young and cover little space,

a shallow rooting crop may with safety be taken off, provided that even then the seed is not allowed to fall within five feet each way of the trees. If this be done for a year or two with safety, it is as much as can be ventured; after which, any crop raised, in place of being taken off, should be ploughed in, to restore what the previous crops have taken out of the soil. It is quite possible, however, that the soil, in situations such as those which I advocate for the Olive, may not be sufficiently good to make it worth while to attempt a green crop. In that case, rather than *waste* the space which is not wanted by the trees in their young state, the farmer might advantageously grow pumpkins, in holes specially manured, and feed them to pigs; always remembering that the worst of our gravel ridges, when first broken up, will give at least one crop of sweet potatoes. While, however, careful cultivation within certain limits between the trees may be permitted, not only must any crop be kept well away from the trees, but the soil about them must be periodically stirred as deeply as is compatible with safety to their roots. *Illustrations C* and *D* are introduced to exemplify labor-saving implements for keeping loose and clean the surface of the soil. (*See Index to Illustrations.*)

Manuring with suitable fertilising substances, at intervals, forms an important element in the successful cultivation of the Olive, especially in soils naturally poor. While the tree rejoices in the mechanical looseness of sandy, gravelly, and stony soils, and in freedom from stagnant moisture, the Olive is not among the very small number of fruit-bearing trees which are most fruitful in sterile soil. Nutriment is necessary to its productiveness; and if not already in the soil, must be introduced artificially. But manure also acts mechanically in retaining moisture, and thus helping the tree to withstand drought, and effecting a saving of labor in watering; which, if the manure has been well dug in, may be done less frequently. The stronger kinds of manures are recommended for the Olive, such as pigeon

and sheep dung; but the best of all for sandy soils is night-soil. But raw, unripened, hot manures of any kind are as bad for this tree as they are for most others. There is nothing to equal a good old compost heap; and where the materials are procurable, it will well repay the labor and first cost to make one. This is best effected by excavating a hole of sufficient dimensions, into which should be thrown sheep and fowl dung, stable manure, soot, ashes, refuse fat, scraps of leather, hoofs, urine, leaves and weeds, and other substances which will ferment and rot. The heap should be occasionally turned until thoroughly incorporated; and when mature, which will probably not be for twelve months, may with great advantage be applied to the trees, being well turned in under the surface. I am told by a gentleman resident among us, that in the south of France, old rags of all kinds, including woollens, are largely used for manuring the Olive.

I have said elsewhere that the Olive likes limestone ridges; and, therefore, an addition of lime to the compost heap, or its separate application, will soon make its effects visible in the healthy appearance and more vigorous growth of the trees.

Having spoken of the value of a compost heap, I cannot leave the subject of manures, without remarking upon the prodigal waste of excellent material which is constantly going on upon our farms by burning the rubbish "out of the way." By this system, a vast amount of excellent fertilizing material is every year destroyed. There is no farm so small that it could not devote an odd corner or two for a rubbish-heap. To this should be carried the refuse matter of every description from the farm—everything, whether vegetable or animal, that will ferment and consolidate into manure. This will only involve the extra labor of cartage, which will be repaid a hundred-fold. It has been objected that, in this dry climate, such heaps would take a long time to ferment into a fit state for use. But what does this really matter? By adopting this system it will be found that

after the lapse of (say) the first twelve months, there will always be, under the outside surface of these heaps, a quantity of rich manure, and of a description excellent even for its merely mechanical uses.

Where the soil is absolutely poor, the trees should be manured every year; but, otherwise, every second year will be sufficient. Of course, if the orchard has been established in rich alluvial bottoms, or fat loam, and the trees have a tendency to over-luxuriance, manuring, I need hardly say, is not only not wanted, but would be wasteful, and inimical to productiveness.

In applying manure, if it be in fit condition, it is most profitable to dig it in just before the rainy season; as, by doing this, the tree at once receives the full benefit of the dressing.

Mulching, especially while young, will be found as useful an adjunct to the cultivation of the Olive, as it is with other trees in our hot dry climate. Its effect is principally mechanical in retaining moisture, and in keeping the surface of the soil, about the roots of the tree, cool. Long manure—grass, straw, or any such substance—will answer the purpose; but it is as well to select something which will gradually decay, and when dug in will act as a fertilizer. Care should, however, be taken that the material selected be free from seeds, or it will involve additional labor with the hoe.

Pruning judiciously is of great importance, as the Olive has the character of only bearing every other year. The fruit is produced on the young shoots of the preceding year; and, in pruning, the object to attain is to secure a regular distribution of wood of the previous year from the axils of the leaves. In poor soil, where the trees would have a struggle to produce both fruit, and young shoots for next year's harvest, pruning is especially necessary; and I am disposed to think that, in our genial climate, plantations skilfully managed ought to bear, with fair certainty, a regular annual crop. Some authorities consider that pruning once in three years is sufficient; but this phase of the cultivation of the Olive

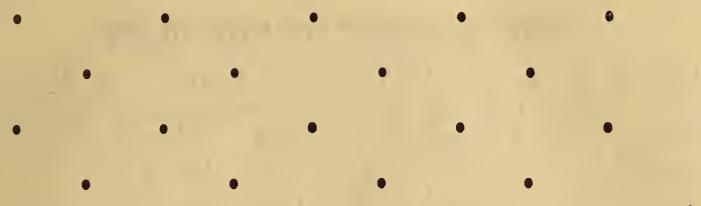
in Queensland will be better understood after a few years' experience of the effects of the climate. By the old method of leaving the tree to attain its full growth, any considerable crop was not obtained for many years ; and hence the character of the Olive for tardy productiveness. Under the present system, however, of cultivating comparatively dwarf trees, abundant crops are afforded in three or four years. Under the head of "*Harvesting*," I shall have occasion to remark further upon the advantages of judicious pruning, and the cultivation of small growing varieties. A clear, straight stem, of five or six feet should be kept. Not only is the growth thus made handsomer, but the tree is more vigorous and strong to resist wind, and the fruit is sufficiently remote from reflected heat, and consequent premature ripening.

The *distance apart* for planting the trees must be determined partly by variety and partly by soil and aspect. Under the old system, which was content with a biennial crop and left the trees to grow much as they pleased, a distance of thirty up to as much as forty feet was necessary. But of late years, the propagation of new and highly productive varieties, and the adoption of a system of pruning the trees to such limits as will render the gathering of the fruit, by hand, comparatively easy, has enabled cultivators to bring their trees closer together, and thus to economise space and consolidate their operations. Orchards are now planted at distances from sixteen feet up to a maximum of thirty feet, according to variety; the distance being further regulated by the quality of the soil.

While I must guard my readers against the false economy of overcrowding, the Tables given in *Appendix V.* will shew the number of trees which can be grown per acre at 16, 20, 30, and 40 feet apart respectively. From these tables will be seen exactly the area of land which is saved by allowing no more room to each variety than is absolutely necessary for the healthy development of the trees.

But at whatever distance apart—all considerations

being duly taken into account—it is determined to plant the trees, the method most effective to the eye and for free circulation of air is what is known as "quincunx fashion," thus :—



To summarise the foregoing remarks upon cultivation, I may say that by intelligent study of the habits of the Olive, and careful attention to its requirements, there is no valid reason why, in four or five years from planting, it should not begin to repay the expense of culture; without taking into account what, in the meantime, may have been got off the ground by intercultivation. A year or two before that even, the few Olives which may be gathered off each tree, may, in the aggregate, suffice to make oil enough for the family requirements; while from the sixth year onwards, it may be relied on in ordinary years as a sure and increasing source of wealth to the farmer.

Continued moisture during flowering, will tend to render a portion of the fruit abortive; but this is a cause of failure which will occur but seldom in this climate.

CHAPTER VI.

THE HARVEST OF THE OLIVE.

The fruit of the Olive is a "drupe"; a Botanical term applied to fruits which are externally succulent or fleshy, with a hard-shelled seed. The plum and the apricot may be cited as other examples of the "drupe"; but the word takes it origin from the Latin "*drupæ*," meaning "unripe olives," which are the type of this form of fruit. The shape of the olive varies according to kind. It is generally oval (or egg shaped), sometimes round, sometimes obovate (or like an inverted egg), occasionally acuminate (or tapering to a point). It varies still more in color than in form, according to kind and to stage of maturity. Thus olives may be seen green, whitish, violet, yellow, red, or even black. The fruit is produced in vast profusion, so that an old olive-tree becomes very valuable to its owner.

The proper time for gathering is the eve of maturity; presuming that the cultivator aims at the production of the finest quality of oil. If delayed too long, and the fruit becomes over-ripe—especially if it be allowed to fall—you lose in quality though gaining somewhat in quantity. But while I advocate the gathering of the fruit at the stage at which it will produce the best and highest priced oil, I would point out, as one of the advantages of the crop, that if, from press of other operations on the farm, the owner is unable to gather his olives when he would wish, they are yet available to him—even in a state which in other fruits would be regarded as rottenness—for the production of a still marketable though not so valuable a commodity. This, however, is a matter which will soon regulate itself; when the grower finds that his more careful neighbor has made more money from his acre, than he himself from twice the area.

Another inducement to harvesting the Olive as soon as it is fit for gathering, is to be found in the fact that, by delaying too long, the productiveness of the tree for the next year is prejudicially affected. Early gathering, on the other hand, relieves the tree and gives time to strengthen for another crop. I have already said that the Olive, if left to itself, will only bear once in two years. This is positively stated by ancient writers, who attribute the fact in great measure to the injury received by the tree in the practice of beating down the fruit. The belief has, however, come down to a period much nearer to us; but there is no doubt that in skilfully managed plantations the trees do bear annual crops, and that the early gathering of the fruit contributes largely to this end. If the fruit is left on the tree too long, it is taking sap which ought to go to the formation of new shoots for fruiting the following year.

The best mode of gathering is by hand. The system, elsewhere alluded to, of cultivating low-growing trees much facilitates the harvest. The gathering can be done by children, and with the aid of light steps the fruit can be reached from the top of the tree. The system of beating the fruit from the tree with light rods of wood, although very old, and still in some places resorted to, should never be practised by the intelligent and painstaking agriculturist. However skilfully done, it cannot fail more or less to injure the young branches, as the blows must fall at random; and what will suffice to bring down the fruit will also strew the ground with leaves and tender shoots; leaving Nature with a large amount of repairs to effect, instead of applying all her energies to preparing for the next crop. The practice has the additional disadvantage of involving the picking over of the fruit in order before pressing to separate leaves, sticks, and other rubbish.

Shaking the tree is also resorted to as a means of obtaining the fruit; but though not so injurious as the beating, is not recommended. This practice obtains in Syria, where they have Scriptural warrant for the

method. The Olive groves there are in common, without fences of any kind, being everybody's property and nobody's property. Proclamation is made by the Governor of the district that the shaking time has arrived, when the whole population—men, women, and children—gather for the purpose, and the rule appears to be everyone for himself. (*See Appendix IV.*)

A good method of ascertaining if the fruit is fit for gathering is to apply a slight pressure with the finger and thumb; when, if oil exudes, the Olives are considered fit for the press.

The largest fruit is the Spanish; but the Olives of Andalusia are said to surpass, both in size and quality, those of other Spanish provinces.

The harvest extends over six weeks or two months; and as the fruit matures and is gathered it should be laid on shelves so as slightly to dry. Contact will do no harm so long as it does not bring about actual heating; as excessive fermentation results in inferiority of quality of oil. This part of the subject will, however, be dealt with more at length elsewhere.

CHAPTER VII.

USES OF THE OLIVE.

The bark, the wood, and the fruit of the Olive are all utilised; although it is for the latter that the tree is grown and forms so important an item in the productions of the earth. The bark is bitter and astringent; and both bark and leaves have febrifuge properties called "olivile," and have been used in medicine, the former having been employed as a substitute for cinchona. From old stems a gum resin exudes, with an odour like that of vanilla; and is largely used in Italy in the preparation of perfumes. The wood is one of the hardest and heaviest known, weighing nearly 70 lbs. to the cubic foot; and, as in the case of the "box," has the pith nearly obliterated. It burns well even when green, being highly resinous, and gives out great heat. When seasoned it takes a fine polish; and, being beautifully veined and spotted, and possessing an agreeable smell, is very valuable for turning and cabinet work. It is, moreover, not subject to crack or to be destroyed by insect life. The root wood has a great variety of shades, and is much in requisition for turners' work.

The fruit, in a whole state, is used in large quantities, before coming to maturity, for pickles, and, to a small extent, in a dried state. The form in which we are chiefly accustomed to see Olives is in small bottles in salt and water, in which state they are used as a restorative to the palate. They undergo various treatment to prepare them for this purpose; but while the receipts are numerous, the object and tendency of the various processes is much alike. The object of treating with an alkaline solution, before putting into the preserving medium of salt and water, is to extract a portion

of the bitter principle which would otherwise make them unpalatable if not nauseous.

I select the following receipts for preparing "picholine" Olives—each being given by its author as producing a good and marketable article :—

Receipt No. 1.

"The lye is to be made as follows :—Take three "pounds of fresh wood-ashes, six ounces of fresh quick- "lime, six quarts of cold water—mix well, and boil "gently for thirty minutes, keeping well stirred. "When the Olive is full grown, but quite green, gather "carefully the quantity wanted, without bruising (of "the largest kind), and place them in a clean vessel "(not iron) pure from any greasy matter, and, when the "lye is cooled down to 150° Fahrenheit, pour sufficient "on the Olives to well cover them ; soak for about "thirty hours. Then, pour off the lye entirely (covering "the vessel to prevent the berries running out), and "rinse the berries with fresh cold water, and for three "days keep them in cold water, changing the water "two or three times each day ; then, having prepared the "pickle (salt and water) of about the strength that will "float an egg (the better plan is to boil the water and "pour it on the salt, leaving it till quite cold), and, "having clean bottles thoroughly dried, put in the "berries, carefully selecting them of equal sizes for each "bottle, shaking but not pressing them down, and "pour in sufficient pickle to cover the Olives, leaving "a space in each of about an inch from the cork, which "should be good and well fitting. Cover with pieces "of bladder, well tied on and secured from the air "with some wax of black rosin and beeswax."

