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THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page 316.*)

By E. Meeking, Senior Fruit Inspector.

PART VIII.

OVERSEA TRADE.—DISTRIBUTION AND MARKETING.

TRADE CHANNELS.

At present our fruits are principally conveyed to oversea markets by vessels belonging to the following companies:—

Name of Company.	Destination.	Route.
P. and O. (Mail) ..	United Kingdom	Suez
P. and O. (Cargo) ..	United Kingdom	Suez
P. and O. (Branch) ..	United Kingdom	Cape Town
Orient (Mail).. ..	United Kingdom	Suez
White Star (Liverpool)..	United Kingdom and South Africa	Cape Town
White Star (Aberdeen)..	United Kingdom and South Africa	Cape Town
Blue Funnel	United Kingdom	Suez
Federal Houlder-Shire..	United Kingdom	Suez
Norddeutscher Lloyd ..	United Kingdom	Suez
Messageries *Maritimes* ..	*Ceylon, India and Marseilles* ..	Suez
German Australian ..	Holland and Germany ..	Suez
British India	Indian Ports, Singapore, Java, Batavia, &c.	Alternative, *via* Sydney or Fremantle
Royal Dutch Packet ..	Singapore, Java, Batavia ..	*via* Sydney
Canadian Australian ..	Vancouver	*via* Inter-State boats, transhipment at Sydney
Oceanic S.S. Co. ..	San Francisco	*via* Inter-State boats, transhipment at Sydney
Union S S Co. ..	New Zealand Ports	Direct

In addition to the foregoing, small lots of fruit are occasionally shipped by various cargo steamers to the Pacific Islands, the East, and South Africa. The graph below shows the various countries which have been opened to our fruit trade, and those which still remain untouched. The figures showing the population of each of these countries, and the quantities of fruits shipped to same, will convey some idea of the directions in which the trade has developed since its inception some twenty years ago, and will also indicate the extent to which the trade may be further developed, both with respect to the markets already opened and those which remain untouched. It would appear

DIAGRAM SHOWING POSSIBILITIES OF OVERSEA MARKETS.

from the evidence of the figures which show the total quantities exported to the various countries since the trade was first established, that our export trade in fruit to oversea countries has practically not yet commenced in earnest, and that with better facilities for distribution coming into existence, the trade should, in the future, expand to an unlimited extent. As, however, proper facilities are not yet available for reaching many of the larger markets of the world, those interested in promoting the growth of the industry would do well to confine their attention to further developing the trade with those places which are the most accessible, and particularly with the countries where trade has already, to some extent, become established. This is the opinion of many reputable and disinterested authorities whose interests and desires are in the direction of developing the industry as a whole, and on broad and sound lines. It is a well-known fact that our fruits are not distributed or disposed of to the best advantage in the markets of the United Kingdom, and that, as a consequence, the best prices possible are not always obtained. This want of proper distribution cannot, of course, be held altogether responsible for the unsatisfactory prices which are often realized. Improper methods of handling and putting up our fruits before shipment, and the neglect of correct and up-to-date transporation by land and sea, must bear their share.

The records taken from the Agent-General's reports for a number of seasons show that fruit has been carried during transit from Australia to the United Kingdom and Europe at temperatures much too high, and it has been already shown in the present series of articles that our methods of transportation by land are far from all that could be desired. The matter of improper distribution in the countries where our fruit trade has already been established is now under review.

In the *Journal of Agriculture*, November, 1911, the following were pointed out as the principal needs which were required for the oversea fruit export industry:—

(1) Provision for rapid cooling of fruit when picked.
(2) Cool car transport.
(3) Pre-cooling of all fruit prior to shipment.
(4) The installation of self-recording thermometers on fruit-carrying steamers.
(5) The provision of cool storage accommodation at London and other ports where transhipment is often required.
(6) Improved methods of consignment, sale, and distribution of fruits.
(7) The organization of the trade generally on the lines which have been adopted in California and Canada.

The matters indicated in (1), (2), (3), and (4) have already been mentioned in this series of articles, and (5) (6), and (7) will be dealt with in this and future articles.

Although the figures shown in the graph indicate that the larger percentage of our fruit trade, so far, has been confined to the United Kingdom and Germany, it might be inferred from these that the limit of supply to those countries had already been reached, and that we should, in consequence, turn our attention to markets still untouched. However, a knowledge of the facts indicate that instead of the limit of consumption of our fruits in the United Kingdom and Germany having been reached, our fruits are almost unknown to the greater proportion of the consumers in those countries.

DISTRIBUTING DISABILITIES.

So far, our fruits have been distributed from London and Liverpool only throughout the United Kingdom, and from Hamburg throughout Germany. This is mainly caused through want of direct steam-ship service to other distributing centres in those countries, and as these centres can only be reached by transhipments, the exporters here have naturally been averse to attempting to open fresh markets by these means. They are justified in this attitude, as, without proper facilities for so doing, transhipment of consignments is usually a very unsatisfactory proposition. The goods are often delayed through hitches occurring at the port of transhipment, and, as the shipper has no one to look after his interests, the fruit is, in many instances, subject to treatment such as to bring about serious deterioration in its market value, or perhaps render it quite unmarketable.

COOL STORAGE ACCOMMODATION IN LONDON.

Many good markets and distributing centres other than London and Liverpool exist in the United Kingdom, such as Hull, Bristol, Glasgow, Cardiff, Manchester, &c., but the difficulties of reaching these under present existing circumstances render a regular supply of fruit to these a risky proposition. There would appear to be one way only whereunder the difficulty of reaching these ports may be overcome, as, in the absence of a direct steam-ship service, London must, perforce, continue to be the chief distributing centre. This solution consists in providing suitable accommodation for holding shipments until such time as vessels trading with the centres mentioned arrive in London, and has been advocated for some years past in the columns of this journal. In the absence of such accommodation, our fruits, to reach centres other than London, must be distributed by rail to these centres or disposed of in London and distributed after sale. This obviously places the exporter at a great disadvantage, as it forces him into the position of having one market only in which to dispose of his goods. Were proper accommodation provided, his fruits could be held until these could be forwarded to centres other than London with a minimum of risk. The exporter would thus be in the position of placing his fruits in direct competition with the London markets, and would thereby stand a far better chance of securing enhanced prices than is possible under present conditions. Even so far as the London market itself is concerned, the establishment of proper cool storage accommodation would enable our exporters to regulate the supply and avoid gluts.

Summarized, the chief advantages which would accrue from cool storage accommodation in London would appear to be as follows:—

(1) The avoidance of gluts by possessing a means for regulating supplies.

(2) The facilities which would be afforded for distributing to centres other than London.

(3) Minimizing the possibility of our fruits being sacrificed through the operations of brokerage rings.

Extra charges would be incurred for carrying out such an arrangement, but it would probably so enhance the all-round market values that the benefits derived would more than compensate for the extra cost.

It may be that the cost of erecting and maintaining the accommodation indicated could not be borne by the fruit industry alone, and that such accommodation would require to be utilized for products other than fruit. This is a matter that could only be determined after consideration and thorough investigation of the facts. The suggestion that those interested in the Canadian fruit industry might reciprocate with those interested in this country seems a good business proposal, and one which should not be difficult to carry into effect.

(*To be continued.*)

CITRUS CULTURE IN VICTORIA.

(*Continued from page 382.*)

PART IV.—PRUNING.

By S. A. Cock, Orchard Supervisor, Bendigo.

Oranges, when received from the nursery, and after their roots have been washed of the mud puddle, will look as at Plate 18. Fig. 1 is a one-year-old tree with a branching head growth of too weak a character, and too high to start off as a three-armed tree; it is therefore cut back to a rod at *a*. If this head were allowed to remain, the new growths would not start readily from the terminals *b*. The strong new growth usually comes from lower down on the newly-planted tree, and renders it necessary, later on, to cut back the old growth to the new strong growth. A fair start is made by hard cutting. The growths come from every leaf axil, and are capable of being produced from every bud on the tree. Fig. 2, plate 18, represents a two-year-old tree with strong branches, well spaced, and branching at the proper height to form the head; this is pruned back to three or four buds on the three arms or branches as shown at *c*, pruning to outside buds.

Fig. 1, Plate 18, will form a new head, whilst Fig. 2, Plate 18, will go on increasing its arms immediately; therefore, it is preferable to obtain strong well-formed trees from the nurseryman, two-year-old for preference. By pinching the strong-growing trees this can be produced the first year as already explained. Nurserymen should see that the trees are headed at the proper height (15 inches from the ground), otherwise recourse to hard cutting to a rod is necessary, in order to form the head at the height stated. It is not necessary to allow any leaves to remain on the trees when planting pruning is done. Evaporation is great from the leaves, and the roots require all the nourishment possible to assure a healthy start. Plate 17 represents the trees after pruning, Fig. 1, the rod. Fig. 2 pruned to three arms. Should any central vertical strong growth be present, it should be absolutely removed. The idea at the outset is to space the branches, and whilst strong, almost upright, growths are required for a few years, the upright growths should be slightly to the horizontal, and no main upright central growth permitted. This is a fault often noticed with many growers, and is wrong, as will be shown later on.

Two strong growths occur every year, and two or more weakened growths. The strong growths produce the leading and strong lateral wood, whilst the weaker growths produce the smaller laterals. It is with the strong growths we are chiefly concerned—September to December, and February to April. It is not advisable to cut back again on orange trees after the planting pruning. The strong leading growths should be guided and led in the direction required. The objective for the first five years should be to procure a tree of sturdy upright growth, with strong uprights and strong laterals, both growths being well and equally spaced for the admission of sunlight and air, and the consequent assimilation and elaboration of fruit-producing wood. This is performed by treating the growths twice in the year—November and April. The terminal buds rest when growth ceases,

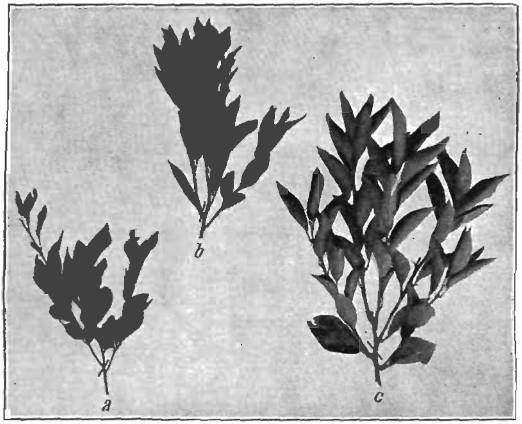


Plate 21.—Terminal growth before regulating

and the successive growths are depicted in Plate 21, *A*, *B*, *C*. The growth may be only single, but generally it is what is termed "clubbed," or many equal growths produced from nearly an equal base (leading buds close together). If all these buds are allowed to remain, they grow until eventually the stronger ones take the lead to form branches, and the weaker ones remain as stunted laterals. If these growths are not thinned the tree rapidly becomes a dense mass of foliage, excluding light and air, and producing no fruit in the centre of the tree, the centre being generally infested with scale. An orange tree in shape should be circular, and flat across the top, the diameter being equal to almost twice the height; or suppose every horizontal branch could be lifted erect, and bound together, they would be of equal height with any vertical branches. Plate 21

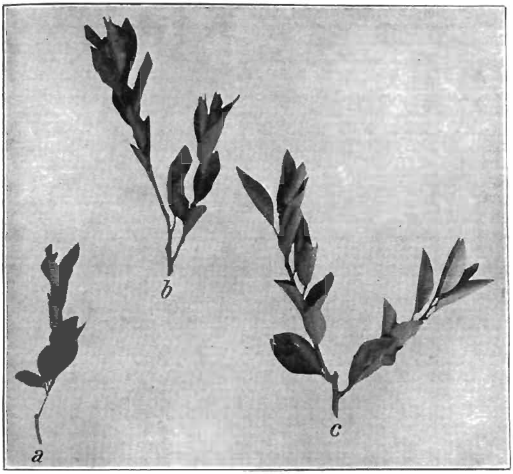


Plate 22.—Terminal growth after regulating.

Plate 23.—Washington Navel, 5 years old, Koondrook.

represents how these growths are regulated to bring about this result. At *a*, the growth is weak, and in order to make it strong and vertical, two growths are removed as shown at —; *b* is stronger than *a*, consequently two growths are left, the upright top growth to form a leader, and the bottom growth for a horizontal strong lateral. The weakened central growth, and the strong side growth are removed at — to strengthen the leader.

c is stronger than *b* or *a*, and as in deciduous fruit trees it is necessary to build a strong frame to support the lateral growths, so

Plate 24.—Twelve years old Azorean St. Michael, Kyabram.

it is necessary in orange trees to induce strong leading growths to support the lengthy laterals in *c*. The leading growths in the centre are removed at —, and two growths of equal size and strength allowed to remain to increase the head or framework of the tree. This is a blocking process also, and while it regulates the leaders, it also places pressure on the buds below the regulated leaders, and pushes them into activity to produce fruiting lateral growths. Plate 22 represents *a*, *b*, *c*, with growths regulated. Plate 14 is a typical three-year-old tree. Plate 23 a typical five-year-old tree. Should any leaders show a tendency to grow stronger than the others, and destroy the balance of the tree, they should be cut back to an outside bud, or absolutely removed by cutting back to a weaker vertical growth. At the age of five years, and when 8 feet high, attention should be paid to thinning out, also promoting a horizontal growth. Orange trees do not require to be hollow in the centre, but should be open enough for the admission of light and air on all parts of the tree as shown in Plate 24 (a twelve-year-old Azorean St. Michael), where the bearing surface is equally distributed right over and through the tree, not as is too often the case with untrained

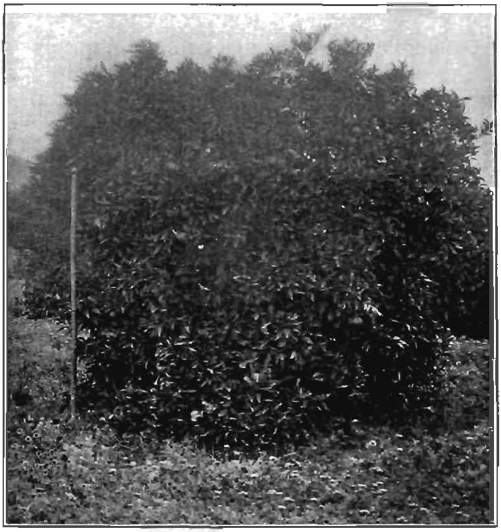


Plate 25.—Twelve years old Siletta, Kyabram.

trees, only over the outside surface, and within for a distance of a foot. Plate 25 represents a twelve-year-old Siletta orange, regulated and pruned flat across the top, height 10 feet, diameter 16 feet. Plate 26 shows a Washington navel twelve-year old, 10 feet high and 18 feet in diameter. These are good types of well-balanced trees, and have a much increased bearing surface as compared with dome-shaped trees; broad of base and falling away to a point on the top, this class of tree has usually been allowed to grow at will, and the strong central uprights have gained the ascendancy. The difference in bearing space is shown in Plate 27. Taking the outside circle *a—a—a* to represent a dome-shaped tree. vertical section (trunk and branches not shown), 20 feet across at the base. and 12 feet high in the centre, the fruiting capacity would be as follows:—

1. When the fruit is borne everywhere along limb from centre to outside leafage—

In a space above double lines B—B of	$2095\frac{5}{21}$	cubic feet
In a space below double lines B—B of	$628\frac{4}{7}$	cubic feet
In a total space of	$2723\frac{17}{21}$	cubic feet

2. When fruit is borne only on the outer twelve inches of the tree—

In a space above double lines B—B of	$1527\frac{3}{7}$	cubic feet
In a space below double lines B—B of	$509\frac{1}{7}$	cubic feet
In a total space of	$2036\frac{4}{7}$	cubic feet inside line

marked C—C—C—thus there will be for fruit bearing a space of $2723\frac{17}{21} - 2036\frac{4}{7}$, or $687\frac{5}{21}$ cubic feet.

If fruit is borne only on the outside surface A—A—A it has only a fruiting surface of $754\frac{2}{7}$ square feet.

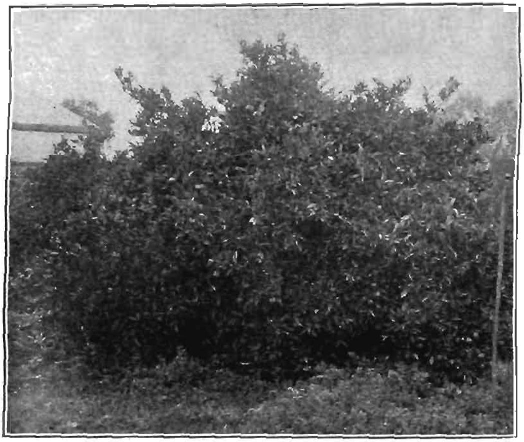


Plate 26.—Washington Navel, 12 years old

A tree as represented in Plate 25, is shown by the dotted lines in Plate 27. *A—D—A—D—A* has a bearing capacity in a space of $3,771\frac{3}{7}$ cubic feet from centre of tree to outside leafage, by properly regulating and pruning, and consequently admitting light and air. The fruiting zone of a tree should be right from the centre to the outside leafage, and, as will be seen from the foregoing calculations, a great amount of space is almost unproductive in many citrus trees.

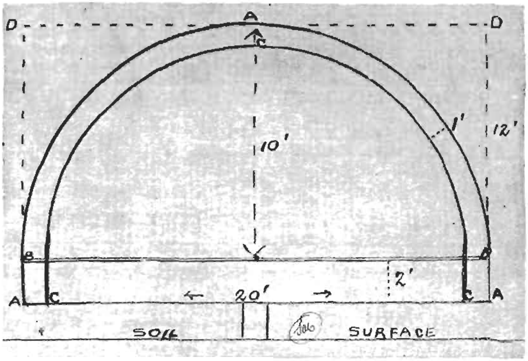


Plate 27.—Diagram of tree

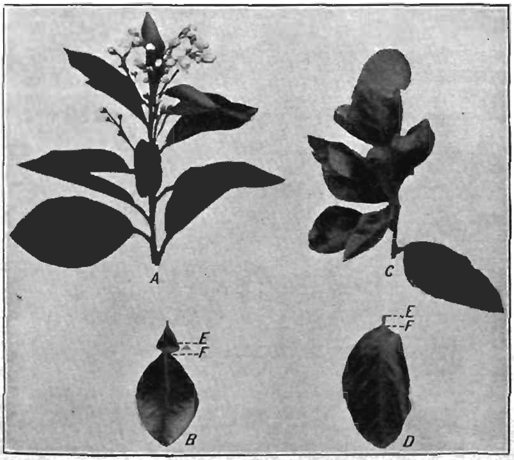


Plate 28.—A. Flowering branch of orange.
B. Seville orange leaf
C. Fruiting branch of lemon.
D. Lemon leaf.

A flowering branch of the orange is shown at *A*, Plate 28. The fruit is borne on elaborated growths, either from the terminals, the axils of the leaves, or any bud brought into activity on the tree. *B* is the leaf of the common Seville orange, showing the winged petiole at *E*, and the articulation (point of union) at *F*. Fruit should always be cut off the tree, not pulled. Dead wood should always be pruned out, by cutting back to a healthy growth. Orange trees should not be pruned up, and the butt and surface feeding roots exposed to the sun. The bottom branches, if becoming too closely pressed to the ground by weight of overlying branches, may be shortened back, or removed, and room made for the overlying branches to take their place, and so relieve the crowding of the foliage of the tree. All strong sap growths (water shoots) should be removed as soon as detected; if allowed to remain, they use up a lot of the energy of the roots. In pruning citrus, always use a sharp cutting *secateurs* or *knife*.

(*To be continued.*)

EARTHWORMS IN VICTORIA.

By Janet W. Raff, M.Sc., Government Research Bursar in the Biological Laboratory, Melbourne University.

The important group of earthworms, the study of whose habits was made so fascinating by the researches of Darwin, has received considerable attention in Victoria and New South Wales, and numerous papers by Professor Spencer, of Melbourne, and Mr. J. J. Fletcher, of New South Wales, are to be found in the publications of the Royal Society of Victoria and of the Linnæan Society of New South Wales. These give chiefly specific descriptions and important points in the anatomy. They are specially interesting forms, but are by no means easy to classify. Other scientists in other parts of the world have also devoted much attention to our Australian species, this continent being one of the most abundantly stocked of any with these "diggers of the soil."

Previous to 1886, only three species of earthworms from Australia had been described, and a fourth from Tasmania; two of the three were from New South Wales, and the third was from Gippsland, Victoria. Since then large collections have been made from different parts of our State, and now the number of species described runs into hundreds. Some parts of the country are exceptionally favorable to their existence; for example, the south-eastern and south-western portions, and often more than one species may be turned over in a single clod of soil.

In spite of the work done on the external and internal structure, which is often somewhat complicated, no one has made a study of the habits of our Australian earthworms to such an extent as has Darwin of the European forms. In his book on *Vegetable Mould and Earthworms,* which deals with the "formation of vegetable mould through the action of worms, with observations on their habits," there is an exhaustive description of the habits and effects on the soil of these small creatures, to whose agency the formation of vegetable mould on the surface of the earth is attributed. Although there are important points of difference structurally between our Australian worms and the European, their habits may be, generally speaking, considered similar. In New Zealand, Mr. A. T. Urquhart has carried out experiments on the worms of that island similar to those previously made by Darwin in England, and he has obtained results which, allowing for climatic differences, agree very closely with those obtained for the European species.

Earthworms are found in almost all parts of the world; in the tropics as well as in the temperate regions, although, naturally, they are more abundant in the latter, and, as has been stated above, they are unusually numerous in Australia. Although our continent has such a very rich earthworm fauna, in the settled districts we find our native forms are continually driven back and starved out by those introduced from Europe. This is noticeable also as regards other animals—for example, snails; and, consequently, to collect Australian species of these animals, one has to go out some distance from the settled districts. The European worms have been imported in soil and by other means, and it is the British species that are commonly

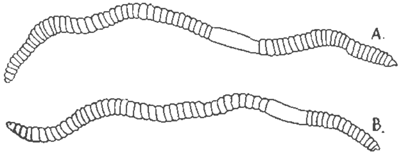


Fig. 1.

seen about our paths and gardens. The accompanying rough sketch (text-figure 1) shows the chief difference in appearance of our Australian forms as compared with those introduced. It will be noticed that the small portion of the body, which has a very smooth surface, and on which the segments are not clearly distinguishable, forms a girdle round the body of the worm; this girdle is much further away from the head end in the European species (A) than it is in the Australian (B). This is a ready means of distinguishing the two forms.

Earthworms have been called "ploughers of the field." They burrow through the earth, swallowing it, and absorbing as food any nutrient material contained therein; and their castings, continually brought to the surface, are blown about when dry, and thus spread over the surface of the ground as a fine layer of mould. An enormous effect is produced in this way on the superficial layers of the earth. Darwin calculated that there were in one small garden of an acre over 53,000 worms, and that 10 tons of soil per acre passed through their bodies annually. They were estimated to cover the surface with a layer of soil .2 of an inch in thickness, so some idea of the important part they play in nature may be formed. The soil is submitted to the action of the atmosphere, and the burrows allow of the free percolation of rain into the deeper lying parts of the soil. The worms live chiefly in the superficial layers of the earth; this is passed through and through their bodies, and is ultimately carried to the surface as castings.

Spring and autumn appear to be the times in the year most favorable for casting, during and just after wet weather. At these times, also, worms are found frequently under logs and in situations that are kept moist. Their castings are not always visible on the surface of the soil, since they are sometimes deposited in their burrows. They form rugged masses, sometimes several inches high, of finely-divided particles of earth, and it has been shown that there is a greater bacterial fauna in the castings than in the surrounding soil. This is of interest, inasmuch as these bacteria are an important factor in the nitrification of the soil. Another part these worms play in nature, from an agricultural stand-point, is the rendering soluble of certain constituents of the soil that would otherwise be insoluble, or only dissolve very slowly. The soil particles, with various insoluble or difficultly soluble constituents, are passed through the body, and are subjected to the various fermentation juices in the body of the worm. This must render some of these more or less insoluble particles soluble and fit for the use of plants. The extent to which the soil is divided into particles must also have an important bearing on its fertility, because the finer the particles of any given quantity are, the greater will be their total surface area. This affects both the absorption by the roots of plants and the retention of water and soluble materials by the soil. The more finely-divided soil would hold a larger quantity of water when all the free water has been drained away, and it is also capable of retaining larger supplies of soluble plant food. Worms in some parts have been observed to drag leaves and other decaying matter into their burrows. This would tend to increase the water-holding power of the soil, and also to increase its fertility.

During the cold seasons the mouths of the burrows are often found protected by the castings, or, when no castings are being ejected, by heaps of little stones and pellets of earth. These probably both protect them from their enemies and aid in excluding the light. During dry periods the worms exist coiled up in little chambers at the bottom of their burrows. The burrows run down obliquely, with an occasional turn horizontally. Sometimes the surface portion of the burrow appears to be lined with a thin cement material, probably secreted by the worm and spread out by their gliding movements. The secretion, on drying, strengthens the walls and also affords a smooth surface over which the worm moves with ease, and is thus enabled to escape from enemies, such as centipedes and birds. The worm forms the burrows either by pushing the earth to one side, or by swallowing it as it moves along in a forward direction. Darwin has proved by means of experiments that the earth is swallowed both for the purpose of obtaining food and of making the burrows.

Before giving a brief account of the structure of earthworms, it might be of interest to note a few points on the habits of our large Gippsland worms—the so-called giant earthworms. One of these, *Megascolides australis*, has been fully described by Professor Spencer in his monograph, published in 1888, in the *Transactions of the Royal Society of Victoria*, and is figured in McCoy's *Prodromus* (see Fig. 3). These giants commonly reach a length of 6 feet, and they may be ¾-inch in thickness. They live principally on the slopes of creeks or beneath fallen logs, and may be turned out of the ground by the plough. Owing to their great size it is not easy to draw them out from their burrows without injuring them. They appear to be able to expand the head and tail portions of their bodies, and so grip firmly to the soil, making it difficult to extricate them. The largest of these giants measured alive reached 7 feet 2 inches in length. There was some doubt as to whether these forms produced castings or not. Investigation showed that they frequently make their burrows in the holes of the so-called land crab, which animal builds up a large casting at the entrance to its hole; but, so far as was observed, when the worm's burrow was found away from the hole of the crab no castings were visible. From this it would appear that the worm itself produced no casting. Their burrows are very long and twisted, and the animal produces a peculiar gurgling noise as it moves about in them. This gurgling sound, which enables them to be located quite easily, is made by the body passing through the slimy fluid secreted along the sides of the burrow. It has been noticed, when the living animal is held in the hand, that the fluid has been thrown out in jets from small pores situated along the middle of the back. Professor Spencer notes that outside the burrow the worm is very sluggish indeed, and scarcely moves at all, but when in the burrow it is very rapid in its movements. The worms' cocoons are only rarely found in the burrows. These cocoons measure 1½ to 2 inches in length, and are formed by a secretion from the girdle-like portion of the body mentioned above. Each cocoon contains an embryo, is light yellow or brown in colour, and has in it a fluid similar to that secreted by the worm. It is made of a leathery material, and has a stalk-like process at both ends.

Although, as stated above, the work of worms is, in the main, of great beneficial importance, it must be admitted that at times their presence is of a rather disadvantageous nature. On lawns in England, for instance, in situations kept continually moist, the amount of casting is so great that the level of the lawns is very much damaged, and the worms become a great nuisance. In such cases, watering the lawn with lime water will quickly bring the worms out of their burrows, and will kill them. Care must be taken not to use excessive amounts of the lime water, since otherwise the grass may be browned. If the lime water is fully saturated, it is best diluted with water before use, particularly if the lawn is dry.

A few words on the structure of earthworms may not be out of place here. The body is cylindrical and ringed, that is, it is divided into a number of segments. There is no distinct head portion, but the front end shows a thick lip overhanging the mouth, while the hinder end terminates bluntly. There are no definite appendages, but most of the segments are provided with little bristles, or setæ, which help the worm in locomotion. These bristles may be felt by passing the worm through the fingers, and can be readily seen with a lens. In the adult worm the saddle or girdle-like portion surrounding the body shows no segmentation externally, and is situated towards the front end of the body. The mouth is in the first segment underneath the thick lip, and the vent is in the last ring. The middle line of the back is distinguished by a clear red line. indicating the dorsal blood-vessel. If the animal is cut lengthwise along this line so as to expose the inside, it will be seen that the constrictions between the rings on the outside of the body correspond to partitions. dividing the worm into segments. The organs of the body are clearly visible passing through these partitions on their way from the front to the hinder end of the body. The food canal stands out as a tube filled with earthy material. The accompanying diagram (text figure 2) represents the front portion only of a worm that has been cut in this manner, and it will be seen that the food canal in this region is somewhat complicated, although beyond this it is a simple tube. The mouth (*B.C.*) is surrounded by fleshy lips (*C.T.*) and passes on through the throat (*P.H.*) to the crop (*C.R.*); this in turn leads on to the gizzard (*GIZ.*), which is very strong and muscular, and in

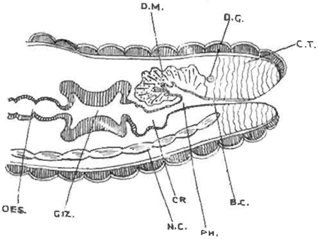


Fig. 2.

which most of the "chewing" of the earthy material takes place; this is followed by the intestine, a comparatively simple tube which continues to the end of the body. Digestion of the food takes place for the most part in the front portion of the canal. The blood of the earthworm is contained in a definite system of vessels running from the front to the hinder end, both above and below the food canal. At intervals these long vessels are connected to one another by smaller lateral branches encircling the digestive tube. The blood is coloured red. and is distributed all through the skin by a network of small vessels. There are no special breathing organs in the worm, aeration of the blood being mainly carried on through the skin. The nervous system consists of a small mass of " brain " tissue (*D.G.*) situated at the extreme front end of the body, above the food canal. This so-called brain is connected to a nerve chain (*N.C.*) that runs along the length of the body below the digestive tube. It can be distinguished as a thin whitish line near the lower surface of the body. A pair of tiny nerves passes off from this main chain in each segment of the body.

The earthworm has no eyes, but is very sensitive to light, which falls on its front segments. It is also sensitive to vibrations, although possessing no organs of hearing. There are no known organs of taste or smell; but the worm can "apparently distinguish red from green cabbage, and exhibits a decided preference for certain foods, such as carrot, celery, onion, and horse-radish."

It is of special interest to remember that the group of worms is the lowest and simplest collection of forms showing any difference between a front and a hinder end. Although there is as yet little external sign of cephalization, that is, of differentiation into a head region, still, the earthworm has a "brain," *i.e.*, a central nerve mass in this head region.

The distribution of earthworms is of particular importance as indicating past changes in the contour of the larger land masses of the earth's surface. Since the earthworm is killed by salt water, it is evident that it could only migrate, previous to man's intervention, along land connexions. The fact that we find allied and very

Fig. 3.—Giant earthworm (from McCoy's Prodromus).

specialized forms in the three Southern Continents and in certain islands around the Antarctic region undoubtedly points to the former land connexion of all these areas.

In conclusion, I would like to quote a few words on the distribution of our *larger* worms from the important monograph mentioned above. Considering the presence of closely-allied forms in South Africa, and in the southern parts of India and Ceylon, as well as in the south of Australia, Professor Spencer says of the earthworms that "the same laws which governed the distribution of other animals must also have governed theirs; and it is just possible that these great earthworms may be the lingering relics of a once widely-spread race of larger earthworms whose representatives at the present day are only found, as occurs with other forms of life, in the southern parts of the large land masses of the earth's surface. Possibly, careful search will reveal the existence of a large earthworm in the southern parts of South America."

FARM SANITATION.

(*Continued from page* 311.)

By C. H. Wright, Instructor in Plumbing, Swinburne Technical College, Hawthorn.

PART 3.—SEPTIC TANKS AND SEWERAGE CONNECTIONS.

As already mentioned, the discharge from a water-closet should not enter a drain through a disconnecting trap—only in exceptional circumstances.

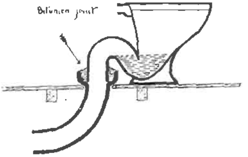


Fig. 24.—Showing method of connecting a pan to a drain pipe.

Fig. 24 shows the method of connecting a pan and trap to a drain in a detached outbuilding for servants' use. If the closet is built of woodwork, the stumps, soleplate, and plinths should be of red gum or jarrah, the closet must be made rigid and not be attached to fences or clothes posts. As the pan and trap are screwed to the floor, any settlement or shifting of the building is likely to cause a fracture.

Bathrooms often provide suitable accommodation for a water-closet. Whatever apartment is selected, it is important that one of its sides at least shall be an external wall. See that the door does not open directly into a living room.

A water-closet apartment should only be entered from a well lighted and well ventilated hall, passage, lobby, or staircase. The apartment should be provided with a window opening directly into the external air.

See that there are no vent holes in the ceiling whereby the air from this apartment may be conveyed through the ceiling to other parts of the house.

In addition to a window, the room should be provided with independent means of constant inlet and outlet ventilation by means of air bricks built in the external walls.

A spring should be fixed to the door of this room to insure that it always remains closed.