Receipt No. 2.

"The method of preparing Picholines, in France, "consists in putting the Olives, after they have been "gathered, into a lye made of one part of quick-lime "to six parts of ashes of young wood sifted. After

" having left them half-a-day in this lye, they are taken " out of it and put in fresh water, where they are allowed " to remain eight days, the water being carefully renewed " every twenty-four hours. After this a brine is made " of a sufficient quantity of marine salt dissolved in " water, to which is added some aromatic plants. The " Olives may be preserved in this brine during a year " and more."

RECEIPT No. 3.

" For pickling, the fruit is gathered before ripe; " and is placed for half-a-day in a lye of one part quick- " lime to six parts ashes of young wood; from this they " are taken and well washed in fresh water, after which " they are finally put into a brine of common salt and " water, in which some aromatic plants, such as fennel, " &c., have been steeped."

RECEIPT No. 4.

" One method of preparation in Portugal is as " follows, viz. :—The common practice is to allow the " larger and more fleshy kinds to become ripe, *i.e.*, black, " when they lose a good deal of their astringent or acrid " taste. These are then scalded in water considerably " under boiling, into which an ounce or so to the gallon " of soda is dissolved, and let it stand in it for three or " four hours—in fact, till it is cold. They are then taken " out and well washed in cold water several times over, " and finally put into a clean wooden or large earthen- " ware vessel, and completely covered with a pretty " strong brine of salt and water, and covered up from " the air."

RECEIPT No. 5

gives the preparatory treatment as in the preceding one; but finishes by putting the Olives so prepared into moderately strong vinegar, to be used as a pickle.

After immersion in lye long enough to extract sufficient of the bitter, the fruit is sometimes packed in tubs with a covering of lime, and thus keeps for years.

In the form of picholines, the Olive is frequently made the subject of adulteration, in order to maintain for the fruit a vivid green color; and thus, by making it look nicer, to render it more marketable. Copper is the medium used for this purpose; and the French Olives are the most extensively adulterated. In purchasing Olives in bottle, select those of a fawn color, and take care, in order to ensure this, that the bottle is of colorless glass. The Spanish Olives are, as a rule, the most free from contamination.

I now come to the principal use of the Olive, viz., the production of the Olive oils of commerce. These, of various qualities, are used for various purposes; the most important being that of food and cookery.

It is hardly necessary to say that the finer qualities and those freest from rancidity, are most in requisition for such purposes; and, when pure, Olive oil is wholesome and nutritious.

In old Olive-growing countries, and especially in the South of Europe, the oil is employed for many of the purposes of cream and butter; so much so indeed, that the inhabitants entertain an actual distaste for butter as an article of food. In Spain, there is scarcely a dish into which it does not enter as an ingredient; those engaged in the industry almost living upon bread and oil. In other Olive countries, it enters into almost every kind of cooking; while we know, from our own experience, that for cooking fish it is unequalled.

In Queensland, thanks to our rich grasses, extensive pasture grounds, and to the enterprise of colonists who have stocked the country with well-bred cattle, we require no substitute for butter, which is plentiful and good; but the uses of Olive oil in cooking are so manifold, that its production by ourselves could not fail to be accompanied by increase of comfort and greater economy of living.

A great wool-producing country like Australia, however, would find another very important use to which to put Olive oil. I refer to its application in the manu-

facture of cloth. From four to five gallons of oil (of some kind) is used in the preparation of every bale of wool. Our neighbors, in two of the Australian colonies, have for years been manufacturing woollen goods—the meaning of the term "colonial tweed," being well understood by those of us who have from time to time to look out for a good lasting material for boys' clothes; and, in all probability, Queensland will, in due course, also have her manufactories of woollen goods, for which large quantities of oil will be required.

Mr. Davenport says that at the tweed factories of Geelong two-pennyworth of oil is used to every pound of cloth; and that in one factory alone they will be able to turn out annually 300,000 yards of three-quarter tweed. The average weight of a yard of this material being thirteen ounces, five yards will weigh four pounds, consuming eight-pennyworth of oil at 8s. per gallon. This calculation, carried out, gives the value of the oil required for 1,000 yards at £6 13s. 4d.; or £2,000 worth annually for the single manufactory.

In Cordova the streets are lighted with oil, the produce of the place, and this is doubtless the case elsewhere. They have a saying in Andalusia, that "in Cordova it is always the same thing; oil for burning, oil for eating—the good Cordovans have but one idea." This is, however, rather hard upon Cordova; for we know that it is also celebrated for its silken fabrics and its leather.

Soft Soap is the result of a combination of Olive oil and potash; and Castile soap, of this oil and soda.

The Marc, or oil cake, being the residuum after the oil has been expressed, is valuable as feed for cattle; or, in a country like this, where stall feeding is not resorted to, it could be put to its other uses of manure or fuel. For the former of these uses it is stimulating, but not lasting in its effects.

The manifold uses of Olive oil as a lubricator, and as an external application in surgery, are so well known as to make their mention hardly necessary.

This oil may be taken as the type of the "fatty" or "fixed" oils, designated also "bland" and "expressed" oils. There are other products of the Olive, such as "Oleine" or "Elaine," "Stearine," "Palmitine," and "Margarine," each capable of separation by chemical process, and having their respective uses in the arts and manufactures.

CHAPTER VIII.

MACHINERY AND APPLIANCES.

The plant required in the manufacture of Olive oil consists of a mill for crushing, a press for separating the oil from the solid portions of the fruit, receivers into which the oil is run from the press, and the necessary vessels for storage and for the market. Besides these, there must be a building of some kind in which the various operations are carried on. In the large majority of cases the machinery employed is of the rudest kind, the same form having been handed down from generation to generation. Those engaged in the industry, especially the peasantry, are obstinately attached to old practices and appliances; and are impatient of suggestions for improvements, saying—"I do as my father did before me, and that is enough." The accompanying illustrations will shew that a very small capital is required for oil making; and that the implements are so simple, that with the exception of the millstones, any intelligent rough carpenter could make them. The labor required being proportionately small, the whole expense of producing from the fruit oil such as will command a fair price in the market is comparatively trifling. Care and intelligence are, of course, indispensable in this as in other products which have to compete for public favor; but in these qualifications our countrymen are not likely to be deficient.

The Spaniards, as a rule, have not improved upon their appliances since the days of Pliny, whose description of the process is much the same as the method chiefly in use at the present day. This is of the most primitive, and its merits rest entirely upon its simplicity, and upon the fact that it has been handed down from generation to generation.

The following description of the *modus operandi* among the Arabs, is taken from Thomson's "The Land and the Book," and will be better understood by the illustration of an ancient Arab press and mill-stones (*see Illustration M.*):—

"The m'aserah is worked by hand, and is only "used for the Olives which fall first in autumn, before "the rains of winter raise the brooks which drive the "mutrûf. The Olives for the m'aserah are ground to a "pulp in circular stone basins, by rolling a large stone "wheel over them. The mass is then put into small "baskets of straw-work, which are placed one upon "another, between two upright posts, and pressed by a "screw which moves in the beam or entablature from "above, like the screw in the standing-press of a book-"binder, or else by a beam-lever. After this first "pressing, the pulp is taken out of the baskets, put into "large copper pans, and, being sprinkled with water, is "heated over a fire, and again pressed as before. This "finishes the process, and the oil is put away in jars to "use, or in cisterns, to be kept for future market.

"The mutrûf is driven like an ordinary mill, except "that the apparatus for beating up the Olives is an "upright cylinder, with iron cross-bars at the lower end. "The cylinder turns rapidly in a hollow tube of stone-"work, into which the Olives are thrown from above, "and beaten to a pulp by the revolving cross-bars. The "interior of the tube is kept hot, so that the mass is "taken out below sufficiently heated to cause the oil to "run freely. The same baskets are used as in the "m'aserah, but the press is a beam-lever, with heavy "weights at the end. This process is repeated a second "time, as in the m'aserah, and then the refuse is thrown "away.

"The m'aserah is, however, the machinery used "from the most remote times, as we know from the "basins and wheels to crush the Olives, still found in "the ruins of old towns. The huge stones upon the tops "of the upright posts, prove conclusively that the

" ancients knew nothing of the screw, but employed " beam-presses, as in the mutrûfs. (*See Illustration M.*)

" Beam-presses are also employed in the m'aserah " to this day, and I think the use of screws is quite " modern.

" There is no process whatever for clarifying the " oil, except to let it gradually settle on the lees in the " cisterns or large jars in which it is kept.

" Certain villages are celebrated all over the country " for producing oil particularly clear and sweet, and it " commands a high price for table use."

The Mill on Oil farms generally takes the forms given in *Illustrations E, G, O,* and *P;* the only explanation of which required is, that the stones must be of a hard and unabsorbent description, such as granite. The reason for this is obvious, for it can readily be seen, that were the stones of a porous character, they would soon become saturated with oil, which, becoming rancid, would taint all that it came in contact with.

But, while the majority of mills are of this description, there are to be seen here and there, on large plantations, and in mills to which no plantations are attached, machinery of a more complicated and expensive character. In these cases, steam or hydraulic power is not infrequently used. In Spain the crushing is sometimes performed by conical iron rollers moved round on an oil-proof floor, on two little margins to prevent the stone being crushed.

There are also to be seen, but very rarely, steam mills; but the crushing is generally done by the Spaniards in the old traditional stone mills. As they generally keep their Olives till in a state of putrefaction before crushing them, aiming more at quantity than quality, the inferior appliances, being less costly, answer their purpose better.

Of late years, however, a new light seems to be dawning upon them. They are awaking to the higher profit to be obtained from manufacturing a superior article; and a few more enlightened among the growers,

finding the injurious effect of fermentation upon the market quality of the article, extract at an earlier stage, and use the more rapid and effectual means of the hydraulic press.

Oil milling in Spain is a distinct industry, as is also sometimes the case in other European Olive countries; but there also are mills on many of the plantations. The oil is, however, often kept for years in their big earthen jars, awaiting a good market.

Screw presses of simple construction are generally used; but the pressure is sometimes obtained by means of lever, or, more rarely still, hydraulic power.

The whole process is so admirably described by Mr. Davenport, that I have taken the liberty of reducing his plan, and reproducing it in these pages for the benefit of Queensland colonists. To the valuable information thus afforded, the same gentleman has been good enough to add plan and description of the receiver which he uses himself. (*See Illustrations E, F, and K.*)

The neat finish of the building in Mr. Davenport's plan, is, of course, not essential; and the beginner would do well to content himself with a much ruder edifice. Slabs, with a bark roof, would, if weather-proof, answer every purpose at first; and a more permanent building could be thereafter erected out of the profits of the plantation.

In the full-page *Illustration Q*, I give the whole interior of chamber devoted to the extraction of the oil still remaining in the marc, after the first and purest has been run off; but such an establishment is as little necessary for the beginner or for the Olive farmer on a small scale, as a sugar plant of the value of five thousand pounds would be to the cultivator of ten acres of cane.

The gigantic stone jars shewn (*see Illustration J.*) are capable of holding 1,200 gallons each. They are called Tinajas, in Malaga, are about six feet in diameter, and nine feet deep. The surface is approached by two earth steps from the door. There is a double row of eight in each, said to be within an inch of each other

under ground. The intervals are filled with sand or earth—experiments with stone having failed, the unequal pressure resulting in breakage of some of these costly jars.

The mill, shewn in *Illustration G*, was from one in use on a farm at Almunecar; and, in the intervals between the Olive seasons, was employed for grinding white Indian corn into flour.

The presses are extremely simple (*see Illustrations F.H*). They are easily made, and strongly put together of seasoned timber, are not liable to disrepair. Presses of a more elaborate character (as shewn in *Illustrations NN, figures* 1 *and* 2) are sometimes, but rarely used. The construction of these is explained fully in the Index to Illustrations. The small illustration I, shews the form of implement used in Spain for skimming off the oil and pouring it into the jars or reservoirs.

The only appliance left to be described before proceeding to the details of the manufacture, is the kind of bag used for enclosing the crushed Olives before putting into the press. These are made of coarse linen, horsehair, open felt, rushes, or grass; and, when filled, are laid one over the other in the press, to the number sometimes of a dozen.

But, while we quietly permit ourselves to smile, with a good deal of self-complacence, at the dull and easy-going peasant of Southern Europe, who receives with veneration the traditionary methods of growing and manufacturing the Olive, and will neither look for, or expect to find, defects in a system which was "good "enough for his father,"—are we quite sure that, without being aware of it, we are not ourselves perpetrating mistakes in our agricultural and horticultural operations? Do we, whether masters or men, amateurs or experts, enquire for ourselves into the rationale of various operations and methods; or is it not rather the rule to accept what we have been taught, or what we have read, without much thought, or any further care than that it

appears to answer the purpose? I strongly advise all who gain their living by tilling the soil, as well as the agricultural student, to take nothing for granted; but, should the meaning of what he is doing or reading not be apparent, not to rest until it is clear to him as the sun at noon day. This course will not only make the work, whether manual or mental, much more easy; but the enquiring mind will often find rays of light at unexpected times, and in unlooked for places, which will dissipate as fallacies, old received practices or opinions. Our marvel at the Italian peasant, with his traditionary blunders, ceases when we observe the wonderful manner in which writers, many of them authorities, will copy from each other and perpetuate errors; and it is only upon laborious comparison of the dicta of various authors that the student will discover the prudence, while accepting their general guidance, of testing everything he learns by his own reason, or by experiment.