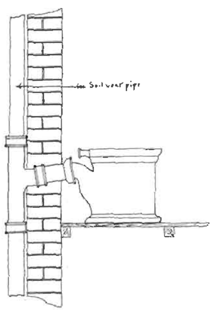


Fig. 25.—All water-closets inside a main building should be vented by a soil vent pipe.

All water-closets inside a main building should be vented by a soil vent pipe, as shown in Fig. 25.

Where the branch from the closet to the soil vent pipe is more than 3 feet in length, or where there is more than one closet, special provision should be made to prevent syphonage by back venting, as shown in Fig. 26.

Every closet pan should be furnished with a reliable flushing cistern of at least three gallons capacity. The cistern should be fixed at a height not less than 5 ft. 9 in. from the floor to the top of the cistern.

BATHROOM FIXTURES.

For the sake of cleanliness, appearance, and convenience, select fixtures that will enable the sweeper to get the brush behind; go in for open plumbing work.

Select a bath with a rolled edge and metal shower screen, a pedestal water-closet with a movable seat to enable it to be used as a slop hopper.

Have a lavatory basin supported on iron brackets with the waste and other pipes exposed, not closed in with boards to form a cupboard and hide from view any leakage from pipes or accumulation of rubbish that has a habit of collecting in such places.

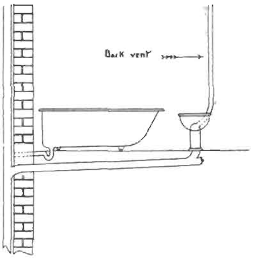
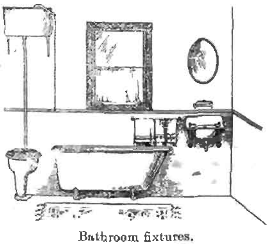


Fig. 26.—When a closet is more than 3 feet away from the soil vent pipe, it should be back vented to prevent syphonage of the closet trap.

HEIGHT OF VENTILATING PIPES TO DRAINS.

As before mentioned, there will always be a circulation of fresh air passing through a well-planned drainage system, the higher the educt vent above the induct vent, the better will be the circulation.

It is of the utmost importance that the position of the educt vent should receive careful consideration. The following suggestions will help as a guide.



Bathroom fixtures.

A main drain should always be vented at its upper end, the mouth of the vent pipe sh uld be at least 6 feet higher than any window, door, or other opening, within a distance of 30 feet. In any case it should be carried 2 feet above the highest point of the roof ridging.

Branch drains need not be vented if they do not exceed 15 feet in length.

Educt vents should be of 4 inches diameter and extended upwards as above, the induct vent if standing in open space more than 30 feet from windows and other openings need not extend higher than 9 feet.

When a sufficiently strong support cannot be obtained for the induct vent pipe, a plated and strutted 4-in. x 4-in. red-gum or jarrah post, sunk 2 feet in the ground, should be fixed to support it.

Remember it will always be easy to find contractors willing to instal sewerage connexions with less than the necessary number of vent pipes, separate wastes, &c., cheaply, especially where there is no Sewerage Board Inspector to satisfy. In country districts householders are an authority unto themselves, for upon them rests the responsibility of selecting a designer and contractor capable of installing proper and safe sanitary conveniences.

SEPTIC TANKS.

Septic tanks can be built in sizes ranging according to the sewage output of the homes they are to cope with.

The tank itself receives its flow at one end and discharges at the other, and no matter what the extent of its work may be, it usually has a capacity of 24 hours' sewage flow. Tanks are usually built in concrete or brickwork.

All sewage contains, within itself, necessary bacteria for its own purifications, but before sewage can be thoroughly purified by a biological process, it must undergo two changes. The solid organic matters must be split up and liquefied into simple forms, and the whole must be oxidized. The sewage must be dealt with first by anaerobic, and secondly by aerobic bacteria. And it has been proved that these organisms will quickly grow and multiply, and rapidly liquefy the solid matters, changing them into harmless forms.

As before mentioned, these organisms are classified into anaerobic, those whose work is performed in the absence of free oxygen, and aerobic those that grow or thrive only in the presence of oxygen.

The anaerobic treatment of sewage, which produces the liquefication of the solids, preferably takes place in a tank constructed in such a manner, that the velocity of the sewage on entering it is so reduced that the solids are deposited, and that the organisms can thrive in it, and liquefy the organic matters during its progress through the tank. Thus, for this to be efficiently performed, a tank should be large enough to hold 24 hours' supply of crude sewage.

When sewage has undergone anaerobic treatment for the specified time, it will be almost wholly without oxygen, that gas having been converted into carbonic acid gas by the decomposing organic matter, produced by the mixed organisms, which arrive in the sewage.

Sewage that has been passed through a properly-designed liquefying tank is so free from organic matter that if it is subsequently dealt with by aeration only, it rapidly becomes clear and free from smell.

The results of experiments go to show that the maximum purification is obtained in warm climates in much less time than in cold. For while a 24 hours' contact may be required in some parts of Australia, an eight hours' contact may be sufficient in the tropics.

Temperature has a marked effect on the amount of gas generated in the septic tank.

A septic tank at first acts as an ordinary settling tank. A proportion of the slowly-settling particles are carried over in the effluent, the remainder, together with the more freely-depositing particles, are, by the flow of the liquid, carried a variable distance along the tank before they become arrested on the bottom, where they form a layer of sludge. To this each succeeding volume adds its portion. In this way a rising floor of sludge is gradually formed, *which diminishes the liquid capacity*, and necessarily increases the rapidity of the flow of the liquid through the tank. In consequence, more and more of the suspended matters find their way out of the tank until the effluent becomes too foul. The tank operation has to be stopped, the accumulation has to be removed, and the tank cleaned out.

As before mentioned, septic tanks usually have a capacity of 24 hours' sewage flow. A tank of less size either becomes rapidly choked, and allows an amount of suspended matter to go forward in the effluent.

The first object in the septic tank is to reduce the flow of sewage, so that all solid matter may be deposited as quickly as possible. The position and construction of baffle walls is, therefore, a matter of considerable importance.

In small installations, the great difficulty is always the uncertain flow of sewage. It is, therefore, desirable to make a septic tank for small installations sufficiently large to counteract this difficulty.

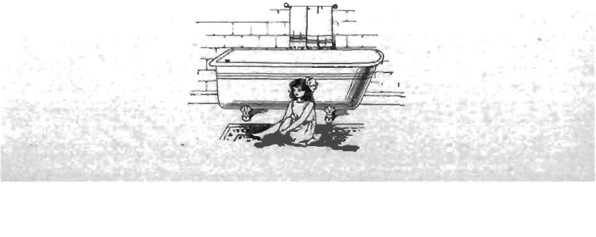
When it is necessary to clean out a septic tank care should be taken to always leave a small amount of deposit in the bottom for the immediate renewal of the liquefying action when the tank is put into operation again.

The bacteria will no doubt develop in an absolutely clean tank, but it will take time for them to accumulate to the quantity required for the maximum degree of purification.

It is important that a regular and systematic withdrawal of sludge be adopted, in order that the working efficiency of a bacterial tank can be maintained. If withdrawn in a haphazard way, allowing the operation to proceed until the tank is full, or the effluent foul, it cannot be regarded as satisfactory.

The withdrawal of sludge necessitates some method of sludge disposal. A reliable method is to convey it to trenches in the land, which are covered over as soon as the sludge will bear the weight of earth. In this way the nuisance from exposure of sludge is reduced to a minimum, and the danger which might otherwise follow from the drying and powdered sludge finding its way into the atmosphere is avoided.

(To be continued.)



WHEAT AND ITS CULTIVATION.

ESSENTIAL FACTORS IN SUCCESSFUL WHEAT CULTIVATION.

No. XIII.

(Continued from page 205.)

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

A considerable amount of attention has been given in previous articles to the structure, nutrition, composition of the wheat plant; the various methods of cultivation, seeding, manuring, and crop rotation found to be effective in our wheat areas, and the improvements that may be effected in the prolificacy of the wheat plant by systematic selection and cross-breeding. It may now be fitting to summarize the most important factors which make for success in the cultivation of wheat.

In considering such a summary, it is necessary to bear in mind, as has already been pointed out, that by far the greater portion of the wheat area in Victoria lies north of the Dividing Range, and in regions of relatively low rainfall. The average annual rainfall of the area in question varies from 10 inches to 20 inches. The following may be taken as the approximate average annual rainfall of the three great wheat districts of the State:—

Mallee	*From 10 to 14 inches.*
Wimmera	From 14 to 17½ inches.
Northern	From 14 to 21 inches.

The greater portion of this rain falls from April to October, and the late spring and summer are invariably hot and dry.

These districts produce over 85 per cent. of the wheat of Victoria.

FIRST FACTOR—EARLY FALLOWING.

One of the most essential factors in the raising of heavy wheat crops under these conditions is to fallow and fallow well. The whole trend of scientific teaching and practical experience is dead against the continuous cropping of wheat on the same land.

It is a matter of common observation that well-fallowed land in our wheat districts will grow bushels more wheat per acre than land that has been merely stubble ploughed. Experiments in the drier parts of the wheat belt and practical experience have both conclusively demonstrated that more wheat can be grown over a period of years on a given block of land by cropping it every other year than by *growing wheat continuously on the same land every year.* In these days of costly labour it is becoming more and more necessary to carry out a thoroughly efficient system of cropping. It does not now pay under Victorian conditions to raise small crops. The most profitable system of agriculture under existing economic conditions in the wheat belt is to raise the largest crops possible on such parts of the farm as are reserved for grain. The way to do this is to raise such grain crops less frequently, fallow, and *alternate* the growing of *forage* crops for feeding down with sheep and lambs with the cultivation of wheat. This is the keynote of successful wheat-farming in these areas.

It is often stated that the continual practice of bare-fallowing deprives the soil of organic matter—the soil's most valuable constituent—and, therefore, it may be supposed that bare-fallowing will gradually impoverish the land. This objection has already been considered (*vide* Journal, page 336, June, 1912), and, all that need be said here is, that if the land is impoverished, the fault lies not with the practice of bare-fallowing, but in growing too many grain crops, and carting them off the farm instead of growing them in rotation with forage crops and pasture for feeding down on the farm with sheep and lambs.

With the adoption of judicious rotation there need be no fear that the practice of fallowing will ultimately result in soil depletion. On the other hand, the alternation of wheat and bare-fallow ***without*** the intervention of forage crops or pasture is the straight road to soil exhaustion.

The advantages of the practice of bare-fallowing have already been set out in detail (pp. 331-336, *Journal* for June, 1912). The fundamental principle underlying the practice is that it conserves soil *moisture—the limiting factor for successful agriculture in an arid* country, and it enables a considerable portion of the rainfall of one year to be conserved in the soil through the summer, and thus to augment the supplies which fall subsequent to the sowing of the crop.

In order to illustrate this, the results of one of a number of investigations made during the past summer on fallowed and non-fallowed land may be quoted.

At Longerenong, on April 1st, 1913, the average moisture content of a block of fallowed land taken 4 feet deep amounted to 32.72 per cent., whilst that of a non-fallowed block 10 yards distant was 26.12 per cent.—a difference of 6.6 per cent. of the total weight of soil (*vide* Appendix A). This, translated into familiar terms, means that the fallowed soil had an amount of moisture over and above that of the non-fallowed block equivalent to 4.07 inches of rain. That is to say, the crop sown on the fallowed land will be able to draw on 4.07 inches more moisture than the crop grown on non-fallowed land. The water requirements of crops grown under Australian conditions have not yet been determined. An exhaustive investigation to test this point is in progress at the Central Research Farm, Werribee, and the Rutherglen Experiment Farm.

Under American conditions King* finds that 7½ inches of water over one acre sufficient for the requirements of at least a 30-bushel crop of wheat provided *all* the moisture is utilized by the crop. Assuming these figures to hold here, the extra amount of moisture conserved in the soil at Longerenong on the fallowed block is sufficient to produce 16.28 bushels of wheat more than the crop that could be raised on the non-fallowed block.

If fallowing only resulted in the conservation of soil moisture it would be sufficient to justify its practice in an arid district.

* King—*Irrigation and Drainage*, p. 97.

There are other incidental advantages accruing from the practice. Chemical and bacterial activities are greatly stimulated through the summer months by the moisture conserved in the soil. The drying out of the soil results in the cessation of all bacterial life. The commingling of air and moisture, consequent on summer tillage operations, and the high soil temperatures in Northern Victoria, enable bacterial and chemical activity in the soil to proceed at a rate unknown in the humid countries of the world.

As a result, a considerable portion of the dormant plant food is gradually liberated, and made available for the succeeding wheat crop. Not the least important of these activities are those due to the nitrifying organisms (*vide Journal*, September, 1912, p. 545). And these may be taken by way of illustration. In order to present some tangible evidence of their activity in a well-fallowed soil, let us see how much nitrate was produced as a result of their energy at Longerenong last season.

On 1st March, 1912, there were present in the first 4 feet of the fallowed block 141.82 lbs. of nitrate-nitrogen per acre, whilst the non-fallowed land, 10 yards distant, was found to contain only 47.74 lbs. Assuming that nitrate of soda contains 15 per cent. of nitrogen, it follows that there was formed as a result of bacterial activity an amount of nitrate in the fallowed soil equal to 632 lbs. of nitrate of soda per acre. If a farmer wanted to purchase this nitrate he would require to pay £4 10s. for it. Other important plant foods are made available through the practice of fallowing.

Other advantages are that by bare-fallowing the work of the farm may be distributed evenly throughout the year, and this enables the farmer to have large areas of land in the highest state of tilth ready for sowing in the autumn.

NOW IS THE TIME TO FALLOW.

When it is realized that the main object of fallowing is to conserve moisture, it will be obvious that the sooner fallowing is commenced the more moisture can be conserved, and the better the ultimate prospects of success.

Now is the time to fallow, and now is the time to lay the foundations for a heavy wheat crop in 1914. The seeding will have been finished in the wheat areas by June, and during July and August the ploughs should be in full swing and the bulk of the fallowing overtaken.

It has been repeatedly demonstrated that land fallowed early gives in normal years heavier crops than land fallowed late, whilst in dry seasons the crop grown on early fallowed land is worth bushels per acre more than that raised on land fallowed late.

So impressed are some farmers with the benefits of early fallowing that many now run over the stubbles in February and March with a disc, and plough immediately after seeding. The early discing assists in conserving moisture, allows the autumn rains to readily penetrate the soil, facilitates subsequent ploughing operations, and promotes the early germination of the weeds.

In fallowing in winter, give a good stiff furrow, the depth depending on the nature of the soil and its previous treatment.

Generally speaking, the earlier-ploughed land may be allowed to remain in the rough till the latter end of August, when it should be worked down with the scarifier. In the case of land ploughed in spring, it is advisable to follow close on the ploughs with either harrows or cultivator, so as to lose as little moisture as possible. From spring-time until seed-time the grower will need to jealously guard the conserved stores of soil moisture. Evaporation will be reduced *to a minimum by keeping the surface loosely mulched to a depth of* 3 inches by scarifying as often as is necessary. The necessity for scarifying arises, whenever, owing to summer rains, the loose surface mulch is in danger of consolidation and compaction.

SECOND FACTOR.—THOROUGH CULTIVATION.

The peculiarities of the climate of our wheat areas are such as to make thorough tillage a prime factor for successful cropping.

The most casual of observers cannot fail to notice each season the most marked contrasts between the crops of various growers in belts of apparently identical country. While these differences may often be accounted for by the quality of the soil, it more frequently happens that they are due to better cultivation.

The raising of successful crops in regions of relatively low rainfall requires, above all things, thorough tillage.

It should be borne in mind that any year may be a dry year, and, therefore, such methods should be followed as will insure a successful crop if the rainfall is below the average. The same methods which will secure a favorable crop in a dry year will also secure highly profitable crops in favorable seasons.

The importance of early fallowing has already been discussed. But early fallowing is of little use if the land is not properly cultivated through the summer.

Reference to Appendix A—dealing with the amount of moisture conserved by fallowing—will show that a *neglected* fallow is little better than autumn-ploughed land. The main purpose of fallowing is missed if the summer cultivation is withheld. The successful wheat-growers in the very dry belts of South Australia, where the rainfall is frequently less than 10 inches per annum, know from long experience that the thorough cultivation of early fallowed land is the only way to secure a payable crop in a dry season. In these areas the cultivators may be seen at work throughout the summer months. Thorough cultivation is equally necessary in more humid areas, but for somewhat different reasons. There is an old saying that "tillage is the best manure." It is well known that in most agricultural soils there are enough mineral plant foods to supply the needs of heavy crops for hundreds, if not thousands, of years. Why then should we require to apply manures? Because by far the greater part of the plant food is locked up in the form of insoluble mineral combinations. It is well that this is so, otherwise these constituents might have been leached out of the soil long ago. Now, the real source of a soil's fertility must be looked for in the vast stores of plant food lying dormant in the soil, and tillage and thorough cultivation are the means by which this plant food is made available for the use of crops. Jethro Tull recognised this fact over 150 years ago, and founded his *Horseshoeing Husbandry* on it.

The soil contains enormous reserves of dormant plant food, and our aim should be to render as much of this available by thorough cultivation as possible. The more thoroughly the soil is tilled the more available plant food will be formed, and the less will be the manure bill. It is in this sense that "thorough tillage is a substitute for manure."

In the case of the wheat plant, other results accrue from good tillage which make for successful crops. Every experienced wheat-farmer knows how important it is to have a firm, finely-divided, consolidated seed-bed for the wheat crop. This consolidation of the seed-bed cannot be secured in a week or a month. Time is a necessary factor for the process, and the consolidation is effected by the packing action of the rain, and the frequent stirring of the soil. Such a seed-bed, resting on a moisture-laden subsoil, is in the very best condition not only for resisting droughty spells, but also for yielding heavy crops. The advantage of a fine firm seed-bed in a dry season is specially pronounced. The finely-divided soil particles act like an unbroken series of force pumps on the storage reservoir below, and keep the roots rapidly and constantly supplied with moisture.

On the other hand, in a loose, open, cloddy seed-bed, the stores of soil moisture cannot rise freely and rapidly by capillarity, and in times of stress the crop will give out. Such a seed-bed is the invariable result of hasty preparation of the soil.

The writer has, during the past seeding, observed in various parts of the State thousands of acres of crop sown straight on the sod of newly-ploughed stubble land.

The patchy germination of these crops, the spindly early growth, and the lack of that deep vigorous green characteristic of young wheat when sown on well-fallowed land, do not augur well for heavy yields.

The best preparation for a wheat crop in districts with a limited annual rainfall, the bulk of which falls between April and October, is to fallow early, fallow well, keep the soil well cultivated through the summer, and be ready to concentrate the whole strength of the farm on the drills and cultivators when the first favorable autumnal rains fall.

THIRD FACTOR.—SYSTEMATIC ROTATION.

Continuous cropping of wheat on the same land year after year, and the biennial system of wheat and bare-fallow alternately have been shown to be undesirable, and to fall short of the requirements of a permanent system of agriculture, inasmuch as these practices lead to the depletion of the organic matter of the soil, and consequently, its fertility.

The outstanding weakness of our system of wheat culture is that insufficient provision is made for the restoration of the organic matter of the soil. It is known that the losses of organic matter due to fallowing in an arid climate are very considerable. The functions of importance of organic matter have already been dealt with, and all that need be said here is that the value of a soil for agricultural purposes depends in no small measure on its organic content. Deprive the soil of its organic matter and you have rock dust, and what farmer would care to farm a soil made of freshly-pulverized bricks!

The absence of organic matter makes a soil sterile, its presence in quantity is a guarantee of fertility. It greatly increases the water-holding capacity of a soil, vastly improves the texture and mechanical condition, and is the material round which all biological activities in the soil are centred.

The most material problem ahead of the agriculturists of this State is to evolve systems of cropping which will give the maximum yields possible under existing climatic conditions, and at the same time maintain, and even increase, the soil's fertility.

The productivity of virgin land as compared with land cropped with cereals for several generations is a matter of common observation. The difference in the fertility is almost solely due to the depletion of organic matter. Were it due to the loss of mineral matter we could immediately restore the soil to its pristine fertility by the application of a sufficiency of artificial fertilizers.

There are only three ways in which organic matter of the soil may be increased:—

(1) The application of stable or farmyard manure.
(2) Ploughing in of green manures.
(3) Pasturing and feeding down of forage crops with stock.

The first is impracticable on a wheat farm in Victoria under *existing* economic conditions.

The second method is very largely practised in orchards and vineyards with admirable results, but it has not yet been used by the Victorian wheat-farmer on a large scale, though such a practice is very common in arid wheat areas in other parts of the world.

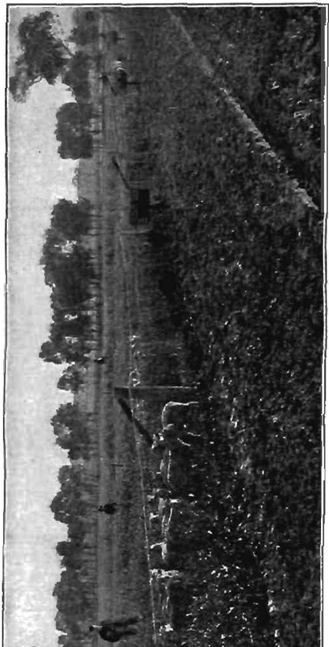
The results of the green manurial experiments in progress at the Werribee and Rutherglen Experiment Farms will be of interest in this connexion, and demonstrate the value of this practice in wheat-growing.

The introduction of pasture into the rotation is now very common in Victoria. Every wheat-farmer should keep sheep, and either grow wool or raise fat lambs. For this purpose a considerable area of the farm is required for pasture. Under these circumstances, the commonest rotations practised are, wheat, pasture, bare-fallow; and wheat, oats, pasture, bare-fallow.

These rotations require a minimum of labour, and are well adapted for districts in which holdings are large, land is relatively cheap, and the rainfall is scanty. They fit in well with existing economic conditions in our drier wheat areas, and especially on mixed farms where sheep are kept in numbers.

It is very questionable whether in these rotations the gain in organic matter is equivalent to the depletion during the period of fallowing and cropping. In most districts, the grass and herbage which springs up spontaneously from the wheat stubbles is of very little grazing value, especially if the land is properly fallowed, for the object aimed at in fallowing is to suppress all weeds, and to allow the wheat crop to have undisputed possession of the soil.

That this fact is recognised is seen by the practice followed in the Wimmera, where, instead of relying on this adventitious herbage springing from the wheat stubbles, a crop like Algerian oats is disced



GENERAL VIEW OF THE FEEDING-OFF EXPERIMENTS, RUTHERGLEN EXPERIMENTAL FARM.

in on the stubbles in March and April to produce grazing for sheep.

In the more favored districts, however, something more than one crop in three or four years is possible. Here peas, rye and vetches, rape, mustard, kale, and mixed forages can be grown successfully in addition to cereal crops, and in *these cases wheat should* be grown in alternation with forage crops for feeding down on the land with stock. Wherever these forage crops are grown in regular rotation with wheat the maintenance of fertility can be assured.

A green crop contains 95 per cent. of its total solid matter from the carbonic acid gas of the air, and only 5 per cent. from the soil. When a green crop is fed to stock the greater portion of the organic matter, and a considerable proportion of the contained mineral matter is returned to the soil. Thus, by the feeding down of green crops with stock, the organic *content of the soil is* greatly increased, for the organic matter returned in the animal excrements was obtained by the crop from the air.

The total amount of *green forage produced* is usually many times *greater* than the total amount of herbage and grass which springs up on the uncultivated wheat stubbles, and for this reason the fertility of the soil will be far more rapidly improved under a system of feeding down of forage crops than under ordinary pasturing.

Some idea of the grazing value of such forage crops as compared with the value of ordinary pasture may be seen from the results of some feeding-off tests, conducted at the Rutherglen Experiment Farm last season, and given in Table I In considering the figures, it is necessary to bear in mind that the season was most unfavorable for forage crops. These figures are only put forward tentatively, and it is proposed to continue the investigation for a number of years before any conclusions are drawn.

TABLE I.

FEEDING-OFF TESTS.

No. and Plot.	No. of sheep on plot.	Weight of sheep on plot.	Weight of sheep off plot.	Increased live weight of sheep per plot.	Days on plot.	Weight of green feed per acre.			Increase of live weight of sheep per acre.
		lb.	lb.	lb.		tons	cwt.	lbs.	lb.
1. Rape ..	19	1,381	1,742	361	21	8	18	104	722
2. Rye and Vetches	19	1,363	1,603	240	21	5	10	6	480
3. Pease ..	25	2,451	2,607	156	14	6	10	96	312
4. Barley ..	19*	1,326	1,635	309	25	7	10	80	658
	5†	480	500	20	14				
5. Beerseem ..	10	1,001	1,100	105	14	1	11	6	210
6. Natural Pasture, 1 cwt. super.	10	731	782	51	12		..		102
7. Natural Pasture, unmanured	10	735	770	35	12		..		70

* First Feed. † Second Feed.

Seven plots of half-acre each were marked out and fenced, and five were sown in May with rape, rye and vetches, peas, barley, and beerseem respectively. These were compared with two plots of natural pasture, one of which received a dressing of 1 cwt. of super.

The sheep used were uniform in grade, and weighed on and off each plot. The increase in live weight and the grazing value of the various plots were thus obtained. In the case of rape, rye and vetches, peas and barley, the grazing value of the crop was at least three to four times that of the natural pasture. Had wheat stubbles been chosen instead of natural pasture the differences in the grazing value would have been still greater.

Not only is it possible to extract higher returns per acre by the growing of forage crops instead of relying on the pasture following the wheat stubbles, but the organic content of the soil is increased, and what is more important, the yield of wheat grown in such a rotation will be raised. Good wheat land in the more favored districts of the State should be capable of growing more than one crop in three or four years. If it cannot do so, then the outlook is not encouraging for our increasing population. The growing of special forage crops for feeding down with stock seems to indicate the direction in which our rotation systems may be improved.

FOURTH FACTOR—RATIONAL MANURING.

The guiding principle in the application of manures is to use them as a *supplement* to the natural soil resources, and not as a main source of fertility. Most good agricultural soils have vast stores of dormant plant food, and our aim should be to develop as much as possible of this plant food lying latent in the soil by thorough cultivation, and supplement any deficiencies with fertilizers.

What these deficiencies are can best be found out by actual experiment, and having determined these deficiencies, the problem for each farmer is to find out the most profitable and economic way of supplying the soil's needs.

Speaking generally, the most marked deficiencies of Victorian wheat soils are organic matter and phosphoric acid. The problem of restoring organic matter was considered in the previous section.

So far as phosphates are concerned, numerous experiments and practical experience have demonstrated beyond doubt that the most profitable method of application is in the form of superphosphate. It gives the best results in normal seasons when the seed and manure are drilled in together at seed-time. If scarified in, some weeks or months before seeding, heavier applications will be required to produce the same effect as when sown with the seed. The amount to be used with greatest profit depends on the rainfall and the nature of the soil. In districts of very light rainfall, as little as 30 to 40 lbs. per acre are used. In moister districts, and especially on limestone soils, much heavier dressings may be applied. Heavy dressings may be used with profit on soils rich in lime. Dressings ranging from 1 to 2 cwt. per acre are regularly used on many limestone soils in South Australia, and such heavy dressings have a most stimulating effect on the quality of the subsequent pasture.

It may be interesting to note that the average amount of superphosphate used per acre during 1911 in the wheat districts of Victoria was as follows:—

Mallee	47 lbs.
Wimmera	59 lbs.
Northern	61 lbs.
North-East	71 lbs.
Western District	95 lbs.

Continuous applications of superphosphate will not, as is often supposed, "exhaust" the land. It will merely bring about a state of affairs in which an excess of phosphates is present, and the soil will not then respond to further applications of phosphate. In all districts with a light rainfall, superphosphate is likely to continue the most profitable of all phosphatic manures. In the wetter areas, and more especially on soils deficient in lime, basic slag, or Thomas phosphates, is a valuable manure. It has a particularly stimulating effect on the pastures. A practice often followed is to sow a citrate soluble phosphate like basic slag on the fallows during the summer cultivation, and to supplement this by a small dressing of superphosphate at seed-time.

Bonedust and ground rock phosphate have given negative results in experimental trials. Both are very insoluble, and, in the drier areas, are of very little value for securing immediate results.

Many of the phosphatic guanos on the market are insoluble, and only very slowly made available in the soil and are consequently little better in their action than bonedust or ground rock phosphate. There are other phosphatic guanos, however, which are very finely divided, and which contain a considerable proportion of citrate soluble phosphate. These are similar in their action to Thomas phosphate.

Nitrogenous manures have very little effect on the wheat crop on areas north of the Dividing Range. Owing to the high soil temperatures during the summer months, the moisture conserved in the fallows, and the comparative absence of summer rains, combined with the frequent aeration of the soil as a result of frequent summer tillage, nitrification proceeds at an exceedingly rapid rate in our northern soils, and to this must be ascribed the non-necessity for nitrogenous manures.*

CLOSER VIEW OF THE FEEDING-OFF EXPERIMENTS, RUTHERGLEN EXPERIMENTAL FARM.

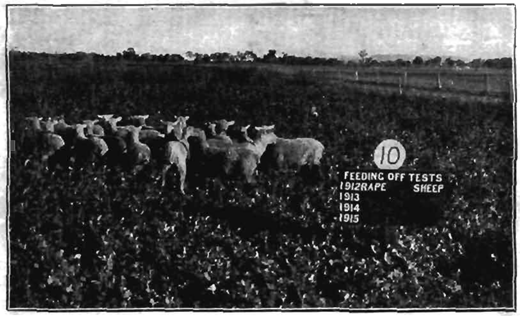
In the wetter Southern and Western Districts the same climatic advantages as regards nitrate production in the soils do not hold, and here the need for nitrogenous manures has become apparent. The needs of the north and south in this respect have been made subjects of separate inquiry by this Department. Experiments conducted in 1902 and following years showed that the addition of sulphate of ammonia gave an increase of only 3 lbs. of wheat per acre on an average of 94 farms, and in no single case of the twelve local groups into which the 94 farms were divided did the nitrogenous manure repay the cost of its purchase. In the moister southern districts, the need for soluble nitrogenous manures was apparent, for on an average of 50 farms tested, 1 cwt. of nitrate of soda increased the yield of hay by nearly 6 cwt., and 1 cwt. sulphate of ammonia by exactly 8 cwt.

* Vide Appendix "B" for fuller details.

We may say, therefore, that in the drier districts the use of nitrogenous manures does not seem to be called for, and they may even prove harmful. In the wetter districts a limited call for nitrates at present exists, and this may be expected to develop as cultivation becomes of older date.

Potassic manures have not been found of much value in the wheat areas; mainly, it would appear, because of the high potash content of the majority of the soils.

Lime occupies a peculiar position. There are whole districts in which the lime content of the soil is considerable, and applications of lime must, therefore, be considered unnecessary. This is notably the case with the Mallee and Wimmera. On the other hand, south of the Ranges, the Goulburn Valley, and the north-east, the soils are generally deficient in lime. On these latter, an application of lime should prove profitable. Experiments conducted at Rutherglen last season indicate that good results might be expected to follow the application of lime in the north-east.



FEEDING-OFF OF RAPE PLOT WITH SHEEP.

The following yields were recorded on the Permanent Experimental Field, Rutherglen, with Zealand blue wheat:—

No manure	11.4 bushels per acre.
Superphosphate, 1 cwt.	16 bushels per acre.
Superphosphate 1 cwt., 5 cwt. lime ..	17 bushels 24 lbs. per acre.
Superphosphate, 1 cwt., 10 cwt. lime ..	18 bushels 20 lbs. per acre.
Superphosphate, 1 cwt., 20 cwt. lime ..	20 bushels 16 lbs. per acre.

While the extra returns obtained are not sufficient to pay for the cost of application, it is probable that the benefit will be distributed over a number of years, and that the liming will thus ultimately prove profitable. It may be added that the season was very unfavorable, as practically no rain fell from January to the middle of June. The effect of the liming will be better seen when these plots again come under crop. The need for lime varies with the district, and careful experimental work is necessary to determine the most profitable form, rate, time, and mode of application.

FIFTH FACTOR—SYSTEMATIC SEED-SELECTION.

A great advance will be made in our wheat industry when the importance of selection of seed is fully appreciated. The improvements in our system of wheat-growing during the past decade have had reference mainly to the improvement of the plant's environment. Very little attention, however, has been given to the improvement of the plant itself.

In order to get the best results from early-fallowed, carefully-worked, properly-rotated, rationally-manured land, the seed sown should be the best the farmer can secure.

The first requirement is to secure varieties suited to the climatic and soil conditions. Of the large variety of wheats at the command of the farmer only relatively few are suited to his conditions. In the dry, hot districts, early maturing wheats possessing a minimum of flag, and a maximum of grain are required. Steinwedel, King's Early, Gluyas, Cumberland, and Federation are examples of such wheats. In moister districts, later maturing wheats like Yandilla King, Marshall's No. 3, Genoa, and Dart's Imperial will generally be found more profitable.

But the important practical point is, that once the farmer has secured varieties known to be of value under his conditions, he should set to work like a breeder of stock, and get the very best possible out of the chosen variety. This can only be done by rigorous systematic selection. This practice has already been discussed in detail.*

It may be confidently stated that such selection will increase the cropping capacity of any given variety at least 15 to 20 per cent., and will render quite unnecessary the periodical "changing of seed" and counteract any tendency to degeneration in our ordinary wheat varieties. Everybody is familiar with the value of selection when applied to the evolution of laying strains of White Leghorns, and to the improvement in the milking capacity of a dairy herd.