CHAPTER IX.

MANUFACTURE.

In the extraction of the oil, there are two distinct processes, viz. :—(1) Crushing, and (2) Pressing.

In the first process, the fruit is by some completely crushed; and by others the pericarp only is first crushed, and when the oil from that part of the fruit has been separately expressed, the more complete crushing is applied for obtaining the remainder of the oil. This difference of system arises from the fact that opinions differ as to the quality of the oil from the several parts of the fruit. By some it is held that the most delicate oil is contained in the pericarp, and that an admixture of that from the kernel has a tendency to render the whole rancid. On the other hand, there is reason to suppose that much of the finest oil that comes to market is manufactured without any such distinction being recognised.

There is no doubt that much of the delicacy of flavor which characterises the oils of highest repute is due to the pressing and storing, rather than to the crushing; while it is also influenced to no slight extent by the variety of the Olive and the degree of maturity and the condition of the fruit when crushed.

The time for gathering the fruit, as has been said elsewhere, is the *eve* of maturity. It is overripe for the finer quality of oil, if allowed to fall. This condition being complied with, much still depends upon the length of time allowed to elapse between the gathering and crushing, and the treatment to which the fruit is subjected in the interval. There is no doubt that fermentation in the fruit should be carefully watched, as anything like excess impairs the quality of the oil produced.

On the other hand, no amount of fermentation affects the quantity of oil; and where this is the main object of the maker, the Olives are often allowed to ferment in heaps for months, till it is convenient to crush them, when they have to be dug out of the bins to put through the mill.

But a *slight* degree of fermentation, if unaccompanied by any material heating, does not appear to affect injuriously the quality of the oil, while it facilitates the separation of the oil from the mucilage. The extent to which, however, fermentation is allowed to proceed should be jealously regulated, as there is no doubt that beyond a certain point, the oil unquestionably suffers in quality, and becomes unfit, for the more delicate uses of food and cookery, to which Olive oil, when good, is put.

By far the safer plan for the beginner in the industry will be to gather his Olives at the right time, and to crush them as soon as he has enough together. In the meanwhile, they should be stored on shelves in moderate layers; the most complete arrangement being one which will admit of a free current of air above and below the layers.

The fruit is first reduced to a pulp, either with or without crushing the stones, according to the views of the miller as to the effect which this has upon the quality of the first droppings from the press, which are always regarded as the best. The crushing process should be conducted by a slow and regular movement, without jerking, in order that all the oil cellules shall be broken, and the press not be called upon to do any of the work which is supposed to have been previously done by the mill. The pulp or paste is then shovelled into the bags before described, which are placed one on the other to a convenient depth in the press. In this process, as in that of the crushing, the power should be applied steadily, slowly, and regularly, to afford time for the oil, as it exudes, to escape from the press through the proper channels. Pliny recommends that the pres-

sing be conducted under a warm temperature, and with as little exposure to the air as possible; and the obvious advantages of these recommendations have led to their universal adoption to the present day by all oil-makers, except the clumsy and prejudiced who follow no examples but their own.

What is generally known as "virgin" oil is that obtained by the first pressing before the application of water or heat to the pulp. This is run into water, where it is allowed time to deposit its mucilage, and, after being skimmed off, is kept separate for the finer use or for the more exacting market. In the district of Montpellier, however, the term is applied to the oil which spontaneously separates from the paste of crushed Olives. This oil is not met with in commerce, the quantity being obviously too small; and appears to be used in watchmaking and for similar purposes requiring extreme purity of quality.

When of good quality, and especially when fresh, Olive oil is of a pale greenish color, with a sweetish nutty flavor much esteemed by those who use it. Inferior oil is of a darker color, being a yellowish or brownish green; and even, when not sufficiently inferior to be rancid and unmarketable for food purposes, is quite wanting in the peculiar flavor referred to. This fruity flavor depends much upon the quality and condition of the Olives when pressed; while by some it is held to be affected also by the variety.

The large and increasing demand for the best qualities, and the consequent high price, leads to adulteration with Poppy, Sesame, Rape, and Cocoanut Oils. Such adulterations may, however, be easily detected by the fact of these oils not congealing at the same temperature as Olive oil, which when pure may be completely solidified by freezing. The adulterating oils also retain air, when shaken up, more readily than pure Olive oil. There are other tests of a more exact character used by chemists, which, however, need not here be enlarged upon.

The finest kinds of oils have hitherto come from Provence, Florence, Lucca, and Aix; the commoner from the Levant, Mogador, Spain, Portugal, and Sicily. It is, however, significant that where the oil has a high reputation, strict investigation will, in the majority of cases, elicit the fact that in those localities the cultivation and manufacture are conducted with unusual care and intelligence. Nor does it appear that the costliness of the appliances has much, if anything, to do with the quality of the produce; for (coming very much nearer home than Europe), I find from information obligingly afforded me by the Hon. Fred. P. Barlee, Colonial Secretary of Western Australia, that in that colony excellent oil is made, principally by Spanish monks, who adopt precisely the same course of treatment as is described by Dr. Wm. Thomson, in "The "Land and the Book," as in vogue for ages among the Arabs. Anything more primitive than these appliances (which are shewn in *Illustration M*) cannot be conceived; and yet Mr. Barlee assures me that they have "answered admirably" with them, and "have produced as fine an oil as could be desired."

To revert to the subject of "manufacture" to which this chapter is devoted—So soon as all exudation of oil from the first pressing ceases, the screw is reversed, and the bags removed and emptied. The pressed pulp being put carefully aside, and the bags refilled, pressure is again applied, and the process repeated until the whole crushing has gone through the mill.

The Marc, which has thus been once pressed, is then thoroughly separated, and stirred up with boiling water, and the process of pressing renewed; this time the pressure being increased, though still gradual and steady. This second oil is nearly as good as the first, but apt to become rancid in time. The principal of the oil after this second process, is skimmed off the water in the receivers; but entire separation takes a long time, and, when it is complete, the process is reversed by the water being drawn off from below.

Once more is the Marc subjected to treatment with boiling water; and it is at this stage that, when the stones were not crushed in the first milling, that process is now gone through, and the last of the oil obtained. This pressing is, however, regarded as of inferior quality, and is kept carefully separate from the results of numbers one and two.

The water which has been used in the several processes, and which still contains an admixture of oil, is conducted into large reservoirs, generally constructed underground; and are called by the French, "Enfer," a word, which if literally translated, would grate somewhat upon English sensibilities. Here it is left for a considerable period, during which the mucilage, water, and oil thoroughly separate—the former falling to the bottom, while the latter rises to the top, whence it is ultimately skimmed off, and applied to local uses of an inferior character—such as burning in lamps. This oil, taking its name from the French designation of the reservoirs used in its extraction, has the specific designation of "oil of the infernal regions."

The process of the second extraction by the aid of heat is in large mills sometimes effected by an elaborate arrangement for the thorough separation of the pulp, and freeing of the oil. This will be better understood by reference to full page *Illustration Q*, with its accompanying key.

There are yet processes for still further extraction of oil to the last fraction, which it is unnecessary here to describe. These may be compared to the finer processes for extraction of gold from quartz, which in the early days of the industry were not adopted; and indeed are still unpractised except in some of the older mines where large capital is employed. My object is to encourage the establishment of oil-making as a new industry; and to shew that some of the processes are simple yet perfectly efficacious, and require so little capital, that the application of so large a word would be out of place. There are few industries which may not

be made more profitable and easy by the improvement of appliances, and the substitution of steam or other power for manual labor; but, if I have shewn that, by the labor of the hands alone, this industry can on a moderate scale be successfully and profitably conducted, the rest will follow in the ordinary course, and the improved appliances will be the result of experience, and may be paid for out of profits.

After manufacture the oil is finally deposited in stone jars or in tanks to facilitate the deposit of impurities which are still held in suspension. Air and light are both excluded, as they would tend to decomposition and rancidity. In a few months the clear oil is racked off into fresh jars for stock, or into other packages for the market; while the inferior is sold for soap-making, lighting, lubricating, or other such purposes.

The ultimate quality of the oil depends much on the nature of the places selected for its storage. Gallipoli, which is one of the greatest oil depôts of the world, owes this advantage to the fact that it is built on rock of such quality as to furnish, at the labor only of excavation, admirable chambers for the reception of oil, which there clarifies sooner and keeps sweet longer than in any other place. The oil which in its turbid state arrives at these depôts black and utterly unfit for market, in time becomes bright and yellow without any help from man. Great care is taken to keep the several qualities or stages distinct. (*See Chapter X.*)

CHAPTER X.

PURIFICATION.

The oil in its crude state contains impurities of various kinds, albuminous, mucilaginous, and other; and to render it clear and fit for its various uses, and consequently marketable, various methods are used. Simple settlement appears to be the process, if it can be so called, most in vogue; but hot air or steam, and infusion of nut galls are resorted to as purifying mediums.

The Arabs produce excellent oil, knowing no other means of clarifying than by settlement in cisterns or jars.

McCulloch gives the following interesting account of the clarifying process, referred to in the last chapter, at Gallipoli :—

"Gallipoli supplies England, Holland, the north of "Europe, and, in short, all those countries that require "the most perfectly purified oil. It is clarified to the "highest degree, by merely keeping it in cisterns "hollowed out of the rock on which the town is built. "The voyages it has to perform being long, it is put into "casks so well constructed, that it frequently arrives at "Petersburg in the heat of summer without the least "waste or leakage, an advantage attributed to the "seasoning of the staves, which, before they are put "together, are well soaked in sea water.

"We borrow the following details with respect to "the preparation of oil at Gallipoli from a very interesting paper by an English gentleman who had resided "in the town.

"The rock on which the town is built is easily "excavated; and in caverns thus constructed oil clarifies "sooner, and keeps without rancidity much longer than

" in any other place. Hence numerous oil houses are " established at Gallipoli, and a very considerable portion " of the rock is cut into cisterns. A Gallipolitan oil " warehouse generally occupies the ground floor of a " dwelling-house, and has a low arched roof. Some are " more extensive, but on an average they are about " thirty feet square. In the stone floor you see four, six, " or more holes, which are circular, about two feet in " diameter, and like the mouths of wells. Each of these " holes gives access to a separate cistern beneath your " feet; and when the oil is poured into them, care is " taken not to mix different qualities, or oils at different " stages, in the same reservoir. One cistern is set apart " for *oglio mosto*, or oil that is not clarified, another for " pure oil of the season, another for old oil, &c. I have " seen oil that had thus been preserved for seven years in " a perfect state. I, also, many times verified the fact " that the *mosto*, or oil in its turbid state, which arrived " almost as black and thick as pitch, soon became bright " and yellow in these excellent reservoirs, without any " help from man.

" All the oil, whatever may be its quality, is brought " to the magazine in sheep or goat skins, which are " generally carried on mules—there being but few " '*strade rotabili*,' or roads fit for wheeled carriages, in " these parts. In a good year, and at the proper season, " I have counted, in the course of an afternoon's ride, " as many as 100 mules returning from Gallipoli, where " they had been to deposit their unctuous burdens, to " different towns and villages in the Serra D'Otranto, or " the more distant province of Bari. The quantity of " oil required may be conceived, when I state that at " one time (in the year 1810), I saw nine English, three " American, two French, and six Genoese vessels (not to " mention some small craft from the Adriatic), all " waiting in the Port of Gallipoli, for entire or partial " cargoes of it."

Of the more elaborate processes, the following are taken from Ure, viz.:—

" Thénard's process consists in adding gradually " one or two per cent. of sulphuric acid to the oil, pre- " viously heated to 100°, and well mixing them by " constant agitation. To effect this, the process may be " carried on in a barrel fixed on an axis and kept " revolving, or in a barrel which is itself immovable, " but having fixed in its axis a movable fan. After the " action of the acid is complete, which is known by the " oil, after twenty-four hours' rest, appearing as a clear " liquid, holding flocculent matter in suspension, there " is added to it a quantity of water, heated to 140°, " equal to about two-thirds of the oil; this mixture is " well agitated, until it acquires a milky appearance. " It is then allowed to settle, when, after a few days, " the clarified oil will rise to the surface, while the " flocculent matter will have fallen to the bottom of the " acid liquid. The oil may then be drawn off, but " requires to be filtered to make it perfectly clear. The " filtration is always a difficult matter, and is conducted " in various ways. It is sometimes placed in tubs, in " the bottom of which are conical holes filled with " cotton, but the holes become speedily choked with " solid matters; another and more speedy process is by " the means of a displacing funnel, the apertures in the " diaphragm being stopped with cotton.

" Several patents have been taken out for the " purification of oils. Some passing hot air through " the oil, while at the same time exposed to the action " of light; others passing steam through the oil.

" Cogan's process is a combination of the latter " with Thénard's. He operates upon about 100 gallons " of oil, and for this quantity he uses about ten pounds " of sulphuric acid, which he dilutes previously with an " equal bulk of water. This acid mixture is added to " the oil, placed in a suitable vessel, in three parts, the " oil being well stirred for about an hour between each " addition. It is then stirred for two or three hours, in " order to insure a perfect mixture, and thus let every " particle of the oil be acted on by the acid. It then

" has assumed a very dark color. After being allowed " to stand for twelve hours, it is transferred to a copper " boiler, in the bottom of which are holes, through " which steam is admitted, and passing in a finely " divided state through the oil, raises it to the tempe- " rature of 212°. This steam process is carried on for " six or seven hours; the oil is then transferred to a " cooler, having the shape of an inverted cone, termi- " nating in a short pipe, provided with a stop-cock " inserted in its side, a little distance from the bottom. " After being allowed to stand till the liquids are " separated, which generally takes about twelve hours, " the acid liquor is drawn off through the pipe at the " bottom, and the clear oil by the stop-cock in the side " of the cooler: all below this tap is generally turbid, " and is clarified by subsidence, or mixed with the next " portion of oil."

Refining is also effected by agitating with a saturated solution of caustic soda. After a time a saponaceous deposit is precipitated, and the remainder becomes quite clear and pure.

But while explaining a few of the more elaborate methods used for refining Olive oil, I invite those of my readers who contemplate the cultivation of the Olive in Queensland, to be content with keeping in view for their first manufacture, purification by simple settlement; because, however effectual any of these other processes may be, this method is found sufficient for a vast quantity of the best Olive oil produced in the world.

CHAPTER XI.

YIELD AND VALUE.

DECANDOLLE states the quantity of oil produced by the Olive at fifty per cent. of the gross weight: Sieuve tells us that 100 lbs. Olives yield 32 lbs. of oil, viz. :—21 from the pericarp, 4 from the kernel, and 7 from the shell, while others state it at 25 per cent.; and while from an inferior variety the yield is set down as low as 10 per cent.

Calculating the yield per tree, it is extremely difficult to give an average. In the case of the Olive as with many other vegetable products, no rule can be laid down. Its productiveness is governed by variety, climate, soil, culture, and age.

The quantity of the crop is also liable to be affected by extremes of wet or drought, lateness of season, hail-storms, gales of wind, and seasons unusually rife with destructive insects. As in the case, therefore, of many other crops, it is more safe to base your calculations, whether of maximum or minimum, upon an average of years; but after allowing for all possible drawbacks, in Olive countries, the tree is considered to be one of the most profitable crops known to agriculture.

In most of the statements given I find some point of weakness which destroys their value as a guide. Where the average per acre is given, the age of the plantation is omitted; while from the produce of single trees in exceptional circumstances little can be learned. The lowest average that I find is 1 gallon per tree; while on other estates the average is given at from $1\frac{1}{4}$ to 2 gallons per tree. The yield of individual trees is given at from 12 to 20 gallons; while one tree of renown is stated to have yielded as much as 55 gallons, and another three hundredweight of oil.

Taking the lowest average, viz., one gallon to the tree, and sixty trees to the acre, the produce at *8s. a gallon, the Brisbane market value of the imported article would be £24 per acre in the early years of bearing; while the value of the Olive when cultivated increases as a matter of certainty with each additional year of age until maturity. But, in the face of this indisputable fact, and the knowledge that a plantation of Olives is a permanent, safe, and improving investment of a most enduring character, we can well afford to be patient for our first returns, especially as the land is not occupied by the trees to the absolute exclusion of other crops. Taking the produce in the early years of bearing at one-fourth of that named, with the knowledge of what to expect as year by year the trees grow older, and with the use of nearly all the land on which they stand for other crops, we can still well afford to wait.

The Olive already in Adelaide, like the cotton with us, affords employment to the children in the picking. For this they are paid 4d. a bucket, or by some 2s. a cwt., and can earn at this light labor, so suited to their strength, as much as 2s. a day without difficulty.

I do not desire to import into the calculations of profit the residuum of oil-cake as an important item; but this, of course, also has it value. In Australia we have not been in the habit of stall-feeding cattle; but it is by no means certain that, as population becomes more dense, and our grazing grounds more remote from the cities, it may not yet enter into our agricultural system. But apart from a somewhat wide question like this, there is at least our old friend the pig quite prepared to convert the Olive oil-cake into bacon, hams, and lard.

* The market price in Adelaide, of the local product, is 12s. per gallon.

CHAPTER XII.

TECHNOLOGICAL TEACHING.

THERE is one subject which, though not strictly belonging to my text, I must, before concluding, take the opportunity of adverting to. I refer to the value of technological teaching, and the importance of the establishment of technological schools—especially in connection with agriculture. Much of the future wealth of Queensland depends upon the proper development of the resources of the soil's surface on her long coast. Hitherto the proportion of good to bad farming has been as the grain of wheat to the bushel of chaff; while much of the success which has been attained has resulted from the combined favorable influences of good soil and fine climate. This will be better understood by those who have watched the career of a shipload of immigrants. Of those who take to farming, a comparatively small number have had any previous practical experience. The majority have been mechanics, collectors, weavers, drovers, merchants' clerks, tradesmen, &c., &c., but know little more of farming than to distinguish between a plough and a harrow when they see them. As they happen to have more or less of money, they commence on their own account, or as farm laborers. Up to this point there is of course nothing to object to; as there is no occupation to which they could take, more likely to benefit the colony, or, in the long run, to lead more rapidly to their own independence. But, instead of benefiting by the experience of others, they—mistaking the influences of climate and virgin soil for their own skill—imagine, before they have been here six months, that they are heaven-born agriculturists, and begin to patronise the older settler by advancing in the columns of the Press, for his

benefit, doctrines of the most startling and perplexing kind. One of the most remarkable instances of this was to be seen in some articles "communicated" to the columns of an influential journal by one of these new lights, in which he solemnly endeavored to prove that trenching and draining were both mistakes. Of course, eventually these persons have to buy their experience, and in due course, through more or less of loss and waste of time, become good farmers, and win their way to independence.

But it is not for the immigrant that I am anxious to provide instruction; but for the hundreds of native-born lads who are destined for the farm. The most thorough way of teaching agriculture would be by the establishment of model farms, which, if well and economically conducted, would soon repay by their results the cost to the State of their establishment. To teach the people practically anything which will add to their comfort, and increase their prosperity, is one of the most profitable investments in which to apply the revenues of a State. The direct return is good, while the indirect is incalculable.

I fear, however, that such a project, in its more extended form, would create alarm among the economists, who, not seeing the great advantages to arise therefrom, would see very clearly another Government department, with its expensive machinery, looming near, and would not listen to the proposal. I would therefore, as a tentative measure, upon the success of which the larger project might be left to depend, suggest that our public schools in the agricultural districts should include the first principles of farming and their practical application as a part of the course of instruction. One of the great difficulties in the way of education in these districts is to be found in the fact that so soon as a boy is old enough to wield a hoe or drive a horse he is taken from school. Nor is this to be wondered at, with the twofold inducement to the father to remove him offered by the intrinsic value of his services, and the fact that the edu-

cation he is getting begins and ends with books, and gives no promise of helping to bring grist to the paternal mill by the superior knowledge which he is attaining. If, on the other hand, the boy comes home from time to time with some fresh piece of knowledge which enables him to teach his father something which he did not know before as to the habits and uses of plants, their assimilation of their food from the soil, the principles and practice of drainage, the rationale and the various methods of pruning, the diseases of cattle and their treatment, and the hundred other items of knowledge of direct practical utility to him in his calling—he would see it to be to his direct advantage to leave the lad at school until both mind and body were better matured for going to work.

It does not require demonstrating that the additional knowledge which boys so taught would bring to bear upon agriculture would repay to the state the cost of teaching; but, though much might be said upon this point, the occasion is not altogether suitable for its treatment more fully.

As a valuable adjunct to such a system, and one involving no great outlay, our public museum should contain models of all the best known labor-saving implements—of the machinery and appliances used in other countries in the preparation for the market of various vegetable products forming staple commodities. I would instance, among those which could be grown in our midst—the Castor Bean, the Olive, Indigo, Coffee, Jute, Hemp, and Rhea plants. The great stumbling-block in the way of commencing these industries is not to demonstrate that the plant will grow to perfection; but, when you have produced your fruit, stem, leaf, or root, as the case may be, to know how to set to work to produce the staple commodity in a marketable form economically and with certainty, without wasting time, patience, and money in blundering, through a host of trials, into the right sort of appliances.

A few thousand pounds annually of additional expenditure in the two directions I have indicated would probably, in the course of a few years, return millions to the colony; while the complete development of the fact, now in the infancy of its demonstration, would be proportionately hastened—that Queensland is destined to take rank among the greatest and the wealthiest of England's colonies.

APPENDICES.

APPENDIX I. (See p. 25.)

Extract from Letter from Mr. Sheriff Boothby, of South Australia.

Sheriff's Office, Adelaide,
26th December, 1871.

Dear Sir,

I am glad to learn that the Acclimatization Society is taking an interest in Olive planting, and that you are about sending to Europe for the best varieties. I venture to suggest, as the best mode of raising trees, the planting of seedling stocks and grafting the year after, about one inch under the ground (cleft grafting) with approved scions. In this way you get a perfectly formed tree, and one more likely to ensure success. I have paid for experience. The bark of an Olive is too thin to succeed well with budding or grafting above ground. The varieties we have planted came many years ago from the neighbourhood of Marseilles, and were imported by the South Australian Company.

I have not any seedling plants, but Captain Simpson, of Glen Osmond, has the oldest plantation here, and has generally a good number springing up, without any care, underneath the old trees. I used these—planted them out, when about three inches high, in the place where they were to stand, in trenched ground. Then, next year, grafted them with scions as above, from the Marseilles varieties, selecting those that appeared to thrive best in this climate. The "Verdale" I think the best on the whole, and is thought also to be the best by Mr. Davenport, a gentleman who takes much interest also in the Olive, and has a plantation. Sir John Morphet has the Spanish; these succeed very well, and produce a larger berry than the French kinds. I have some of these also, but cannot move them.

We commenced planting about ten years ago, and have now a large number of trees growing, and coming, most of them, into bearing.

I have sent to Paris for several French works on the Olive and oil making. Mr. Davenport, when he was last in Europe, took Busby's book with him, and went over the same ground and visited the Olive yards and manufactories in the south of France, bringing back much useful information.

I shall be glad to aid, in any way that I can, and shall feel obliged by an occasional exchange of information on this subject.

Believe me to be, dear Sir,
Yours very truly,
W. R. BOOTHBY.

Lewis A. Bernays, Esq., F.L.S.,
Vice-President, &c., &c., &c.

APPENDIX II.

Brisbane, 17th May, 1872.

Dear Sir,

In reply to your letter of 27th April, I am very happy to describe the method of cultivating the Olive tree in Italy, as I believe it would also suit this climate.

There are many varieties of the Olive, but all require the same cultivation. The soil should be dry and stony and on a slope, and, if possible, should contain lime. The exposure should be favorable for receiving the sun in winter, especially in severe climates; but where there are no frosty winds, the Olive can be planted in any aspect.

There should be no other cultivation in a plantation of Olives; except occasionally, in order to remove the grass and loosen the soil, a green crop such as lupins or beans is sown, for the purpose of being ploughed in as manure.

The Olive tree should be planted in holes five feet every way, and thirty feet from tree to tree, which are planted *quincunx* fashion, thus:—

. . . . . so as to admit of the most perfect admission of sun and air.

. . . . . At least twice a-year, the land should be worked with the hoe for three feet around the tree, which process should every second year be preceded by a manuring. By thus applying the manure, it is covered from the sun, and the moisture can penetrate to the roots of the tree.

. . . . .

. . . . .

Every third year, the Olive tree must be pruned by an expert person, so that the plant may not be injured—only dry barren branches should be cut away. The art of pruning the Olive tree is difficult; and therefore more easily taught by practice than theoretically.

Cuttings from any part of the Olive tree will grow and become trees. However, we first form a nursery of plants, either from fruit sown in well-cultivated soil, or by taking off the *uovoli* from the superficial roots of other trees. These latter when replanted more rapidly become trees; but to extract the *uovoli* when we work the ground around the tree, requires the practised hand of an intelligent person, in order that the tree, which should be at least *ten* years old, may not be injured.

The trees should be trained to one stem to the height of at least seven to ten feet, before allowing it to make branches; because the fruit must not be exposed to the reverberated heat of the earth by the rays of the sun, or to the *miasmata* of the soil. In the first case, the fruit would ripen too rapidly; and, in the second, would get spoiled before maturity. By this system, the tree becomes strong, and able to resist the wind, while it also fruits with more vigor. On the other hand, by allowing suckers and low branches to grow unrestrained, the plant becomes enervated, and the sap produces only wood and leaves.

Generally speaking, the Olive tree produces *abundantly* only in alternate years; and the fruit must be gathered (by hand) by ascending the tree, or by beating the tree with rods without breaking any young branches which would produce fruit the next year. A practised person should be present at the harvesting of the fruit, in order to see that the trees are not damaged. The fruit must be carried to a store, and kept for a few days before extracting the oil, that it may be purified from aqueous moisture, and its maturity be completed by natural fermentation; but strong and prolonged chemical fermentation must be avoided, because it imparts to the oil a bad flavor. The Olives are afterwards ground, and pressed for the extraction of the oil, which

can be taken off *without water*, with *fresh water*, and with *hot water*, according to the quality of oil desired; but of this matter I shall speak another time, if necessary.

To manure the Olive in those soils which are deficient in lime, sulphur, and soda, a strong animal manure must be used; and the best of all manures are those of sheep, pigeons, or poultry, or soot and ashes, mixed with horse-dung; or refuse fat, or scraps of leather in urine, mixed with stockyard manure. To mature this manure, a tank should be sunk, cemented so as to hold urine and water, into which should be put all the substances above-mentioned, and let all ferment together. Every two or three months, the fermentation could be increased by turning over the contents. When it is a year old, apply it to the trees, turning it quickly underground with the hoe, so that the moisture can penetrate to the roots of the tree, and evaporation be prevented.

The short space of a letter does not admit of full explanations; but I hope I have made myself sufficiently understood, always begging you to remember that my acquaintance with your language is imperfect. My services are always at the disposal of your Society; and I can inform you, that next month I am expecting from Italy several kinds of Olive trees, and fruits and vines of different species, which I intend testing on land of my own.