Equally effective results can be secured in raising the prolificacy of our wheat varieties.

The results obtained by selection on oats, barley, and potatoes have already been shown.† So far as wheat is concerned, at Longerenong, last season, seed of Federation selected on lines laid down in article IX. gave 43.2 bushels per acre, whilst ordinary Federation seed, sown alongside, under identical conditions, gave 34.5 bushels. The value of this increased yield, at 3s. 4d. per bushel, was equal to 29s. 2d. per acre. Similar results can be obtained by any farmer who chooses to take the care and attention necessary for the process.

Thorough grading of the seed is also vitally necessary on every wheat farm. Grading of seed with a good machine not only removes weed seeds, grains of other cereals, rubbish, damaged and cracked grain, and thus separates material of considerable commercial value for feed, but of negligible value for seed, but the graded residue is more prolific than the ungraded product.

For the trifling expenditure of 6d. per bushel, graded seed may be obtained which will yield 10 to 15 per cent. more wheat per acre

* *Vide* Wheat Improvement, *Journal of Agriculture* (Victoria), Jan. 1913, pp. 38–56.
† *Vide* Wheat Improvement, *Journal of Agriculture* (Victoria), Jan. 1913, p. 51.

than ungraded seed. This fact has been demonstrated repeatedly by various experiment stations, and is confirmed by results obtained last season at the Wyuna Experiment Farm. Thus, grain from the harvester was separated by the grader into three distinct grades, two of which gave increased returns of 2 bushels 39 lbs. and 2 bushels 26 lbs. per acre. An equivalent of 8s. 10d. and 8s. 1d. per acre respectively, and a low-grade sample which would normally be reserved for feeding purposes.‡

APPENDIX "A."

THE AMOUNT OF MOISTURE CONSERVED BY FALLOWING.

An investigation was commenced at Longerenong last season to determine the variation in the moisture content and the nitrate content of soils when fallowed, cropped, and pastured. For this purpose two even strips of land were selected in May; one of these had been lying in fallow, and the other was down in pasture. The fallowed portion was subsequently sown with wheat. Soil samples of the fallowed, and pasture plots to a depth of 5 feet were taken on 1st June, and on analysis were found to contain the following amounts of moisture:—

TABLE I.

PERCENTAGE OF MOISTURE IN FALLOWED AND PASTURE LAND.
LONGERENONG.

	Fallowed. Per cent. (on dry soil).	*Non-fallowed.* Per cent. (on dry soil).
0-12 inches ..	29.57 ..	18.99
12-24 inches ..	36.02 ..	23.40
24-36 inches ..	29.41 ..	24.87
36-48 inches ..	33.21 ..	29.00
48-60 inches ..	35.93 ..	32.08
Average first 5 feet ..	32.8 per cent.	25.6 per cent.

The soil samples were taken in the following manner:—A trench, the width of the spade, and 5 feet 6 inches deep, was sunk on each plot. One narrow edge of the trench was plumbed off, and a spit of soil 1 foot deep and 2 inches thick was quickly removed to a smooth board, and after being thoroughly mixed, was transferred to a hermetically-sealed jar. Various soil samplers were tried, but owing to the sticky nature of the soil the slower method of sinking trenches was adopted.

During the first week in September the cropped plot was divided into three portions; on one of these the crop was permitted to grow, the remaining two portions were ploughed and cultivated. One of these plots, "the neglected fallow" plot, received no further cultivation. The other plot was cultivated as often as the fallow land in the vicinity was worked. Two months later soil samples on the "worked fallow," "neglected fallow," "cropped land," and "pasture land"

‡ Treatment of Seed Wheat, *Journal of Agriculture*, April, 1913.

were taken to a depth of 4 feet. The following table summarizes the results:—

TABLE II.

AMOUNT OF MOISTURE IN LAND VARIOUSLY TREATED, 1ST NOVEMBER, 1912—LONGERENONG.

—	Worked Fallow.	Neglected Fallow.	Cropped Land.	Pasture Land.
	per cent.	per cent.	per cent.	per cent.
0–12 inches ..	24·83	17·46	19·21	24·31
12–24 ,, ..	27·05	24·88	24·72	27·91
24–36 ,, ..	30·24	27·88	31·00	26·31
36–48 ,, ..	34·74	31·46	33·82	29·47
Average first 4 feet ..	29·21	25·42	26·69	27·00

The process of soil sampling was repeated each month until 1st April, 1913.

The following table summarizes the results:—

TABLE III.

SEASONAL VARIATION OF THE MOISTURE CONTENT IN SOILS VARIOUSLY CULTIVATED (LONGERENONG, 1912-13).

(Average of 4 feet.)

—	Plot 1—Worked Fallow.	Plot 2—Neglected Fallow.	Plot 3—Cropped Soil.	Plot 4—Pasture Land.
	per cent.	per cent.	per cent.	per cent.
June, 1912 .	32·8	32·8	32·8	25·6
November, 1912	29·21	25·42	26·69	27·0
December, 1912 ..	31·89	27·27	25·44	29·22
January, 1913 ..	30·45	27·89	22·96	26·49
February, 1913 ..	33·96	25 01	22·41	22·57
March, 1913 ..	32·58	20·61	27·14	25·00
April, 1913 ..	32·71	27·16	26·70	26·12

It is apparent, from these figures, that the moisture content varies widely from month to month. The reason for the variation is twofold—the unequal amounts of evaporation from the four plots, and the additions to the soil content in the form of rain. The former depress the moisture content, whilst the latter augment it. Table IV states the monthly rainfall at Longerenong from June, 1912, to March, 1913, inclusive. It will be seen that the rainfall was very unequally distributed over the months under review.

TABLE IV.

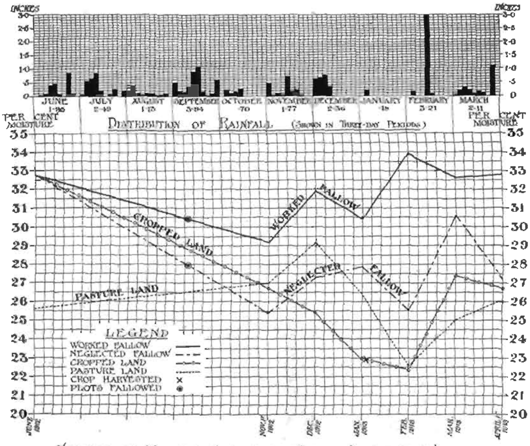
RAINFALL AT LONGERENONG, 1ST JUNE—30TH APRIL.

June ..	.. 1.95	December ..	.. 2.36
July ..	.. 2.49	January ..	.. 0.18
August ..	.. 1.13	February ..	.. 3.21
September ..	.. 3.94	March ..	.. 2.11
October ..	.. .70	April ..	.. .87
November ..	.. 1.77		

The variations in the four plots may be more clearly followed by showing the results graphically, and considering them in relation to the rainfall.

TABLE V.

GRAPHS SHOWING THE DISTRIBUTION OF THE RAINFALL IN THREE-DAY PERIODS, AND THE VARIATION IN THE AVERAGE MOISTURE CONTENT OF LAND VARIOUSLY CULTIVATED.



VARIATIONS IN MOISTURE CONTENT OF SOILS (LONGERENONG)
AVERAGES OF FIRST FOUR FEET

From these graphs it will be seen that the fallowed plots had in June, 1912, an average moisture content of 32.8, whilst the pasture land contained only 25.6 per cent. On 1st November, the variations in moisture content of the four plots were marked, but the differences were smaller than at any subsequent period. The worked fallow plot contained 2.21 per cent. more moisture than the pasture plot, and 3.79 per cent. more than the neglected fallow, which at this time had a hard crusty top. From this point the differences in the plots increase until 6th February, when they reached the maximum. The moisture in the cropped plot gradually fell from 32.8 per cent. to 22.41 per cent. when the crop was harvested. The heavy rainfall in February gave a marked increase of moisture content to all plots save the "worked fallow." Investigation showed, however, that on this plot the excess moisture had penetrated below 4 feet.

At the end of the period under review the moisture content of the fallowed land averaged 32.71 per cent., practically the same as it was ten months previously, whilst the "neglected fallow" plot, and the "pasture plot," were 27.16 per cent. and 26.7 per cent. respectively.

In other words, the fallowed plot contained on 1st April, in the first 4 feet of soil, an amount of water over and above that of the neglected fallow plot, equal to 5.55 per cent. of the *total weight* of the soil.

Expressing these figures in terms of moisture content, it means that if the amount of moisture in the neglected fallow be reckoned at 100, the amount contained in the cultivated fallow would be 120.6, *i.e.*, the cultivated fallow land contains 20.6 per cent. more water than the neglected fallow.

We may express these figures in another way. The cultivated fallow contains an extra amount of water over and above that of the neglected fallow equivalent to 5.55 per cent. of the total weight of the soil, and an amount over and above that of pasture land of 5.59 per cent. of the total weight of the soil.

Reckoning the weight of 1 acre-inch of water at 101 tons, this extra water conserved by the fallowed plot as compared with the pasture plot is equivalent to 4.14 inches of rain. The cultivated fallow has also conserved an amount of extra water equivalent to 3.43 inches of rain, as compared with the neglected fallow.

APPENDIX "B."

VARIATIONS IN NITRATE NITROGEN IN LAND VARIOUSLY TREATED.

The soil samples from the four plots already described were analyzed for nitrate nitrogen. The following table gives a summary of the nitrate content of the first 4 feet of representative soil from each plot during the period, June, 1912—April, 1913:—

The analyses were conducted by Messrs. P. R. Scott (Chemist for Agriculture) and W. C. Robertson (Supervising Analyst).

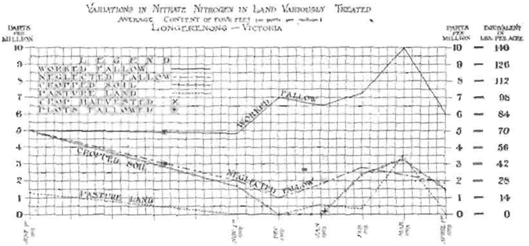
TABLE VI.

SHOWING NITRATE-NITROGEN IN SOILS VARIOUSLY TREATED (AVERAGE OF 4 FEET).

(In parts per million.)

Month.	Plot 1—Worked Fallow.	Plot 2—Neglected Fallow.	Plot 3—Cropped Land.	Plot 4—Pasture Land.
June, 1912 ..	5·13	5·13	5·13	1·21
November, 1912 ..	4·96	2·01	1·91	Nil.
December, 1912 ..	7·09	1·10	Trace	Nil.
January, 1913 ..	6·54	1·76	Trace	·67
February, 1913 ..	7·3	2·74	2·36	·41
March, 1913 ..	10·13	2·27	3·27	3·41
April, 1913 ..	5.85	1·81	1·43	Trace

The results will be clearer if they are reduced to graphical form, and the nitrate content is calculated to an equivalent of lbs. per acre of soil 4 feet deep. The following graph gives such results:—



These results may be summarized thus:—

(1) On a plot which was kept well fallowed through the summer there was a maximum both of moisture and nitrate-nitrogen throughout the period. In the first 4 feet of soil on this plot the maximum amount of nitrate was found in March, when no less than 141.9 lbs. per acre were present, = 10.13 parts per million. Further, the greater part of the nitrate found at any one period was invariably confined to the surface layers. Thus, the vertical distribution of this nitrate-nitrogen on 1st March was as follows:—

0–12 inches	..	24·07 parts per million	=	84·2 lbs. per acre
12–24 ,,	..	8·66 ,, ,,	=	30·3 ,, ,,
34–36 ,,	..	4·40 ,, ,,	=	15·4 ,, ,,
36–46 ,,	..	3·40 ,, ,,	=	12·0 ,, ,,
Average Content..		10·13 ,, ,,	=	141·9 ,, ,,

At the beginning of April, the amount of nitrate on this plot was 81.9 lbs. per acre, nearly three times as much as that found in any of the other three plots.

(2) In a "neglected fallow" both the moisture content and the nitrate content are very much lower than in a well-worked fallow. So far as the nitrogen content is concerned, it would appear as if a hard, crusty fallow contained about the same amount of nitrate as stubble land in the late autumn.

(3) The nitrate content of the cropped plot gradually declined till December, when it reached zero. It remained depleted of nitrate-nitrogen until the crop was removed (January), when it gradually improved.

In January, the surface foot of soil contained only 12.70 per cent. of moisture, and a mere trace of nitrate. The February rains (3.21″) brought the moisture content of the surface foot up to 28.69 per cent., and the average nitrate content to 3.27 parts per million, after which it steadily declined to 1.43 parts per million, an equivalent of 20 lbs. per acre.

(4) The pasture plot showed the widest variation. It gradually declined from 1.21 parts per million to zero. From November to December the nitrate content was at a minimum, after which the amount steadily rose till on the 1st March it reached 3.47 parts per million. On 1st April only a trace of nitrate was found.

Incidentally these results throw much light on the question of fertilization of our wheat crops in the arid areas. So long as bare fallowing is practised, it would appear that nitrogenous manures are unnecessary. The bare-fallow plot contained throughout the year far more available nitrogen than is required to satisfy the needs of the heaviest wheat crop that could be grown on a 20-inch rainfall. It would appear that, although our soils are not so well supplied with *total* nitrogen as those of Europe and America, they contain, when well fallowed, a larger proportion of *available* nitrogen than is usually found in far richer soils. The explanation for this is to be found in the unexampled activity of the nitrifying organisms in our northern wheat soils. Under the stimulus of moisture conserved in a good bare fallow, and the free permeation of air allowed when the soil is well mulched, combined with the high soil temperatures ruling in our warm climate, the nitrifying organisms have three conditions essential for perfect development. On the other hand, the exclusion of air and low temperatures hinder their development and frequently promote the opposite process, denitrification. The extent to which these factors aid or hinder this process is being made the subject of further investigation.

(6) Tests such as these could be carried out to much better advantage if the soil samples could be taken from specially-constructed drain-gauges, where the whole body of the soil would be more or less under proper control. Such drain-gauges are costly to construct, and, though they are invaluable for the accurate observation of soil changes, they make the soil conditions somewhat different from those that obtain in an ordinary field. The cost of construction of the drain-gauges, and the desire to carry out the experiments under ordinary field conditions led to establishment of these field plots at Longerenong. The experiments will be enlarged in scope, and repeated at the Central Research Farm, Werribee, during the coming season.

SUNFLOWER SEEDS IN RUSSIA—

Of late years cultivation of the sunflower has increased enormously in Russia. The shells are sold for heating purposes, the stalks dried in piles are preferred to pine wood for producing a quick and hot flame, while the seeds yield an oil which is highly valued for culinary purposes. According to *Fertilisers*, each acre yields about 2,000 lbs. of this firewood and some 1,350 lbs. of oil. The oil cakes are considered superior to hemp or rape cakes, and upwards of 2,000,000 lbs. are exported by the Government of Saratoff alone. Out of 104 mills in Russia, 85 are employed solely in obtaining sunflower oil.

TOMATO CULTURE IN VICTORIA.

(*Continued from page* 346.)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

SOILS, ASPECT, MANURE.

The tomato does best in a fairly rich, loamy, and well-drained soil. It is not necessary to particularize locality soils, everything depends on the preparation of the soil, and the feeding of the plant. A proper aspect in hilly districts is north or east. On the flat surfaces of the northern plains, and on the sedimentary flats so favored by market gardeners, aspect cannot very well be considered. Artificial means are resorted to, to prevent frost and cold from causing injury to the plants. The tomato is a gross feeder, and will produce a large plant with a quantity of late fruit if too liberally treated with nitrogenous manures. The growth required is steady matured growth in all stages of its development, consequently soils over rich in nitrogen are better avoided. This is frequently the case where fresh stable manure, in excessive quantities, is applied to the soil. Stable manure, well rotted, applied at the rate of 20 tons to the acre on poor soils will be found sufficient; on richer soils a less liberal dressing will suffice. Stable manure is the best manure to use for tomatoes, and in all classes of intense culture, as it adds humus to the soil, changes its physical condition, and contains to a greater or less extent nearly all the food requirements of the plant. The manure should be spread over the surface and ploughed under in the autumn, or if any winter crops, such as cabbages or cauliflowers, have been grown, the manure should be spread and ploughed under as soon as they are removed. When the tomatoes are being planted, bone dust is nearly always applied at the rate of a handful of bone dust to each plant. Bone dust is the artificial manure generally used for tomatoes. It is slowly soluble, and the quantity given is sufficient to last the plant through all its stages of growth.

Where stable manure is not available in large quantities, and artificial fertilizers have to be used instead, the manure to be applied should be rich in phosphoric acid and potash, with sufficient nitrogen to produce a free, but not over luxuriant growth of plant. The tomato-grower should remember that fruit is the objective. The same ground should not be used for tomatoes for longer than four or five years in succession. New ground should be brought under cultivation, and the old ground treated with a dressing of lime at the rate of half a ton to the acre, and given over to the production of other crops, for two or three years, when tomatoes can again be grown on the same ground. This is for the purposes of keeping down diseases, which will be dealt with under another heading.

PLANNING SURFACES.

The tomato requires frequent irrigation, consequently the surface must be planned so as to facilitate watering and cultivation. On almost flat surfaces the system usually adopted by the Chinese is shown in Plate 1.

Plate 5 shows the European system at Bendigo, introduced by the Spaniards twenty years ago, and probably is the finest system of irrigation for intense culture on either flat surfaces or steep slopes known. The intense culture irrigationist of Bendigo and district is an adept in the skilful use of water on small areas.

After ploughing and harrowing, the whole area to be planted out is planned and laid out according to the contour of the surface.

Plate 5 shows a section of a field on a fall of approximately 1 in 80, as shown by contour lines 400′ and 399′ 25″. The distributary

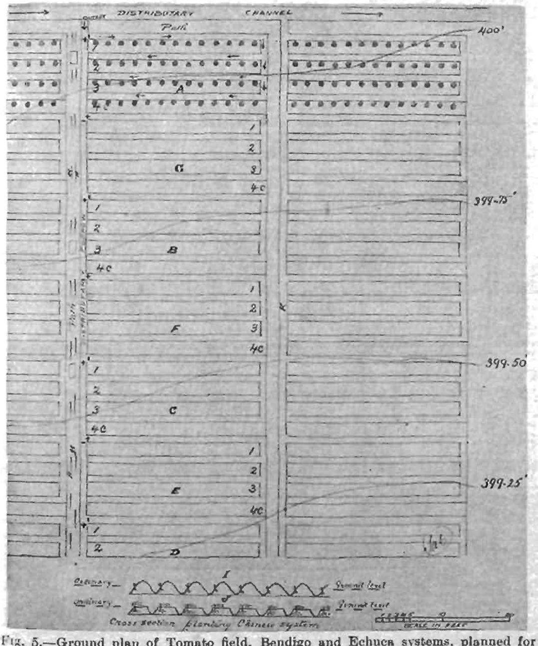


Fig. 5.—Ground plan of Tomato field, Bendigo and Echuca systems, planned for irrigation and hand cultivation.

furrows are brought down with the fall, and the lateral furrows are placed at right angles following as nearly as possible the lines of contour or levels. This system can be adapted to any greater fall, or on an almost level surface. In the Chinese system the distributary channel is a permanent one, and is brought down the centre of the path, as shown in Plate 1 and in Plate 5 by dotted lines marked ***H*** The three squares along the line of flow represent deep boxes inserted in the ground, and are used for dissolving manure, whence liquid manure can be applied during the process of watering. Outlets are

Fig. 6.—Planting tomatoes, Chinese system, Echuca.

made from the channel marked *H* into the distributary furrows at required intervals. Under this system of irrigation, handwork with

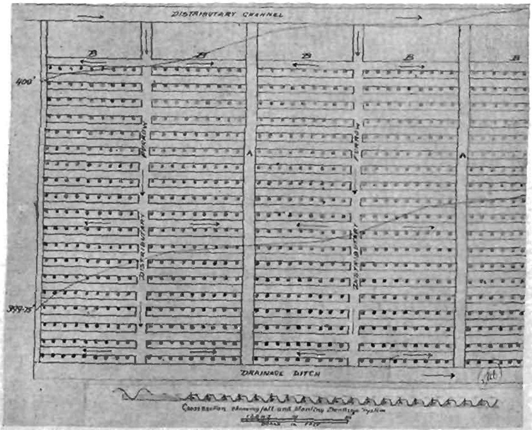


Fig. 7.—Ground plan of Tomato field showing plants 3 feet x 2 feet, and planned for irrigation and horse cultivation.

the hoe is the only system of cultivation after the surface has been planned and planted. A cross section is shown at I, showing lateral furrows, and also in Plate 6. Plate 7 shows a good system to be adopted on fairly level surfaces. The fall here shown is approximately 1 in 160, the distributary furrows are taken down the fall which is marked at 400′ and 399′ 75″, and the water spread right and left along the level lateral furrows as indicated by arrows. This system lends itself to horsework at all times, cultivating right along the lateral furrows, and striking out the distributary furrows afterwards,

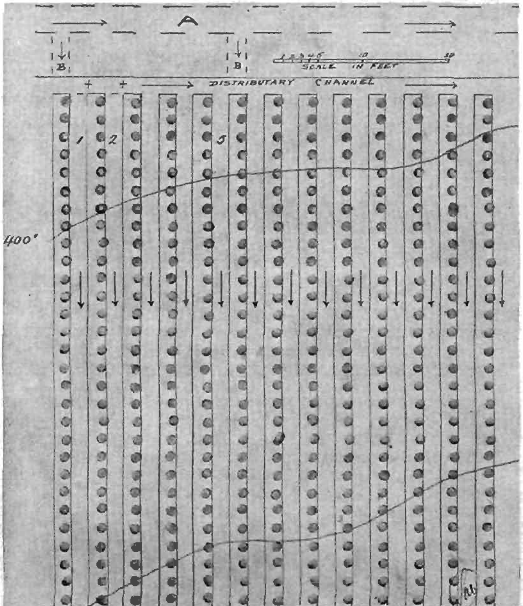


Plate 8.—Ground plan of Tomato field showing plants 4 feet x 2 feet planned for irrigation and horse cultivation.

leaving a headland marked B of sufficient space between the distributary channel and the first row of tomatoes for a horse to turn on. A third system is shown in Plate 8, where the fall is approximately 1 in 160, and this system can be adapted to greater or less gradients, provided always that the fall is not sufficient to cause scour in the furrow. In this system the distributary channel is brought along the level, and the water turned into the lateral furrows in turn, or a larger number of furrows may be irrigated at the same time by using a larger volume of water. Under the Chinese system the tomatoes are generally planted 4 feet between the rows, and 1½ to 2 feet apart in the rows. On the Bendigo system the planting is usually 2 to 3 feet between the rows, and 1½ to 2 feet in the rows. A good distance apart for planting will be found in Plate 5, 3 feet between the rows

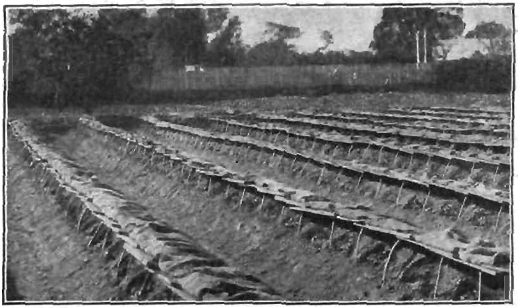


Plate 9.—Tomatoes covered to protect from frost, Chinese system, Echuca.

and 2 feet apart in the rows, 7,260 plants to the acre. Plate 8 shows 4 feet between the rows and 2 feet apart in the rows, 5,445 plants to the acre, a good distance apart for tomatoes not staked.

After the surfaces have been planned according to the distances the plants are to stand apart, planting takes place. Plate 6 shows the

Plate 10.—Tomatoes covered to protect from frost, European system, Bendigo.

PLANTING, COVERING, STAKING, PRUNING.

Chinese system. The plants are lifted from the cold frame in the tins as shown by + Plate 4. In early planting the furrows are made east and west as nearly as possible, and the tomatoes planted on the *northerly side of the ridge to protect them from the frost drift from the south.*

The soil is removed as shown midway up the ridge with a shovel, forming a sort of circular recess, a handful of bone dust is mixed with the soil in each recess, and the tomato, carefully removed from the encircling tin so as not to disturb the earth from the roots, is

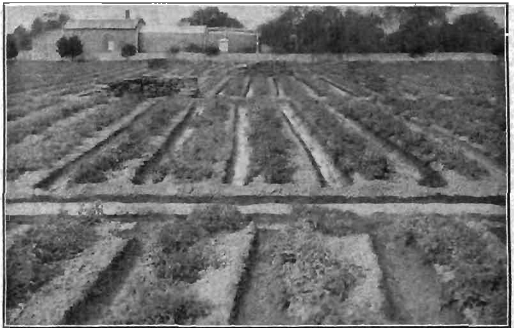


Plate 11.—Tomatoes growing on levelled ridges after frost covers are removed, Chinese system, Echuca.

planted here. The soil is packed around the plant, and a little brought forward and ridged to form a small basin for the water, which is applied to every plant after planting.

On the European system at Bendigo, planting takes place later, consequently the furrows are not so highly ridged, and very little

Plate 12.—Tomatoes and onions, Chinese system, Echuca.

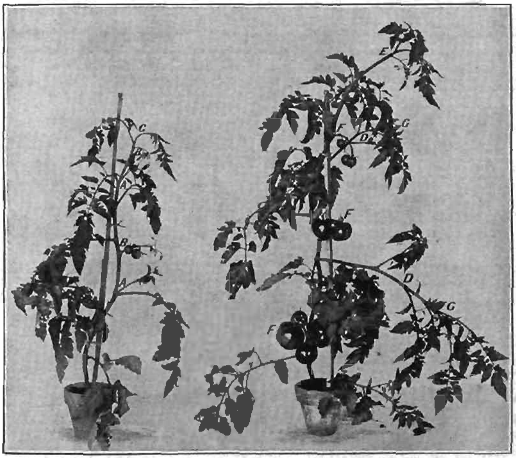
covering is done. The ridges are fixed at permanent heights, and on these the tomatoes are planted, with similar care as to manure and watering as in the Chinese system. Stock plants should always be kept in reserve, as sometimes late frosts may do a lot of damage.

Covering to protect against frost is shown in Plate 9, Chinese system. Boards 2 feet x 1 foot are used, and placed as shown on the ridges, and extend right over the plants with a good open slope, and are held in position by little props underneath. On the top of the boards hessian coverings (bagging may also be used) are placed, and soil placed on the hessian to hold both board and hessian securely in position. The hessian coverings are let down over the plants at night if frost threatens, and thrown back as shown in the day time. Another system is shown in Plate 10, where the covering boards or "slats" are placed endways over the plants, and no hessian covering is used. When the danger of frost is over the boards and coverings are removed, and stacked until required in the following season. Under the Chinese system the earth on the ridge is now brought forward and backward into the furrows to the ordinary soil level, as shown in Plate 11, and in cross section J. Plate 5. This leaves a furrow large enough for irrigation, with a flat surface on the ridge, at A with the leader or terminal growth at C, and the flower clusters

Plate 13.—Tomatoes staked, European system, Bendigo.

on which the plants grow, twice the width of the furrow. On the Bendigo system the plants are staked or trellised, and the ridging or furrows are not altered once they are planned. Should it be thought that too much ground is taken up under the Chinese system, Plate 12 shows a row of onions planted along the edge of the ridge opposite the tomatoes. When the tomato plants are about a foot high, they are staked as shown in Plate 13. Stakes are made from small saplings, and are usually 3 feet long, 1½ inches in diameter, and are pointed at one end, and driven into the ground about 6 inches deep alongside each plant, inclining one stake towards the other in the row, or inclining the stakes in one row toward the stake in the other row. The plants are tied to the stakes at regular required intervals, tying tightly to the stake and loosely around the stem of the plant. Trellised tomatoes are shown in Plate 2.

Pruning is necessary for production of early fruits. Plate 14, Fig. 1, shows the lateral growth produced from the axil of the leaf at B. Fig. 2 shows the lengthened growth of laterals at D. Terminal or leader growth at E, fruit clusters on the main stem F, and flower clusters on laterals at G. If all these lateral and leader growths were allowed to remain, there would be an increased crop, but late ripening of the fruit, as unchecked lateral and leader growths do not promote early setting of the fruit. Lateral growth should be pinched out as soon as it appears as shown, Plate 15, Fig. 1. This will promote the production of flower clusters, and setting of the fruit. When two or three flower clusters have been produced, the leader is stopped at one leaf above the cluster of flowers as shown, Plate 15, Fig. 1. The plants should be looked over every week to keep down lateral growth until flowers are produced, and the leader checked. The checking of



1 2

Plate 14.—Tomatoes staked and tied, showing lateral and leader growth.

the leader turns the energies of the plant to the growth and maturing of the fruits already set. If the laterals are not removed the plant generally drops its first flowers and earliest fruits. The large crown flower on the side of the cluster will mature into a misshapen fruit if allowed to remain. It is necessary on the cluster for pollination purposes, but it should be ultimately removed. This is done when the rest of the fruit on the cluster has formed.

Plate 15, Fig. 1, shows plant staked and pruned to two clusters of fruit. Fig. 2 to three clusters of fruit. Should trellising be adopted, as shown, Plate 2, lateral growth is permitted after the first two or three clusters of fruit are set. The laterals are tied to the cross ropes or wires, and the point of growth pinched after a cluster of fruit has formed. The pinching or cutting out of large laterals, as shown at D, Plate 14, Fig. 2, is very injurious. They should be pinched out when 1 or 2 inches long. If they are allowed to remain and develop leaves and woody tissue, this is done only at the expense of other parts of the plant; the removal of large laterals upsets the balance between leaf and root surface, and causes injury. Pruning increases the size and colour of the leaf, hastens the setting of the fruit, and increases its size. The Chinese check all lateral growth until

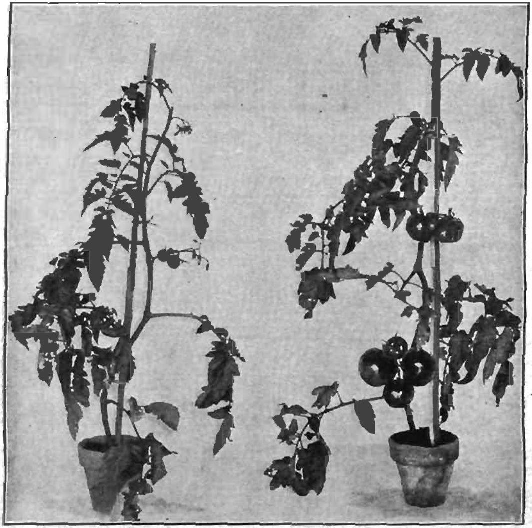


Fig. 15.—Tomatoes pruned, leader and lateral growth removed.

the flower clusters are formed; they then pinch the leader, and after that allow the plant to grow at will on the ground. In staked plantations where tomatoes are more thickly planted, it will be found necessary to keep down lateral growth for some weeks after the leader has been checked. This is to allow the free access of light and air to the plants. This thinning, however, should be of such a character as to retain sufficient foliage to prevent sun scald of the fruit. Tomato plants allowed to grow unchecked may produce more fruit, but this is compensated for by closer planting on the staking system, the increased size of the fruit, greater facilities for keeping down disease, and bigger prices through early ripening.

(To be continued.)

THE FERMENTATION OF CIGAR LEAF.

By Temple A. J. Smith, Chief Field Officer.

The fermentation of cigar leaf in America is not, as a rule, done by the grower, but is undertaken by the middleman or dealer, who regrades and treats the leaf according to requirements. In Victoria we have no one doing this work, consequently it devolves upon the grower or manufacturer; as the latter is in the habit of purchasing his leaf already treated and prepared for manufacture, he is not conversant with the methods of fermentation, and is, therefore, not inclined to bother with the unfermented article. The grower must, for some time to come, undertake this part of the work; no doubt in the future, when cigar leaf of Victorian production is more generally grown and used, dealers will be found to carry out such operations. Fair sized bulks are necessary for successful and economical fermentation, and as cigar leaf should be classed into at least six grades to suit the trade, it will be readily seen that fairly large quantities would have to be handled by a middleman to insure a profitable business.

It is my intention to deal as fully and clearly as possible with the subject in its different phases, showing the changes which the leaf is subjected and the various modes of treatment. This is necessary, as the amount of fermentation required depends upon the leaf itself and the purpose it is used for, heavy-bodied leaf requiring a longer and more exhaustive treatment, while light, thin leaf will neither stand nor require so much. After the leaf has been cured in the shed, it is practically dead, so far as the leaf-cells are concerned; at the same time if sufficient moisture is absorbed or applied to the leaf, and it is packed closely together, fermentation takes place and heat is generated and thrown off. This process is again due to enzymes or ferments, and these must be suited by certain temperatures and moisture conditions before they can act. The best temperatures in the sweating room are from 75 to 100 degrees Fahrenheit, and the degree of humidity from 70 to 90 degrees. These conditions can be maintained by stoves and steam, and it must be borne in mind that these remarks apply to the treatment of cigar leaf which requires a much higher and more complicated fermentation than pipe tobaccoes, and unless the operator understands his work, or follows the directions given closely, unsatisfactory results will ensue. Fermentation will, if properly conducted, get rid of any surplus vegetable matter in the leaf, will bring out the aroma and improve the colours; the combustion, or burn, will also be far better, and the general smoking qualities enhanced. There is a loss of weight during fermentation of from 2 per cent. to 15 per cent., partly due to moisture and partly due to solid matter thrown off through the decomposition of different elements and the formation of gases, the changes being both chemical, and, in some degree, owing to life processes. The starches in the leaf change to sugar, and the sugar is consumed in the curing, the remainder of both being driven off in fermentation. The enzymes attack the protein, nicotine, and tannin in the leaf, thus reducing the bitterness found in unfermented tobacco. Nitrates and fat are also attacked and destroyed, and the burning qualities thereby made better. The natural gum and resin is reduced, and the leaf, when fermented, has a dry clean feel as compared with its original condition. Citric, malic, and oxalic acids are partially changed into acetic and butyric acids.