* * * * * * * * *
* * * * * * * *

Yours respectfully,
EUGENIO RICCI.

Lewis A. Bernays, Esquire.

APPENDIX III. (See page 25.)

Extract from letter from the Hon. Samuel Davenport, dated Adelaide, 23rd May, 1872.

The seedlings now sent will be readily budded or grafted underground. After having grown two years with you, or even three, and from a strong stock, which, by that time, should have formed, you would in two years more have a well-shaped tree. The truncheons sent you in September next, should have sprouted within nine or ten months after being bedded, and over the next year the growth is rapid, till (as with me) a two or three year old truncheon shoot becomes a tree four to six feet high, with an inch or two inch diameter stem, according to kind, and can readily give grafts and buds for a large amount of seedlings.

I here graft seedlings of five or six years old with easy success, only this is not so good as grafting on two or three year old plants, if for no other cause than that the volume of sap in the larger older plant is too excessive for a graft, and consequently you are subsequently troubled with having to rub off numerous bark shoots and root suckers pushed out by the old tree.

The grafting I find best is underground, to be heaped up after binding air and water tight with unbleached calico strip, drawn through mixed mutton fat and beeswax and then cooled, so that two eyes of the graft only remain above the ground.

With us the dry heat of direct sun's rays will peel off the bark of the old plant below the graft if exposed above ground, and only the graft, if any, on the shady side will survive. The style of grafting is crown. The graft is cut slantingly from beneath a bud, and so as not to leave any ragged or torn

edge, and then at once inserted in a slit of the bark of the old wood, one lip of the slit coming to the side of graft, the other on its bark, so that it will all bind over closely without vacuum in the connecting points of the sap vessels of the two woods.

For grafts I have used two-year-old wood, and worked towards the end of July, which seems to suit in our climate.

APPENDIX IV. (See page 38.)

Extract from Dr. Thomson's "The Land and The Book."

Labor of the Olive.

This tree requires but little labor or care of any kind, and, if long neglected, will revive again when the ground is dug or ploughed, and begin afresh to yield as before. Vineyards forsaken die out almost immediately; and mulberry orchards neglected run rapidly to ruin; but not so the Olive. I saw the desolate hills of Jebel-el-Alâh, above Antioch, covered with these groves, although no one had paid attention to them for half a century. If the Olive bore every year, its value would be incalculable; but, like most other trees, it yields only every other year. Even with this deduction, it is the most valuable species of property in the country. Large trees, in a good season, will yield from ten to fifteen gallons of oil, and an acre of them gives a crop worth at least one hundred dollars. No wonder it is so highly prized.

Its Usefulness.

The value of this tree is enhanced by the fact that its fruit is indispensable for the comfort, and even existence of the mass of the community. The Biblical references to this matter are not at all exaggerated. The berry, pickled, forms the general relish to the farmers' dry bread. He goes forth to his work in the field at early dawn, or sets out on a journey, with no other provision than Olives wrapped up in a quantity of his *paper-like* loaves; and with this he is contented. Then almost every kind of dish is cooked in oil, and without it the good wife is utterly confounded; and when the oil fails, the lamp in the dwelling of the poor expires. Moreover, the entire supply of soap in this country is from the produce of the Olive. Habakkuk, therefore, gives a very striking attestation of his faith in God when he says, "Although "the labor of the Olive should fail, yet I will rejoice in the Lord, I will joy in "the God of my salvation."

Gathering of the Olive.

Isaiah refers to the *gathering* of the Olive thus: "Yet gleaning grapes "shall be in it, as the shaking of an Olive tree; two or three berries in the "top of the uppermost boughs, four or five in the outermost fruitful branches "thereof." Have you noticed the circumstances alluded to by the prophet? Very often; and it is the language of familiar acquaintance with the subject. As you may never have an opportunity to watch the process, I will describe it as it occurs in such places as Hasbeiya, where I have studied it to best advantage. Early in autumn the berries begin to drop of themselves, or are shaken off by the wind. They are allowed to remain under the trees for some time, guarded by the watchman of the town—a very familiar Biblical character. Then a proclamation is made by the Governor that all who have trees go out and pick what is fallen. Previous to this, not even the owners

are allowed to gather Olives in the groves. This proclamation is repeated once or twice, according to the season. In November comes the general and final summons, which sends forth all Hasbeiya. No Olives are now safe unless the owner looks after them, for the watchmen are removed, and the orchards are alive with men, women, and children. It is a merry time, and the laugh and song echo far and wide.

Shaking of the Olive.

Everywhere the people are in the trees, "shaking" them with all their might, to bring down the fruit. This is what the prophet had in mind. The effort is to make a clear sweep of all the crop; but, in spite of shaking and beating there is always a gleaning left—"two or three berries in the top of "the uppermost boughs, four or five in the outermost fruitful branches." These are afterwards gleaned up by the very poor, who have no trees of their own; and by industry they gather enough to keep a lamp in their habitation during the dismal nights of winter, and to cook their mess of pottage and bitter herbs. I have often seen these miserable outcasts gleaning among the groves, and shivering in winter's biting cold. In fact, the "shaking of the Olive" is the severest operation in Syrian husbandry, particularly in such mountainous regions as Hasbeiya. When the proclamation goes forth to "shake," there can be no postponement. The rainy season has already set in, the trees are dripping with the last shower, or bowing under a load of moist snow; but shake, shake you must, drenching yourself and those below in an artificial storm of rain, snow, and Olives. No matter how piercing the wind, how biting the frost, this work must go on from early dawn to dark night; and then the weary laborer must carry on his aching back a heavy load of dripping berries, two or three miles up the mountain, to his home. To comprehend the necessity of all this, you must remember that the Olive groves are in common—not owned in common, but planted on the same general tract of land, and are without fences, walls, or hedges of any kind, mingled together like trees in a natural forest. This tree belongs to "Zeid," that to "Abeid," as they say, and so on through the whole plantation. Such at least, is the case with the groves we are describing. This vast orchard of Shwoifat, through which we have been riding for the last hour, has a thousand owners, and in "shaking time" every one must look sharply after his own, or he loses all. There is an utter confounding of the *meum* and *tuum* in the general conscience of Olive gatherers.

Olive Plants round the Table.

To what particular circumstance does David refer in the 128th Psalm, where he says, "Thy children shall be like Olive plants round about thy table"? Follow me into the grove and I will shew you what may have suggested the comparison. Here we have hit upon a beautiful illustration. This aged and decayed tree is surrounded, as you see, by several young and thrifty shoots, which spring from the root of the venerable parent. They seem to uphold, protect, and embrace it. We may even fancy that they now bear that load of fruit which would otherwise be demanded of the feeble parent. Thus do good and affectionate children gather round the table of the righteous. Each contributes something to the common wealth and welfare of the whole—a beautiful sight, with which may God refresh the eyes of every friend of mine.

APPENDIX V. (See page 34.)

1.—*Acre, of shape* 220 *feet long by* 198 *feet wide.*

Deducting dray road (12 feet wide), we have—

Area to be planted = 174 feet wide by 196 feet long,

which will admit of 10 rows, with 11 trees in each row, 16 feet apart,

„ „ 8 „ 9 „ „ 20 „

„ „ 5 „ 6 „ „ 30 „

„ „ 4 „ 4 „ „ 40 „

the fractional parts of the spaces being adjacent in each case to the dray road.

2.—*Acre, of shape* 264 *feet long by* 165 *feet wide.*

Deducting dray road (12 feet wide), we have—

Area to be planted = 141 feet wide by 240 feet long,

which will admit of 8 rows, with 14 trees in each row, 16 feet apart,

„ „ 6 „ 11 „ „ 20 „

„ „ 4 „ 7 „ „ 30 „

„ „ 3 „ 5 „ „ 40 „

the fractional parts of the spaces being adjacent in each case to the dray road.

3.—*Acre, of shape* 330 *feet long by* 132 *feet wide.*

Deducting dray road (12 feet wide), we have—

Area to be planted = 108 feet wide by 306 feet long,

which will admit of 6 rows, with 18 trees in each row, 16 feet apart,

„ „ 4 „ 14 „ „ 20 „

„ „ 3 „ 9 „ „ 30 „

„ „ 2 „ 7 „ „ 40 „

the fractional parts of the spaces being in each case adjacent to the dray road

Collecting the above results, we have the following table :—

Distance apart.	Acre, 220 x 198.	Acre, 264 x 165.	Acre, 330 x 132.
16 feet	110 trees required	112 trees required	108 trees required
20 „	72 „ „	66 „ „	56 „ „
30 „	30 „ „	28 „ „	27 „ „
40 „	16 „ „	15 „ „	14 „ „

We may form a second table by excluding all consideration of the fractional spaces adjacent to the dray road, and simply calculating how many times the area required for each tree is contained in the available areas of acres of each of the preceding forms. A table so calculated is as follows :—

Acre of form.	Available area in square feet.	Trees 16 feet apart.	Trees 20 feet apart.	Trees 30 feet apart.	Trees 40 feet apart.
feet feet		Trees required.	Trees required.	Trees required.	Trees required.
220 x 198 ...	34,104	133	85	38	21
264 x 165 ...	33,840	132	85	37	21
330 x 132 ...	33,048	129	83	37	21

INDEX TO ILLUSTRATIONS.

(The author is much indebted to Mr. Thomas McLeod, one of the masters of the Brisbane Grammar School, for the excellent manner in which the drawings were prepared for the stone.)

PLATE A.—The Olive.—A branch shewing the fruit and flowers.

PLATE B.—"Knaurs" or Embryo Buds. To illustrate the "Uovoli" of the Olive tree. (See page 29.)

PLATE C.—Labor-saving implements for keeping the surface of the soil open and clean.—Haynsworth's Garden Cultivator, an American patent.

PLATE D.—Hoe for keeping down the weeds between the rows of trees.

PLATE E.—Olive Mill and Building at Corfu, from sketch made on the spot in 1863. (Reproduced from a Paper on the cultivation of the Olive, read by the Hon. Samuel Davenport before the Chamber of Manufactures, Adelaide, South Australia, on 19th July, 1870.)

PLATE F.—Oil Press used in the above Mill. (See Illustration E.)

PLATE G.—Stone Oil-Mill, at Almunecar, Spain.

PLATE H.—Oil Press, at Almunecar, Spain.

PLATE I.—Tin Skimmer, used for skimming off the oil from the receiver, and pouring into the tinajas at Malaga.

PLATE J.—"Tinajas," or earthenware jars, used for storing oil at Malaga.

PLATE K.—"Florentine Receiver," used by the Hon. Samuel Davenport, of Adelaide, South Australia. The Receiver is built of slabs of slate cemented, in the absence of marble. Each chamber holds 40 gallons. The oil comes from tap *c* like new honey. The object of the second chamber is that tap *c* can be left to run all night; *a* and *b* are draining-off taps. The waste pipe is below the level of the receiver, as the receiver never overflows; out of this the fruit water (the waste of the press) flows, leaving the oil on the top of the fluid in the receiver Mr. Davenport is of opinion that much labor is saved by adopting this structure.

PLATE L.—One form of Mill used in Spain.

PLATE M.—Ancient Oil Mill and Presses. (From Dr. Thomson's "The Land and the Book.")

PLATE N.—Sieuvè's Method of extracting Olive Oil. From a work published in Padova, in 1819. The primary object of this method is to separate the pulp from the kernel of the Olives; these are then pressed by another separate process. Plate N represents the above machine; figure 1, as seen front and sideways; figure 2, in its perpendicular section.

AB and CD represent the brackets for the whole frame to rest upon.

EF, GH, IK, LM, the four uprights of the structure fastened together, with as many tie beams or cross pieces.

NO, the windlass intended to raise the crusher, when necessary.

N, a wooden wheel to which is attached a rope.

P, a pully through which the rope passes that holds the crusher in suspension.

Q, the end of the rope to which are fastened the four ends of the crusher.

RS, the crusher as placed in its frame;—this frame consists of a large piece of board with grooves cut on the lower side.

S, a wooden peg fixed in the crusher in order to give motion to the valve of the mill-hopper.

R, the catch-peg for withdrawing or setting the crusher in its case.

T, the mill-hopper into which the Olives are placed, and from whence they fall in small numbers at a time when the crusher is set in motion.

WV, the case at the bottom of which is a board grooved like that of the crusher.

X, a funnel terminating in a bag, into which the pulp of the fruit falls.

Z, a trough into which the oil falls, which the crushing had caused to ooze out from the cells in which it was contained (shut up).

When the bag is full of pulp it is taken away and another placed instead.

a, an axis (shelf board) of iron upon which the case is balanced.

bc, receiver through which the kernels are made to fall into the trough.

df, the trough for receiving the kernels.

Plate O.—The Oil Mill, as represented in Plate O, figure 1, consists of a good solid circular wall, generally from 24 to 30 inches in height and from 6 to 8 feet in diameter. This structure is then covered with hard well-polished stones (slabs) or thick planks of oak when stones are not procurable, and arranged in such manner that the edges are more raised than the centre, allowing a fall of about six inches—as, for example, from E to F; wherefore, the circle passing in C is lower and more depressed.

A millstone of the thickness of a foot (more or less), upon a diameter of five feet (more or less), is fastened to a beam, JK, which turns on a pivot, 1, in the centre of circle, in a hole bored into the beam, LL, by means of pole, CD, firmly secured in the mortise, D, of that pole, the axis upon which it has a rotatory motion.

It is only necessary to glance at the figure to understand the mechanism of this mill. A horse tied to the axle, C, turns the beam, and with it the millstone, which, turning on itself, naturally crushes by its weight everything that is put in its way. A man appointed to it, with a spade shoves as much

as possible all the stuff under the millstone, so that it should only be emptied slowly through the action of the millstone, and principally on the lower side, or in E.