During the fermentation amido compounds are formed, and the smell of ammonia is present. This is a natural result of the process, as also is the appearance of a light whitish powder, resembling a dry mould. This is due to an excess of magnesia, lime, or salt in the tobacco, and these can be taken off with a spray of weak vinegar in solution, or by brushing, when dry, with a light hair brush. The general tendency in Victoria has been to terminate the fermentation process too soon, and before the salts mentioned have been driven out; no definite rule as to how much fermentation should be given can be set down, as some tobaccoes ferment slowly, others fairly fast. In some cases the enzyme or ferment is present in greater numbers, and soil constituents and climate have their effects, causing an impetus, or check, as the case may be, on the leaf's condition. Consequently each tobacco will need to be treated according to its special condition. Wrapper leaf and filler leaf should be fermented separately, as each will have to receive different degrees of treatment. Careful observation during the process is essential, and the use of thermometers desirable, notwithstanding the fact that many operators depend on their sense of touch and the appearance of the leaf during the different stages of development.

BULK FERMENTATION.

A room for this purpose should be so built that the temperatures can be regulated at will, also the humidity; the latter can be best controlled by steam pipes, which are placed close to the floor round the room, and are supplied by a boiler outside. Heat is also generated in this way; the temperature of the room should be kept as nearly as possible to 100 degrees Fahrenheit, and should not be allowed to drop below 85 degrees F. during the process. Fermentation takes place when the temperature reaches 75 degrees F., but the best effects are brought about with the temperature over 85 degrees F., and under 110 degrees F.

For heavy coarse leaf, the latter degree of heat can be reached without fear of damage, but for fine thin leaf it will be safer not to exceed 98 degrees to 100 degrees F. Close fitting windows or shutters are required, so that the room can be easily cooled down by opening them, or an even temperature maintained while they are closed.

A stage or floor should be built, about a foot from the floor, 5 feet wide by 10 feet or more in length; such a stage can be easily constructed by laying ordinary flooring boards across joists 2 ft. 6 in. apart on the floor of the shed. It is a good plan to have bulk heads at each end of the stage the width of the floor, and at least 5 feet in height; if the stage is more than 10 feet long, a bulk head in the middle is also advisable.

The tobacco is prepared for fermentation by spraying with a fine spray of water on the hands or bundles, which should be placed in layers to receive it, each layer being two hands in depth. The leaf should contain from 20 to 24 per cent. of moisture, evenly distributed, light thin leaf containing the smaller quantity, and heavy leaf the larger. It sometimes happens that in very moist weather leaf containing a large percentage of gum will absorb sufficient moisture without any artificial application, and such a condition is very satisfactory. The system for testing the amount of moisture in tobacco is simple. A parcel of, say, 10 or 20 lbs. of leaf is weighed, and the moisture content then dried out by slow heat in a stove, and when thoroughly dried again weighed, the difference in weights giving the percentage of moisture, as, for instance, a 10-lb. parcel losing 2 lbs. in weight under the treatment would have contained 20 per cent. of water. It is never wise to apply water to pipe tobacco leaf, as these tobaccoes require a far simpler fermentation than cigar, and will go through the necessary process with a smaller moisture content, such as will be absorbed by the leaf itself in moist weather.

After spraying cigar leaf, the hands or bundles should be packed in heaps for 24 hours, to allow the moisture to become evenly distributed before bulking on the stage, in order to obtain a uniform condition throughout, otherwise one portion of the heaps may reach the rotting stage before other portions commence to ferment. The floor of the stage should be covered with a couple of inches of clean straw or old tobacco trash. The better grade hands are then laid on the floor, beginning at the outside edges, laying the hands close together, with the tips of the leaves to the centre and the butts to the outside, keeping them level and closely packed together; care should be taken not to double any of the leaves back, but to keep them straight to their full length. Having completed the row of hands on each side of the bulk, the next row is placed with the butts lapped half-way up the first row, and so on until the different rows meet in the centre. Each succeeding layer is put on in the same way, and the stacker should not get off the bulk until it is finished, but should have the hands given to him in pairs, and knee them down in order to pack the tobacco closely and solidly, keeping each layer as level as possible until packed to a height of 4 ft. 6 in. or 5 feet. It is a good plan to make the two top layers of inferior grade leaf and to build the centre of the bulk higher than the sides to finish off, as during the fermentation process the middle will sink more than the sides. During the building, at intervals of 5 feet, a galvanized tin pipe perforated with holes to admit air should be built in with the tobacco about the centre of the bulk, and in this a thermometer, suspended by a cord, is placed, which can be drawn from time to time to ascertain the changes in temperature. When finished, the whole of the bulk tops and sides should be covered with trash tobacco and hessian or old tarpaulins, placing slabs, or any convenient weights, to evenly compact the whole. The tops of the galvanized pipes should be corked up to prevent the access of air from outside.

The degree of fermentation to which each class of tobacco is subjected depends entirely on the leaf itself, and the purpose for which it is required. Thin wrapper leaf, in which it is desired to keep a light colour, should be put down with only 15 per cent. of moisture, and be very lightly fermented; in fact, allowed to sweat, a more applicable term, for to submit such leaf to a heavy fermentation would result in turning it nearly black and destroy its elasticity and textile strength, ruining it for wrapper purposes. The fact that its flavour would not be developed to the full is of small account, as wrapper leaf must be thin, and consequently is a small proportion of the cigar. A pound of Sumatra wrapper leaf will cover 500 cigars. Bunch wrapper is the leaf immediately beneath the cover, and is of heavier character than the outside, and requires a greater degree of fermentation, but not so much as will destroy its elasticity, as its function is to hold the filler leaf in shape. Colour is not of much importance, but it must have good burning qualities and flavour, and for this latter reason special leaf of some particular quality for blending purposes is often employed.

Filler leaf generally requires the greatest amount of fermentation, and as this portion of the cigar has the most influence on its smoking qualities, all organic matter must be expelled so far as is possible, and the flavour developed to the greatest extent. Only experience can determine exactly how far fermentation can be proceeded with in each case, as all tobaccoes of the different classes vary more or less in texture, body, &c.

The temperature of the bulk will begin to rise the second day after building, and should continue to do so at the rate of 10 degrees to 12 degrees F. each day. The thermometer should be examined each day to ascertain the rate and extent to which it has risen; if it rises faster than 12 degrees in 24 hours the whole bulk should be taken down and each hand shaken out, and the bulk rebuilt, putting the outside hands to the centre of the heap and *vice versâ*. Should the temperature rise slowly, there is no occasion to turn the bulk until the degree of heat reached is 110 degrees to 114 degrees. It may be necessary to turn the bulk three or four times, but it will be found that the heat will rise at a slower rate after each turning, and should it be found that no further increase of heat is made, the room can be cooled down by opening the ventilators and the bulk opened and spread to dry out all excess of moisture until the tobacco is just so dry as to admit of handling and packing without danger of rotting. It can then be packed in boxes to age or send to market. Filler and binder leaf will often smell a little musty and show a white powder on the leaf after fermenting, but this will not detract from its value, and if properly done, will feel dry and like satin to the touch, though pliable. The colour will darken, and, while in a moist condition, look almost black, but when dried out again will be a dark brown in heavily fermented leaf. Ageing by storing in boxes for a summer will improve the smoking qualities, and, if packed away for this purpose, the boxes should not be too close in the sides or tops, and are better lined with straw. Boxes holding from 80 to 150 lbs. are the most convenient sizes. Should it be found that fermentation in the bulk is too slow from some unknown cause, probably acidity, a spray of carbonate of ammonia in a 15 per cent. solution of water will accelerate the fermentation by neutralizing the acidity, thus making the general conditions more suitable for the working of the ferments.

There are several formulæ for treating low grade cigar leaf to improve flavours, but these should not be necessary, and depend largely on requirements.

Seeing that the fermentation is partly a life process and partly chemical, too much care cannot be taken in regulating the temperatures of the bulk. The ferments, or enzymes, on which depend the result of the treatment are killed at temperatures of over 130 degrees F., and should such a degree of heat be reached, no further fermentation will take place, but decay will set in; on the other hand, if temperatures below 70 degrees F. obtain, there is no development of the enzyme and fermentation is delayed. Cigar leaf is sometimes put through a slow ferment in boxes kept in a uniform temperature, with a small moisture content, over a long period, but such methods are slow and unreliable, and, except where only small quantities are being treated, not advisable.

MARKETING FARM PRODUCTS—

A bulky report furnishing a survey of the various systems of marketing farm products throughout the Republic has just been submitted to Congress by the United States Secretary of Agriculture. The report also puts forward a number of tentative suggestions designed to aid the producers, and as an aid to carrying these into effect, it is recommended that a "Division of Markets" be established. This division would be provided with a corps of travelling field agents, and a large corps of local agents and correspondents. Among its duties would be—(1) to help producers to market co-operatively or through a non-co-operative agency, (2) the examination of local difficulties, (3) to help producers to find markets, (4) to report the current descriptive condition of crops in addition to the work already done for principal crops only, (5) to estimate the probable production of crops a short time before harvest, (6) to report the beginning and ending of the shipping season from places of chief production, (7) to ascertain routes, methods, time, and costs of transportation, (8) to investigate storage rates and accommodation, (9) to establish lists of honest and trustworthy commission agents, (10) to describe methods of sale, monthly supplies, hours, and local fancies of customers at different markets, (11) to make, keep, and publish records of producers' prices, wholesale prices, and retail prices, (12) to make and publish lists of marketing associations, buying associations, and agencies of associations of consumers, and the business done by marketing associations, (13) to investigate systems of marketing in other countries. A general market news service by telegraph or mail is not recommended. It is recognised that the new division of markets could not reach its full activity at once, as time would be required to bring lines of service up to smooth effective work, and also to ascertain in what particular directions the activities of the division should specially develop. In these circumstances an appropriation of £20,000 is suggested towards the costs for the opening year; but this expenditure is expected to increase when the work is properly organized.

PROFITABLE DAIRYING ON SOUTH GIPPSLAND HILL COUNTRY.

RETURNS FROM A HERD OF 20 COWS OWNED BY MR. ALFRED BOX.

By J. Fleming, Dairy Supervisor.

This farm, of about 95 acres, is situated on Jeffries' Creek, near its junction with the Albert River, about 22 miles north-west of Alberton. It is typical grey soil, hill country, most of it rather steep and broken, with northern and southern slopes to the creek running through it. The creek flats are small and narrow. Very little fodder is grown, as the farm is too steep and too heavily-timbered to allow of much cultivation, although kept very free of bracken and undergrowth. The pasture is a mixture of rye, cocksfoot, and clover, cocksfoot predominating on the hills. Weighing, for the first time, commenced on 24th August, 1911, and was continued until the end of season, with some striking results, as under:—

Name.	Weeks in Milk.	Milk.	Average Test.	Butter Fat.	Average Price.	Cash Return per Cow.
		lbs.		lbs.	s. d.	£ s. d.
*Poley	39	3,613	4·6	166·19	1 1	8 19 10
*Briudle	32	3,693	4·8	177·26	1 1	9 11 0
*Bess	36	3,739	4·7	175·73	1 1	9 10 4
Darkie	34	5,856	4·4	257·64	1 1	13 18 11
Brownie ..	39	5,232	4·2	219·74	1 1	11 18 0
Cherry	37	3,680	4·7	172·96	1 1	9 7 2
Fancy	37	5,163	4·9	252·08	1 1	13 14 1
Dairymaid ..	37	4,196	4·8	201·40	1 1	10 18 0
*†Jane	31	2,541	4·7	119·42	1 1	6 9 2
*†Lily	30	2,184	4·8	104·83	1 1	5 13 5
Lass	40	8,016	4·2	336·67	1 1	18 4 6
†Beauty	40	4,123	4·9	202·02	1 1	10 18 0
†Madge	35	3,517	4·2	147·71	1 1	8 0 0
Blossom ..	32	5,332	3·7	197·28	1 1	10 13 8
Nancy	33	4,585	4·4	201·74	1 1	10 18 6
†Princess ..	36	2,941	4·8	141·16	1 1	7 12 9
Pet	33	4,144	4·3	178·19	1 1	9 12 10
†Jubitor	33	2,993	4·2	125·70	1 1	6 15 11
Daphne ..	41	6,014	4·3	258·60	1 1	14 0 0
Jennie	38	4,510	4·7	211·97	1 1	11 9 8
Total ..	..	86,072	..	3849·19	..	208 6 7

* These three cows were in milk some time before weighing commenced.
† Were two-year-old heifers.
*† Have been dispensed with on their returns per scales and test.

Milk from each cow was weighed every day, night and morning. Samples for testing were taken on the following dates:—19th and 27th October, 9th November, 12th and 22nd December, 4th, 11th, and 18th January, and 8th and 28th March. Each cow was tested, on an average, three times. The tests of each cow have been averaged. The milk was tested by the Butter Factory manager. A great difference in the production of the best and the worst cow will be noted. One produced over 800 gallons of milk, containing 336½ lbs. of butter fat, worth £18 4s. 6d.; the other produced only 218 gallons of milk, containing 104¾ lbs. butter fat, worth £5 13s. 5d., a difference of 231¾ lbs. butter fat, worth £12 11s. 1d. between the best and the worst cow in a herd of twenty. The ten best cows averaged 530.1 gallons of milk per cow, with an average butter fat return of 234 lbs., worth £12 13s. 6d. per cow. The five worst cows averaged 283.2 gallons, with an average butter fat return of slightly over 127 lbs., worth £6 18s. 3d. per cow. Notwithstanding this, the averages for the whole herd were 430.7 gallons milk, 192.9 lbs. butter fat, worth £10 8s. 4d. per cow. The monetary returns are calculated from the average price paid for butter fat by Mr. Box's factory for the period over which the weighing and testing extended.

So interesting and instructive were this season's figures that it has been decided to continue the practice of weighing and testing each cow's milk. It may be mentioned that the majority of this herd are pure and grade Jerseys. The balance show some Ayrshire breeding. Lass, the cow that produced over 800 gallons of milk, is about three-quarter bred Jersey. Two pure bred Jersey bulls are kept. Mr. Box is putting together a small Jersey stud, which has at the head of it the four-year-old bull Comparable's Lad, by Lily 4th, Defender, from Comparable, who was guaranteed up to 18 lbs. butter per week, and is by Canterbury's Lad, from Favourite 2nd. Mr. Box has also secured from Miss Robinson Lotina's Noble of Oaklands, who is now one year old. He is by Lucy's Noble of Oaklands (imp.), from Lotina (imp.), both of whom were reserve champions at Melbourne Royal Show. With bulls like the above to breed from, and the selection of heifer calves from the *known* best cows, Mr. Box should have no difficulty in raising his average production per cow considerably before very long. If a system of weighing and testing were generally adopted by dairy farmers, and the inferior animals culled, their profits would be materially increased, and the returns from dairying generally enormously enhanced. The system of pedigree herd testing inaugurated by the Department of Agriculture should do much to assist these farmers, as they will be able to choose bulls from tested cows with greater certainty of improvement in the heifers. A long pedigree does not necessarily indicate that the animal is capable of producing a profitable amount of butter, often the contrary is the case, hence the value to be derived from this system of herd testing. As they become known, the unproductive strains will be neglected.

In fat animals about 80 per cent. of the ash constituents is found in the bones. Bone ash is chiefly prosphate of lime, with a little carbonate of lime and phosphate of magnesia.

Don't drive the boy off the farm. Arrange the farm work so that he will like it.

JOINT ILL AND WHITE SCOUR.

DISEASES OF FOALS AND CALVES CAUSED BY INFECTION THROUGH THE NAVEL AT BIRTH.

By R. Griffin, M.R.C.V.S., Veterinary Staff.