It is of the utmost importance, in building a mill of the kind, to choose for the beds large hard stones well cemented together, and for the millstone one heavy and hard. Granite is the best kind of stone for the purpose, but it is often beyond the reach of many on account of the great expense of having it made or on account of its heavy freight. Next in quality are red marbles ; ordinary building stones, bricks and woods, are of no use, for they wear out too soon, and absorb, also, a considerable quantity of oil, which is not only lost, but, by its getting rancid, communicates to the oil made afterwards the leaven of rancidity that prevents it from keeping.

The whole surface of this structure, as well as the millstone and the basis of the beams, ought to be washed with warm water every time they are put in motion ; and if they have not been worked for some time, it is better, before using them, to rub them over, so as to take away any rancid oil that might have secreted itself within the crevices.

As we have said already, the proportions of the mill can vary accordingly ; but it is necessary, in all cases, that the shaft, CD, should be at the same height as the horse's chest, for if the beam should be too low the horse would be soon tired, and if too high the millstone would be lifted up too often, and answer imperfectly its office. On the whole, it is better to make the horse turn rather at a slow than at a quick pace : but too slow a walk has also its inconveniences, if we only take into consideration the loss of time. A few days' experience will teach more than a whole volume of good advice.

The mill represented in figure 2 is constructed on quite different principles. The part A is also a wall, but the higher portion of it, instead of being on the incline, is of the shape of a circular trough. In this trough, EF, which is of the depth of about six or eight inches, is the millstone, BB, to the axis of which are attached two little chains at the points LL, and behind which is tied a rake or "servant," H. This rake or servant, which is curved or bent like a semi-circle one way, and like the shape of the trough on the other, brings back towards the middle of the trough the husks that, through the movement of the millstone, might stick to the sides. It spares hand labor.

When animals are made to turn the mill, it is well to bandage their eyes to prevent giddiness.

Horses and mules are made to turn the mills, but oxen are preferred by some people on account of their steady pace.

It is not reasonable to work a horse for more than two hours at once ; six hours' work is enough for any horse, although it is nothing unusual to see them overworked.

It is, besides, so very easy to increase the velocity of the mill without tiring the horse. There might be a little more outlay at the beginning, but it will amply with time, as it will spare horseflesh. To obtain the result required, it is neces-

sary to erect a large beam; at the point K a round block with spindles is attached, and, at a distance of about six or eight feet, on a granite pedestal, another beam parallel to the first one. Opposite, and at a corresponding height, secured to this beam, is a large cog-wheel. The horse turns this last beam, and will, as a natural consequence, make the millstone turn quicker, for the larger the wheel and the smaller the other block opposite, the more evolutions will be performed by the smaller beam; so that if the block had only ten spindles, and the wheel a hundred cogs, the mill would perform ten evolutions while the horse goes round once. If the locality did not allow a distance of six or eight feet to be put between the wall and the beam turned by the horse, it could be remedied by putting him either above (in a higher story), or below in another compartment. (See figure 3, which design (vertical) shews this kind of mill.)

PLATE P.—If water power be at hand it would be wise to make use of it, as it spares horse flesh, and also because the work can go on without interruption. One can vary the construction of the wheel, as all depends on the force of the water power, and the height of its fall. In plate P, figure I, is represented one of these mills, supposed to be put into motion by a weak fall of water, but from a good height. Watercourse A puts in motion wheel B, which, by means of the axis CC, and the perpendicular and horizontal cogs DD and EE, turns beam FF, and consequently the millstone GG attached to the beam. The principles of construction in this mill differ in no way from the two former ones.

The cider mills in Britany and Normandy differ from the former ones, for pears and apples do not require the same amount of pressure as oil-giving seeds, as the nuts of the Olive. Figure 2, in plate P, gives an idea of it.

AA, circular trough. B, rake or servant that brings back the fruit under the millstone. CC, little partitions for the different varieties of apples or pears. D, millstone. E, axis of the millstone. F, traces for the horse. L, guide, or a long light pole tied to the inner side of the horse's mouth, in order to keep him at the right distance from the mill.

The Dutch mills are considered to be the most perfect of all.

PLATE Q.—Represents the apparatus for refining the oil, and the instruments used for the purpose. There is no scale in the figure, as the dimensions of this kind of mill can vary according to means.

A.—A wooden or leaden tube to lead the water into the press.

B.—A bung stopper, through which one lets the water into the press.

C.—A tank made of stone or of wood, of the best material possible, and built within and above of solid mason work. At the bottom of this tank is a millstone with a hole in the middle of it.

D.—A hardwood beam, generally of oak; it is held in a vertical position by a cross beam F, it afterwards goes through the wall CC, and through the opening made as far as II. In this opening is a wheel attached to the beam. K is the pivot it turns upon.

E.—Is a piece of hardwood of box or green oak, about nearly the diameter of the base of the millstone, and joined with the lower beam with the aid of strong spikes or screws.

G.—The millstone. It is generally about five or six inches in thickness, and four or five feet in height. The weightier this perpendicular mill is, the better the husks are crushed; and it is from the greater division of the particles that depends more or less the profit to be made by this kind of mill. It has two motions, one inside on the beam, and the other on beam D, and consequently on it. It ought to be of granite; but in certain localities people are obliged to use common marble.

H.—Base of the beam shod with iron, revolving in an iron, or, what is still better, a bronze pedestal.

II.—An opening made in the wall, large enough for the horizontal wheel KK, which is put in motion by the fall of the water coming from the canal M.

KK.—Horizontal wheel provided with small palettes or cogs, against which the water strikes with force, and to which it communicates the motion. These small palettes ought to be cut in the shape of a spoon, in order to offer the water a greater resistance.

LL.—The above-mentioned little troughs or palettes.

MM.—Canal that carries the water towards the wheel KK. The quickness of rotation of wheel K, as well as naturally of beam D, and the millstone C, depend on the volume of water coming from canal MM. It is not advisable to allow the motion to be too rapid, for we must give the millstone time to crush the husks and extract from them the oil; for, if it passed too rapidly over this paste, a part of the oil already squeezed out would be re-absorbed, and the aim would be incomplete.

NN.—Canal of escape, beginning at the surface of the water on the press C. The remainder of the parenchyma of the skin of the fruit floating on the top of the water, as well as the other little particles of oil that are dragged along by the motion of the millstone, come into this canal, which is constructed in zigzag, in order to prevent the water from rushing too quickly into the reservoir P; also, in order that this water should not in its fall stir up the dregs that are at the bottom of the reservoir opposite the mouth of the canal, it is well to put a piece of wood, OO; it helps to break the force of the water.

OO.—Block of wood, generally taken from the stem of a tree. It is generally fastened at the bottom of the wall, so as to be immovable.

P.—First reservoir or tank, made either of stone or brickwork. It has to be the largest of all, and is generally ten feet in length by eight feet in breadth. It is also as well to have also a roof over, to prevent any filth from falling into it. The roof is not in the plan, but it is easy to fancy one.

Q.—If the water was allowed to flow above the reservoir, it would carry along with it oleaginous particles and the remainder of the husks that float on the top. To avoid this real loss, there

is made a valve Q, that can be opened or shut at one's will, and leads from the middle part of the reservoir by the pipe R R.

R.—Pipe leading from tub P to tub S, where the water in flowing encounters a block of wood similar to the one described in the other reservoir.

S.—Another basin similar to the first, but in this one the water flows directly into the third basin T, and this one into the fourth, X. The communication of these three last basins is at the centre, as is seen in Y. One could, if thought proper, even add another reservoir.

Z.—The same valve lets escape the water in V and in Z, by lifting it more or less. It is only lifted when one wants to clean it out.

The water that flows from the upper part of the basin CC is only charged with the remnants of the fruits, and a little oil, and also some little particles detached from the kernel of the fruit, known under the name of black crust ; the other parts of the kernel do not come to the top, but remain at the bottom of the basin. But as they (the remainder) might, and do really retain little bits of fruit, it is necessary not to lose these particles ; to this purpose a hole is made in the wall at the bottom of the tower, that communicates by hole 2 with wall 3, and comes out into canal No. 4, that carries the water and the rest of the fruit, known under the name of white crust, into basin 5, which basin is also provided like the other ones with a valve, 6. Basins 7 and 8 are filled also in the same way, and also as many other ones as one wished to build.

The last basins give, as a rule, very little oil, it is true ; but as it is no outlay to gather even this small quantity, this little is a net profit.

Such is the shape of the mill ; let us see how it has to be worked. The husks of the Olives, after having been crushed in the ordinary mill, are spread on the floor of the refining mill, to be taken from there into the vats. When there is a sufficient quantity in the vat, the mill is set in motion for a quarter of an hour, so that the crust (husk) is crushed another time. After this stopper B is opened to let in some water, and the wheel is made to turn again. The force of the water rushing rapidly, and that of the mill, serve to dissolve more completely the husks ; more water is added to turn the wheel, and at last all the water is let loose. The black crust rises to the surface, and the water flowing through canal N drags it into the different basins P, S, T, X. When it appears that the water drags no more particles of black crust, the valve No. 2, at the bottom, is opened, and then the water carries off the white crust into the basins 5, 7, 8. When the water of these black and white crusts have arrived into their respective basins, or otherwise when the vat is emptied of whatever kind of crust, the valve No. 2 is shut as well the cock B, and the vat is replenished with husks.

While this operation is going on again, a man placed near the basins, armed with a long pole at the extremity of which there is a

scraper or rake, passes it lightly over the surface of the water in the basin, and thrusts it into the corners, so that the oil and the different other particles of the fruit come to the top: upon which he takes a short-handled perforated ladle, and what is still better, a hair sieve, with which he gathers all that is on the surface to throw it into a little tub or whatever kind of wooden recipient he may have close by. He goes on with this work till the water of the different basins, without being agitated, shews nothing more on its surface; upon which he carries his bucket over to the boiler 13, into which he empties the contents. This boiler is half full of water, which is allowed to boil until the smoke is quite white and thick; which is a sign that the water has evaporated sufficiently, and that also the paste is thick enough.

The workman takes the substance out with a large ladle, and fills the baskets, 15; these are put one above the other. This done, four men—two placed at both handspikes, which are introduced into the opening 16—turn the vice that presses the oil into the buckets ready to receive it. When these buckets are full, other ones are put instead, and the first are emptied into earthenware jars, at the bottom of which the oil deposes a lot of sediment.

The whole of the paste or doughy water is not taken away during the operation. It is necessary also to leave a certain quantity at the bottom of the boiler, in order that the boiler should not be burned, and that there should be time to fetch some water from the tubs.

As soon as the press acts on the baskets, boiling water is sprinkled on the outside of these baskets. This water helps to detach from the outside those particles of oil which otherwise would not drop down. They flow, with the other oil, then into the same tubs. The whole is then put into jars; and as water is heavier than oil, the former goes to the bottom, while the other floats on the surface. The whole is allowed to rest for a few days, during which all the sediment, earthy substances, &c., separate from the oil and go the bottom of the water, and then by means of a small cane, fitted to the jar, the cock is opened. The sediment is the first to come out, and it is carried over to the boiler to be boiled over again; afterwards comes the water. Then, when the oil begins to shew, the cock is stopped. This oil is put in casks; but there are some people who put it again into other jars, which operation naturally purifies it still more.

Let us go back to the vats with the different kinds of crusts.

After having gathered as much as possible of the oleaginous part, and the different particles of fruit, a workman armed with another instrument, 9, nearly similar to the one used by masons for mixing sand with lime to make mortar, agitates the bottom of the basins, towards where the sediment with the other particles has been precipitated; then all the oleaginous and light particles that float on the top are taken away. This operation is repeated often, and when one believes that there is nothing more to be taken away from the basins P, S, T, X, the valve is opened in the basin X, to allow the water and sediment to flow away. Even this sediment could

be boiled over again, and would give a little oil, for even if there were basins for half-a-mile, even the last would give some particles.

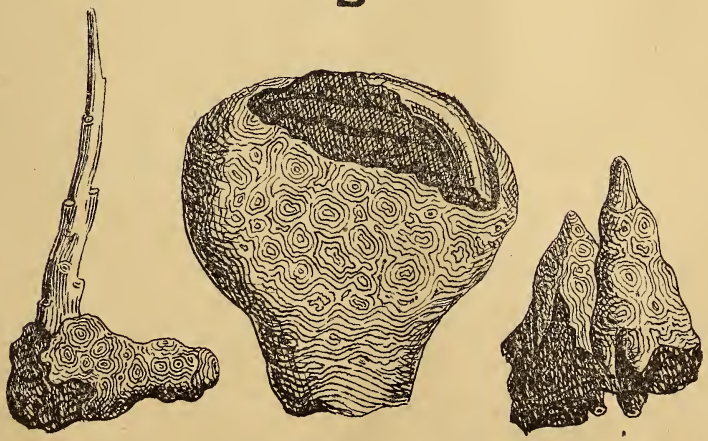
The husks, after having been taken away from the press, are made use of to keep up the fire under the boiler, and the water boiling. These husks form also an excellent kind of grease.

As to the white crust, or remainder of the kernels that remain in the basins 5, 7, 8, they have to undergo the same operations as the black crust. Finally, the valve is opened ; but, as this basin is furnished with an iron grate, it is only the water that can escape, and the white crust remains dry. This crust is sold for heating the furnaces, and the profit made with it is sufficient to pay the wages of the men employed in the refinery.

A

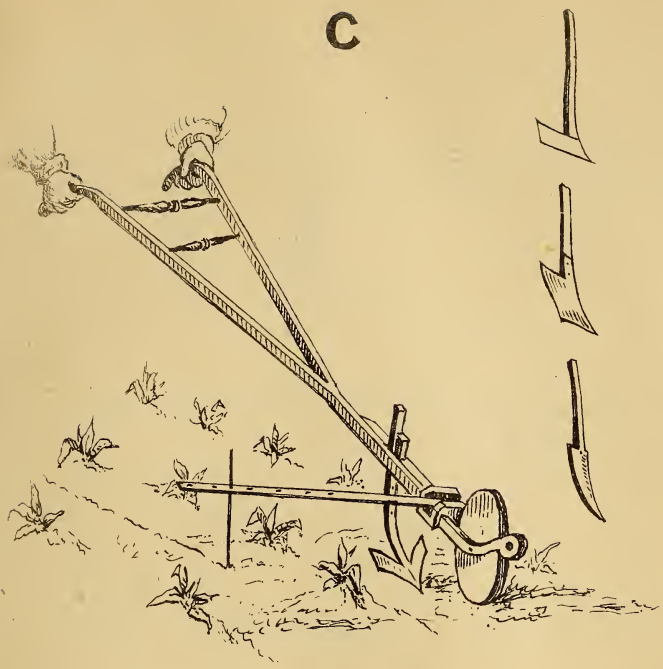
THE OLIVE

B



KNAURS, OR EMBRYO BUDS.

C



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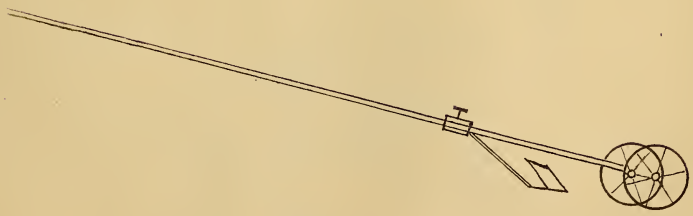
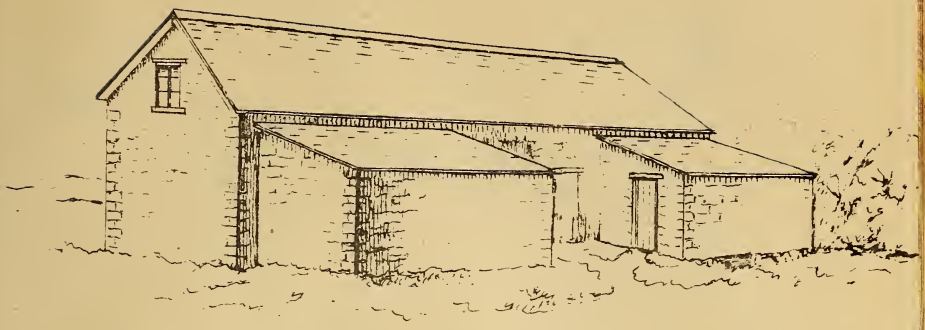
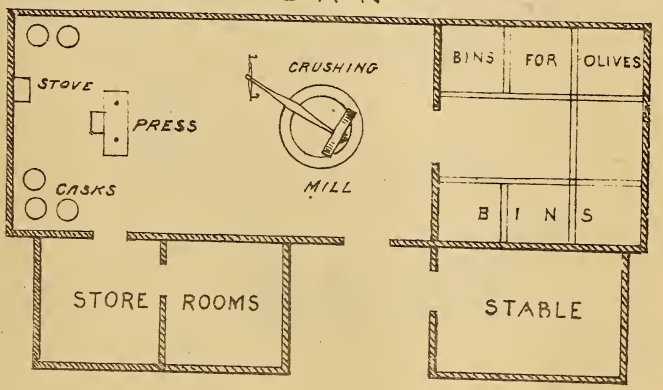


E

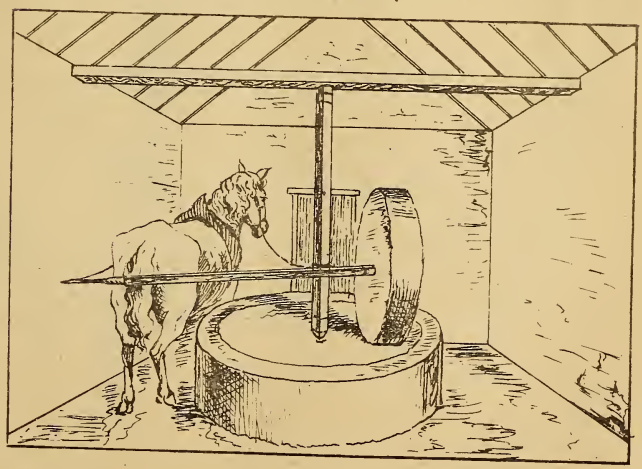
BUILDING.



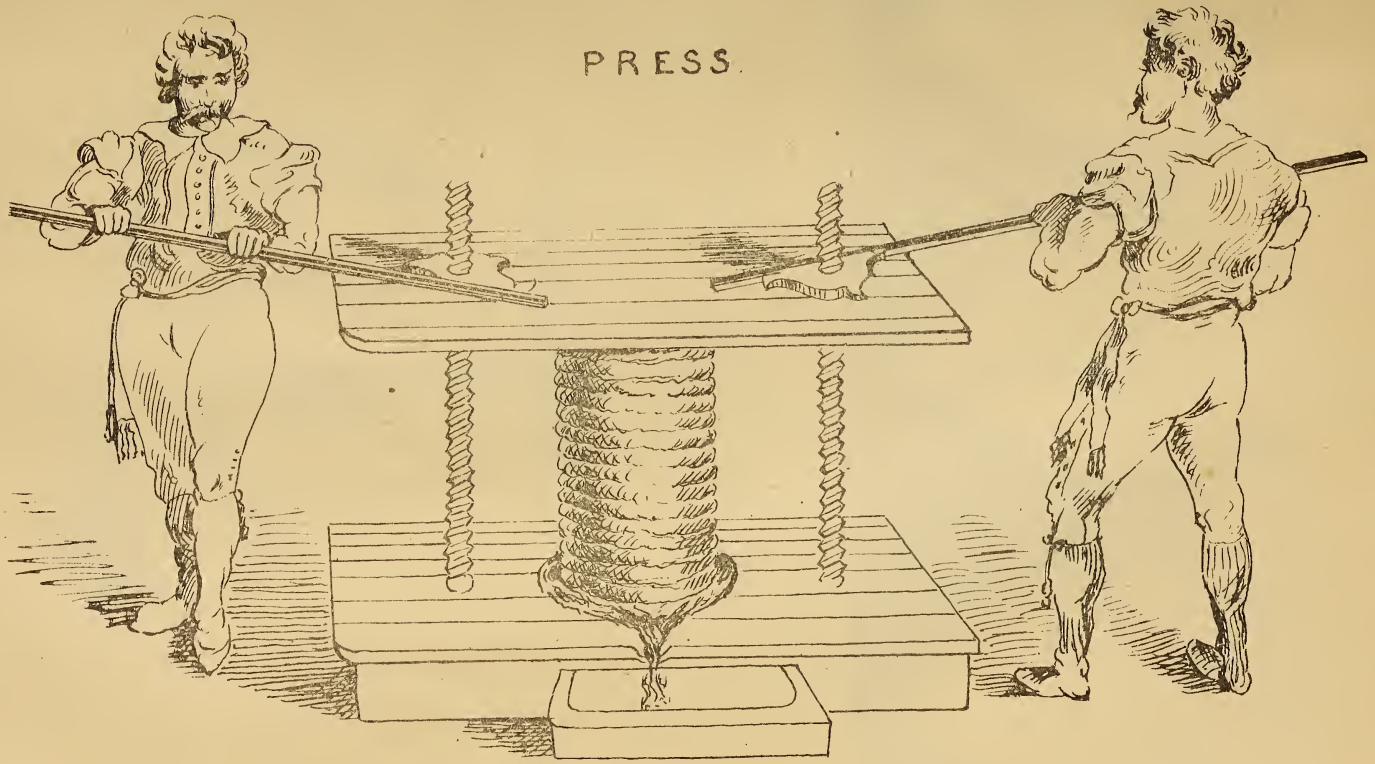
PLAN



CRUSHER



PRESS.



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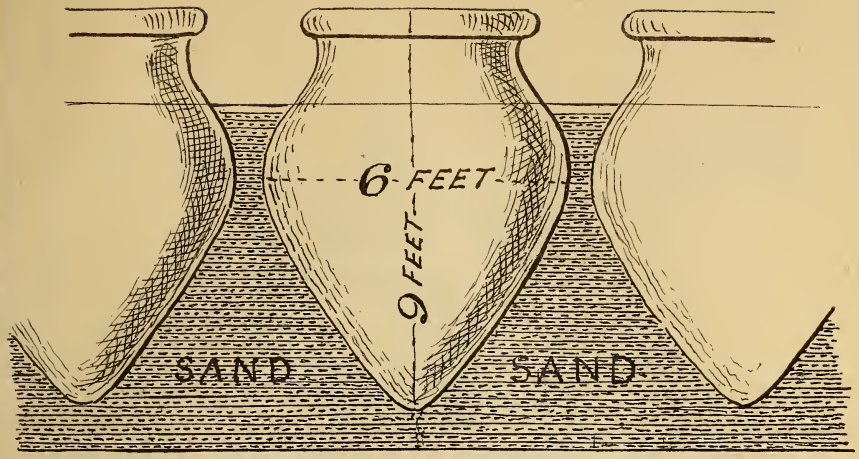

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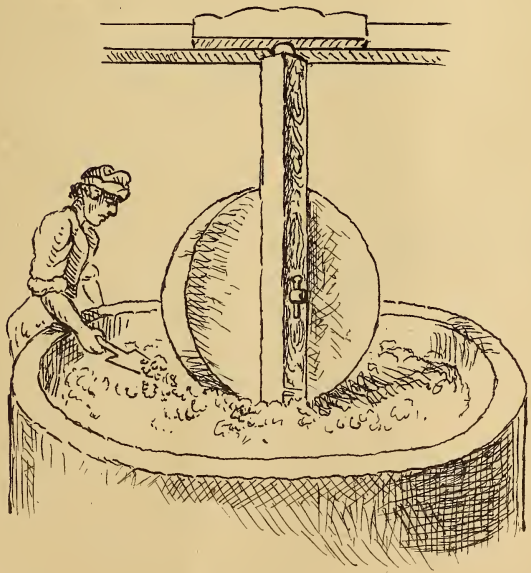

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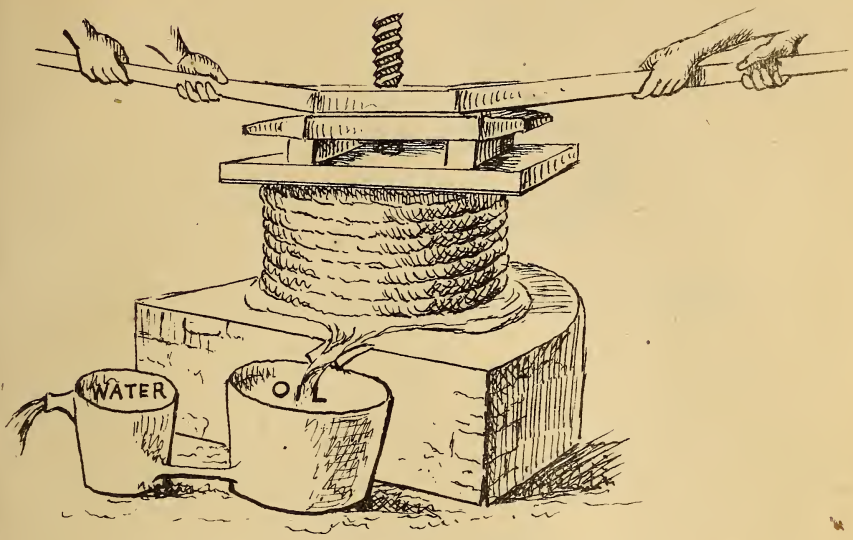

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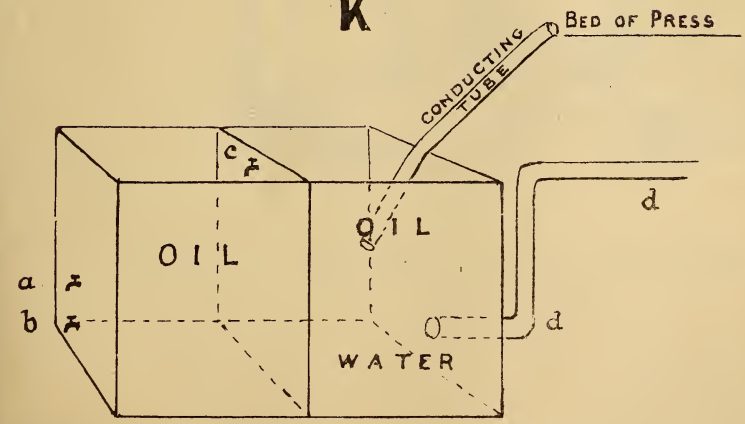
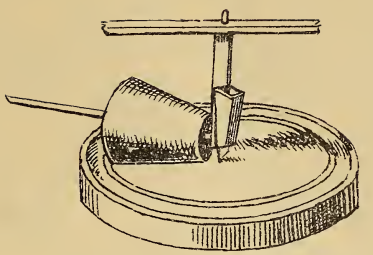


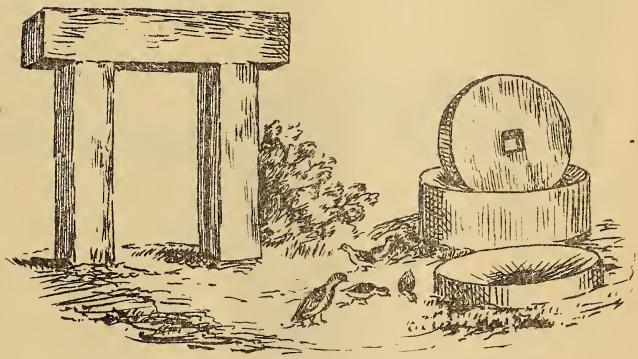
RECEIVER UNDER LEVEL OF PRESS-FLOOR

L



ONE FORM OF MILL USED IN SPAIN.

M



ANCIENT OIL-MILL AND PRESSES.

RUINS OF EM EL 'AWAMID, PALESTINE.

Fig. 2.

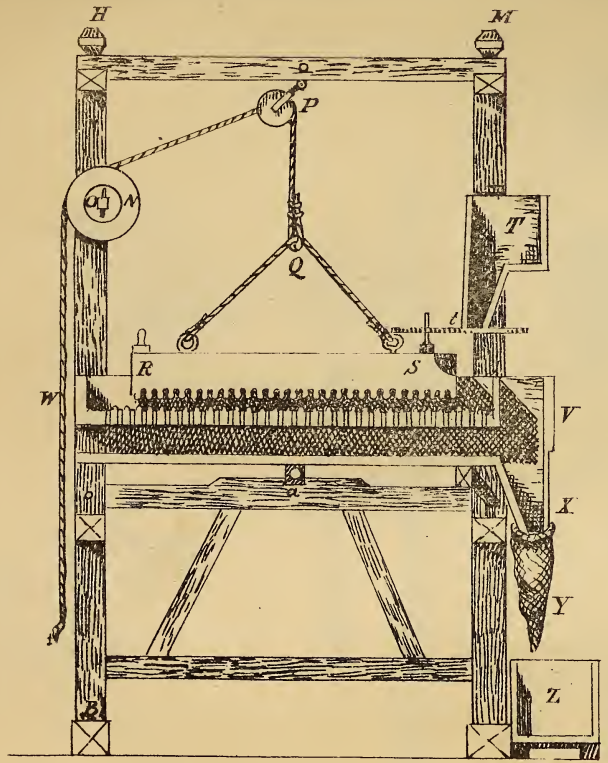


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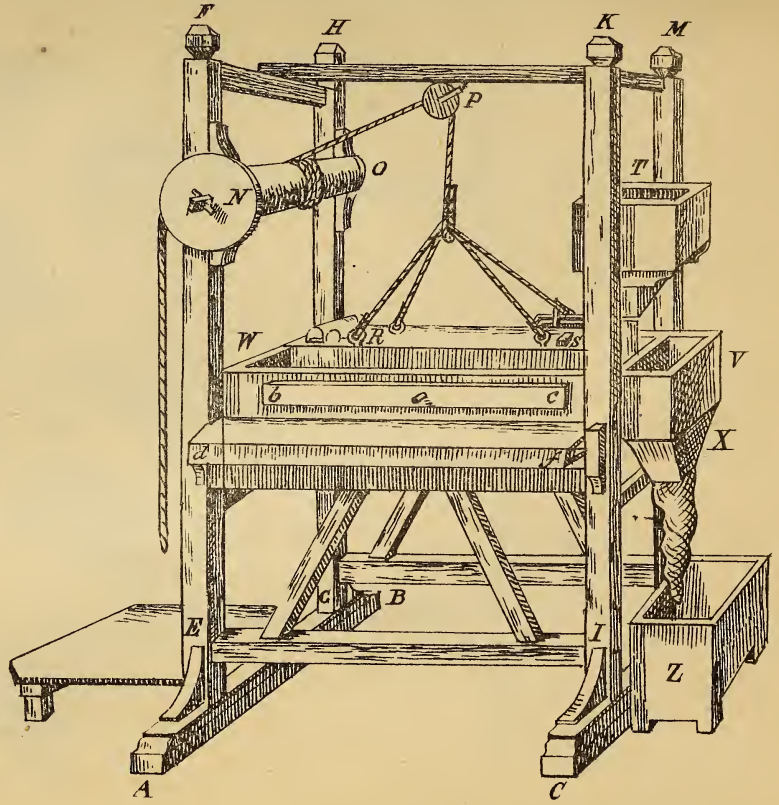
Fig. 1.



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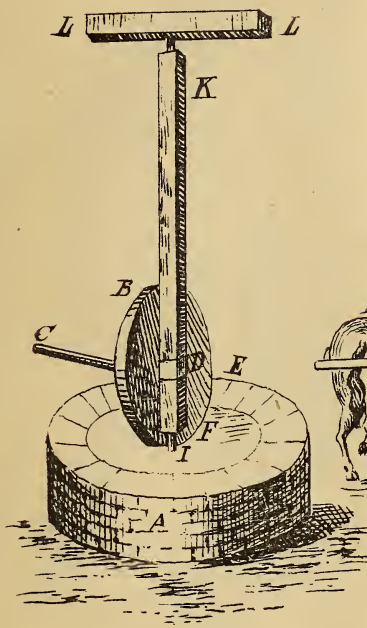

Fig. 2.

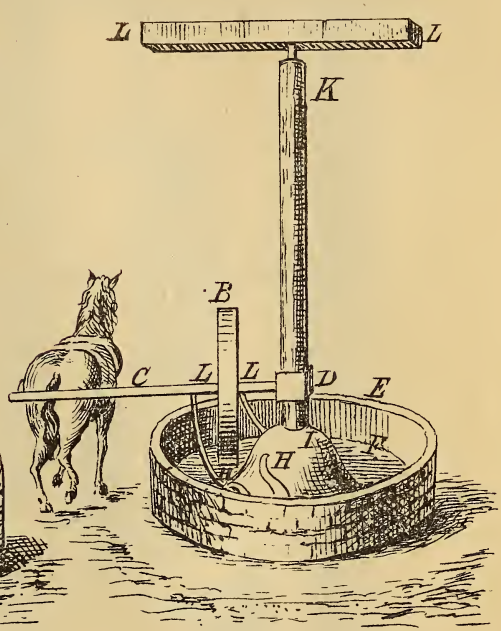

Fig. 3

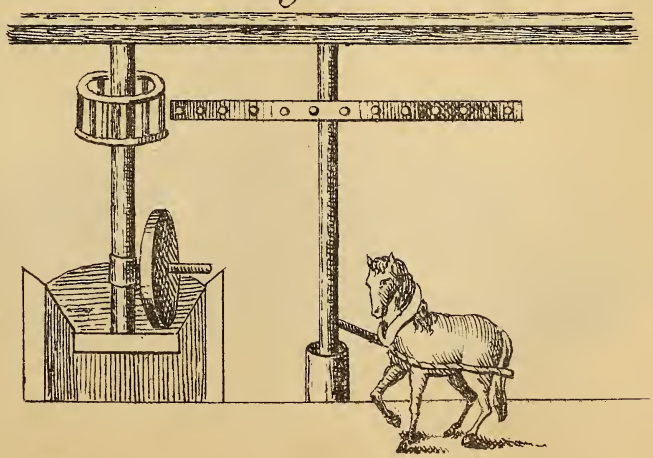

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Fig. 1.

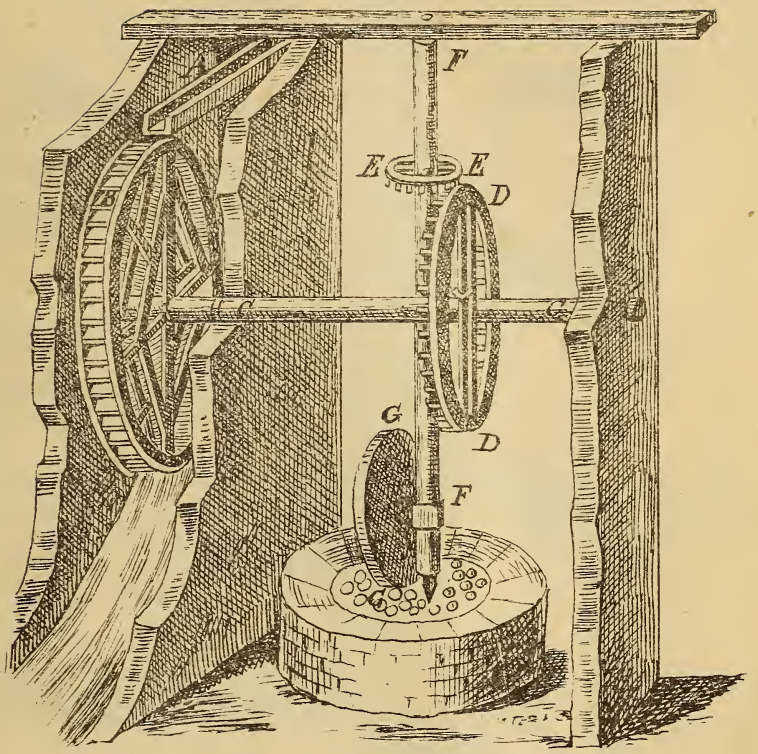
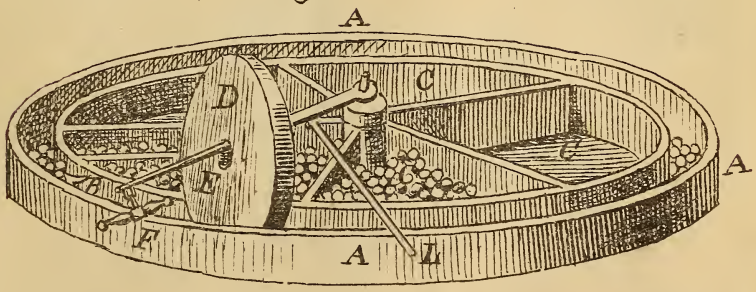
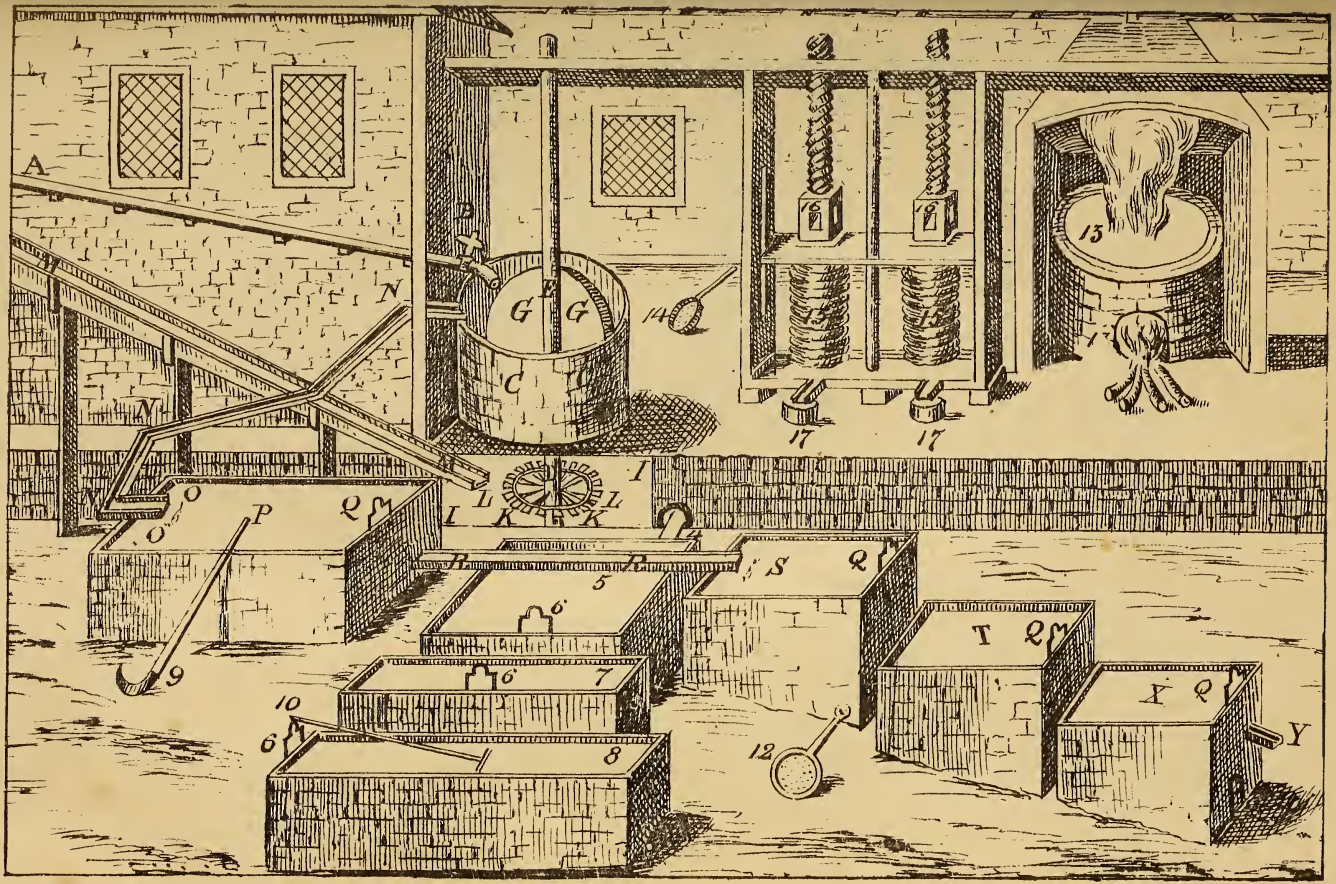


Fig 2

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THE OLIVE AND ITS PRODUCTS.

A TREATISE ON THE

HABITS, CULTIVATION, AND PROPAGATION OF THE TREE;

AND UPON THE

MANUFACTURE OF OIL AND OTHER PRODUCTS THEREFROM.

BY LEWIS A. BERNAYS, F.L.S.,

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