It may not be generally known that probably the most fatal of all diseases of foals and calves is caused by the invasion of a specific organism or germ through the navel at or soon after birth. On several occasions in Victoria I have seen foals affected with Navel Ill, the owners being unaware of the nature or cause of it. Those breeders, however, who know the fatal nature of Navel Ill take every precaution to prevent it, and if their farm has already been infected with the germs of this disease go so far as to remove their breeding animals, prior to foaling or calving, as the case may be, to a farm where Navel Ill has never existed. When once a farm becomes infected with the germs of the disease it is a most difficult undertaking to eradicate them, and those farmers who take the precaution of removing their breeding stock to a farm which may be classed as "clean" prior to such removal, wash the animals all over with a disinfectant in order to minimize as much as possible the risk of carrying the germs of disease to their new location. The annual loss by death of foals and calves from disease due to navel infection must be very great, especially on those farms where the breeder is unable to adopt any preventive measures, as he is unaware of the nature and cause of the infection. Consequently in certain districts of this State a large percentage of the foals continue to die from what is termed "a mysterious disease."

The two diseases that will be discussed in this article are "Navel or Joint Ill in Foals" and "White Scour in Calves." In each it is caused by the entrance of a specific organism or germ through the navel opening. In foals producing Navel Ill with secondary infection in the joints and internal organs. In the case of calves, White Scour, and possibly joint lesions as well.

To better understand how this secondary infection in joints and other organs takes place a short description of the umbilical, or navel cord, its structure and functions, may be helpful. The umbilical, or navel cord is the connecting link between the fœtus, or young, and its parent. It is made up of vein, arteries, and a tube called the urachus, and it is through these structures that the blood, which causes the development and growth of the fœtus within the womb, passes from the parent to its offspring, and the waste products from the fœtus are returned. At birth this cord is broken or cut, and it is through the several vessels that the specific organisms gain access to the system, and eventually give rise to lesions in remote parts, the so-called secondary infections.

NAVEL OR JOINT ILL.

As the above-mentioned diseases resemble one another in many particulars, the cause, symptoms, and preventive treatment of Navel Ill in foals may be taken, with slight differences, to be noted later, as descriptive of both diseases. The cause, as already stated, is the entrance of a specific germ through the navel at or soon after birth. These germs, however, may be found in the vagina, or first passage, of mares prior to foaling, in which case infection would take place during the foaling process, but by far the most common source of infection is the insanitary condition of stables and foaling paddocks on farms where the disease has already existed. The cord coming in contact with the floor of the stable or earth in the paddock becomes infected, and in due course Navel Ill is the result. Infection may take place when the cord seems to have dried up; this is due to some grit or foreign substance getting entrance into the navel soon after foaling, which cause suppuration, and thus leave a channel through which the specific germs may gain entrance.

Persistent urachus, indicated by dropping of urine from the navel, is also a channel through which the germs may find entrance. Weak and insufficiently nourished foals are more liable to contract Navel Ill than strong healthy ones, on account of the want of vitality and practical absence of any protection against the invasiou of micro-organisms of any variety.

Symptoms.

In most cases the first symptoms observable are restlessness, colicky pains, and tendency to lie about. Later there is a disinclination to stand, refusal to suck mare, bowels are usually constipated, but occasionally diarrhœa may be present. Urine may be seen trickling from the navel in the event of the urachus not having closed. The navel may be swollen and painful, and this swelling may be felt, extending backward along the abdomen. Suppuration may also be present, and if the foal be made to move it is very stiff, and possibly one or more joints are swollen (usually knees and hocks).

It frequently happens that the first symptom is swelling of the knee and hock joints. The navel having dried up, and no swelling or pain being apparent in that region, the foal prefers the recumbent position, owing to the pain present in the joints; it refuses to take nourishment, and death ensues in a few days.

Treatment.

Treatment to be successful should be in the nature of prevention, for curative treatment in the majority of cases is most unsatisfactory, especially when not in the hands of a veterinarian who has a thorough knowledge of the disease and the structures involved, and is able to resort to surgery, if necessary, to aid in recovery, and to administer such serums as are indicated.

It is, therefore, strongly recommended that, if recovery is to take place, skilled advice should be early called upon, without recourse to the ordinary home remedies.

Preventive Treatment.

If this is properly carried out it is by far the most satisfactory, but it must not be undertaken in a half-hearted manner, but carefully, thoroughly, and regularly, until the cord has completely dried up and the danger of infection past.

As the germs of Navel Ill are most difficult to eradicate from a farm already infected, drastic measures must be adopted if success is to be achieved. If stables are of wood, and not of a permanent nature, burning them is the proper course to adopt; but if permanent thorough disinfecting must be carried out. Clean out and burn all litter, wash floors and walls with a strong solution of copper sulphate, then lime wash, with the addition of a pint of crude carbolic acid to each bucketful of wash; see that all corners are disinfected.

With regard to a foaling paddock which has been contaminated, mares should not be allowed access to it for some time prior to foaling; better still, it should be cultivated for a few years.

If foaling is to take place in stable, an ample supply of clean straw should be provided for bedding down, so that at foaling the navel cord does not come in contact with the floor; but if foaling is to be in paddock, select one with a plentiful supply of grass. This will also prevent the navel cord getting fouled with the clay or sand.

It is much preferable to allow foaling to take place in a paddock known to be free from infection than in a stable, no matter how thorough the disinfecting has been carried out. If it be considered necessary to irrigate with disinfectants the vaginal passages of the mare before foaling, one part of lysol to 100 parts of clean water that has been boiled and allowed to cool is a safe and effective douche, and can be injected with a syringe, or funnel with piece of hose pipe attached. The syringe or hose pipe should not be passed more than 3 inches into the vagina, and, in the case of a syringe, little force must be used. Tail and quarters should also be disinfected.

If possible, be with mare at foaling. This is not always possible, on account of the short premonitory symptoms and the rapidity with which a mare foals under normal conditions. If the navel cord has not broken during the act of foaling, it should be tied with tape or cord, previously disinfected, about 2 inches from abdomen, and then severed. Wash the cord with one part of corrosive sublimate in 1,000 of water, paint with tincture of iodine, and, lastly, dress with styptic collodium, a preparation known as new skin (which can be procured at a chemist's) will answer the latter purpose. This treatment should be repeated carefully each day until the cord has completely dried up. When disinfecting the cord, a space of a couple of inches round the navel opening should be included in the dressing.

In the event of the urine being observed escaping from navel, professional advice should be obtained.

WHITE SCOUR IN CALVES.

This disease, as already stated, is caused by infection through the navel, and, as the name indicates, is characterized by a white scouring, which is very persistent and difficult to arrest.

Some few years ago an epidemic of White Scour in calves occurred in Great Britain, and the services of Professor Nocard, of France, were secured, and, after careful investigation and numerous experiments, he found that the preventive treatment already described for Navel Ill in foals checked the progress of the disease, and in a short period practically eradicated it.

White Scour in calves should not be confounded with the diarrhœa due to dietetic causes. In the former there is stiffness, swollen joints, possibly discharge from navel, refusal to take food, rapid emaciation and death, whereas in diarrhœa caused by errors in feeding and internal parasites, practically all the symptoms of Navel Ill are absent, and with careful attention to food and proper medicinal remedies recovery will soon take place.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

MONTHLY REPORT ENDING 14TH JUNE.

The past month has been noted for its severity in weather conditions, as heavy rain fell during the month, followed by severe frosts. The thermometer registered 30 to 32 degrees on four mornings. Under these conditions, the egg production has been highly satisfactory, and in comparison with the former competition for the same period, the figures show an increase of 246 eggs, the totals being for 1912-13 competition 4,844, and the present one 5,090, and one pen less competing.

The system of feeding at the present competition is on similar lines to that followed last year. In the morning half pollard and half branning is used. Bullock livers are minced and mixed into the dry meal, and also a quantity of green food, consisting of grass, thistles and chick weed, which abounds in large quantities at present, the whole being well mixed into a crumbly state with hot meat soup. At mid-day wheat, bran, and pollard is given, mixed with hot soup, especially in cold, bleak weather. At night, wheat, maize (cracked) and oats mixed is the ration. In wet and frosty weather, cracked maize only is given. The birds in the leading pen No. 6 (Spotswood) are laying very consistently, but are being gradually overhauled by pen No. 23 (Gill). The leaders at present have laid 10 eggs above the leaders at last competition for the same period, viz., 257, a very good performance.

Moulting.—Several pens have entirely gone into moult, and quite a number have one or more birds so affected. This has considerably interfered with the output from those pens. These birds are, however, looking brighter and feathering quickly, while others are now entering into the moult.

Rainfall.—Measured for the month at the pens, 204 points.

Sickness.—Several severe cases of diarrhœa were experienced, and lately several mild cases of chicken pock, which has now almost disappeared. Stock generally are bright and alert.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition. April 15 to May 14.	May 15 to June 14.	Total to date—2 months.	Position in Competition.
6	White Leghorns ..	J. S. Spotswood ..	126	131	257	1
23	" ..	J. H. Gill	95	147	242	2
65	" ..	E. A. Lawson ..	104	133	237	3
61	" ..	Jno. Campbell ..	108	120	228	4
8	" .	E. H. Bridge ..	93	124	217	5
21	" ..	A. Ross	107	106	213	6
48	" ..	Thirkell and Smith ..	72	140	212	7
46	Black Orpingtons ..	T. W. Coto.. ..	109	101	210	8
11	White Leghorns ..	C. J. Beatty ..	78	131	209	9
31	" ..	W. G. Swift ..	99	104	203	10
50	" .	A. H. Mould ..	98	102	200	11
68	" ..	Jones and Curtis ..	93	104	197	12
66	" .	W. Featherstone ..	94	97	191	13
16	Black Orpingtons .	D. Fisher	76	113	189	14
2	White Leghorns ..	R. W. Pope ..	108	75	183	15
34	" ..	J. E. Bradley ..	86	95	181	16
35	" ..	Moritz Bros. ..	56	125	181	16
47	" ..	W. McLister ..	75	104	179	18
10	" ..	T. A. Pettigrove ..	62	115	177	19
40	" ..	Geo. Edwards ..	74	101	175	20
37	" .	C. H. Busst ..	79	95	174	21
49	" ..	M. H. Noye ..	86	88	174	21
14	" .	F. Hannaford ..	75	98	173	23
32	" ..	R. Hanbury ..	76	92	168	24
63	" .	A. Sellers	80	82	162	25
45	" .	D. Gouddie .	85	76	161	26
7	" .	H. McKenzie ..	62	98	160	27
41	" ..	Percy Walker ..	68	86	154	28
38	" ..	M. A. Monk ..	65	87	152	20
18	" ..	B. Rowlinson ..	68	80	148	30
27	" ..	J. Sinclair .. .	66	81	147	31
39	" ..	W. Purvis	62	82	144	32
20	" ..	C. B. Bertelsmeier ..	29	115	144	32
3	" ..	S. Buscumb ..	60	83	143	34
26	" ..	B. Rolls	44	95	139	35
68	" ..	Stranks Bros. ..	45	92	137	36
59	S.C. White Leghorns	Cowan Bros. .	78	58	136	37
43	White Leghorns ..	Morgan and Watson..	52	83	135	38
53	Black Orpingtons ..	A. Greenhalgh .	77	56	133	30
25	" ..	King and Watson ..	52	81	133	30
24	White Leghorns ..	Redfern Poultry Farm	45	87	132	41
62	" ..	G. A. Gent ..	74	49	123	42
67	" ..	C. Hepburn ..	58	64	122	43
28	" ..	E. Waldon ..	47	73	120	44
13	Black Orpingtons ..	T. S. Dallimore ..	79	37	116	45
22	White Leghorns ..	B. Mitchell ..	43	64	107	46
5	" ..	G. W. Robbins ..	27	76	103	47
55	" ..	P. H. Killeen ..	40	57	97	48
52	" ..	W. G. Osborne ..	42	53	95	49
57	" ..	Gleadell Bros. ..	32	59	91	50
44	" ..	W. A. Rennie ..	52	37	89	51
19	" ..	W. Dunlop ..	49	39	88	52
17	R.C. Brown Leghorns	S. P. Giles	34	54	88	52
12	White Leghorns ..	A. H. Padman ..	35	43	78	54
42	" ..	A. Stringer ..	15	43	58	55
56	" ..	Schaefer Bros. :	15	40	55	56
33	" ..	South Yan Yean Poultry Farm	13	41	54	57
36	" ..	A. J. Jones.. ..	24	27	51	58
15	" ..	J. Shaw	24	23	47	59
30	Black Orpingtons ..	Jas. Ogden ..	15	27	42	60
51	Black Spanish ..	W. H. Steer ..	13	28	41	61
64	Golden Wyandottes	C. L. Sharman ..	2	33	35	62
9	White Leghorns ..	Sylvania Stud Farm..	10	24	34	63
29	" ..	S. Brundrett ..	19	11	30	64
54	" ..	Jas. McAllan ..	26	..	26	65
4	" ..	Jas. Brigden ..	12	13	25	66
60	Black Spanish ..	Watson and Rushworth	..	12	12	67
		Total	3,967	5,090	9,057	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Ploughing the orchard should now be completed; and, where necessary, the drainage system should be continued and increased. A dressing of stable manure should now be given wherever it is needed; and, if any artificial manures are to be used, especially if in the form of bonedust or potash, they should be applied now, so that they will be available as food for the roots in early spring. A dressing of lime may be given with great advantage to heavy, cold, or sour soils.

Spraying should be started for aphis, mite, and scale troubles; and, if the pest is at all severe or obstinate, the work should be done before pruning. Crude petroleum, red oil, and kerosene emulsions are all useful in dealing with these pests.

PLANTING.

The planting of deciduous fruit trees will still be continued on the lines laid down in last month's notes. Care should be taken to have the soil thoroughly sweetened and aerated, the roots should be well trimmed, and the young trees firmly planted. Owing to the time that elapses between the removal of the tree from the nursery row and the planting of the tree in its permanent situation, practically the whole of the fibrous and feeding root system has been destroyed. It will be well to remove all of the finer roots, and to thoroughly trim back the stronger ones; this will allow the tree to make a new root system for itself.

PRUNING.

After planting, young trees should be pruned severely back, usually removing far more than is retained. One reason for this is that it is necessary to do so on account of the severe cutting back of the roots. It is also necessary to prune hard because, as a result, strong growth will invariably follow. The severe cutting back of young trees is not only followed by strong growth, but the trunk and main stems are considerably increased in size. This latter result is an essential, as in thus giving a strong framework to the tree, it is being built up and strengthened for the carrying of heavy crops in later years.

In pruning back the newly-planted trees, they should be deprived of all light growth, and either one, three, or four main arms left. These main arms should be cut back to outside buds, leaving about 3 or 4 inches of wood. It is not necessary that the buds should be immediately in the line of the old growth; it is usually found that two, or perhaps three, buds will break away from each arm after pruning, so that in pruning it should be observed that, while the buds are in outside situations, they should be in such positions that, when they ultimately grow, there will be an even spacing between the growths. It, therefore, may be necessary to prune so as to have one bud in the direct line of growth, and the others as side buds. It is not wise to prune a young tree to two arms, as this would in future years place too great a stress on the trunk; one side might possibly be overloaded, and would have a tendency to break away from the main system. The same hard pruning should be observed for the two subsequent prunings, the object of the pruner being to produce a strong, sturdy type of tree with evenly-spaced arms, all breaking away low down. The habit and character of the tree will determine the number of arms to be finally retained. A tree of spreading habit would naturally have more than one of an upright habit of growth. A spreading tree could be allowed later on to form an internal framework, while an upright-growing tree could be induced to produce a few outgrowing leaders.

After the third or fourth year, the aim of the pruner should be towards production of fruit-bearing wood. During these years, the tree has not been unmindful of this, and quite a number of weak lateral growths will have been produced. These may always be retained unless they become too long and spindly, when their length may be somewhat reduced. These laterals will produce all along their length a number of fruit buds, and they are thus valuable wood. A strong-growing lateral may always be shortened back, or cut out altogether.

Fruit buds may always be distinguished by their well-nourished, plump appearance, in contradistinction to leaf or wood buds, which are flattened, and which often lie flat along the wood. Fruit spurs are the prolongations of fruit buds, often branching into various buds with age. Laterals are the weak, twiggy growths which, in their second and subsequent years, generally produce fruit buds along their course. Strong growing, as well as upright, laterals must always be suppressed, cutting them back to a few basal buds, or removing them altogether. Vertical growths of any description should always be discouraged in fruit trees, as such upright growths induce a free rush of sap, the sap thus strengthening them, and depriving the lower and other parts of the tree of their legitimate nourishment. Slow sap movement always results in fruit production, and this can be attained by (*a*) sloping the whole framework of leaders out at a fair angle, and (*b*) suppressing or changing the direction of growth of any strong, upright growths, whether laterals or leaders.

In the management of the lateral system, it is generally advisable not to interfere with these unless they become too strong, when they may be treated as previously advised. Should they become too long, thus unduly interfering with each other, they may be shortened back, but always to a sub-lateral growth, which often occurs at right angles to the parent, or to a fruit bud lower down. To cut to a leaf bud merely induces a continuance of growth, with a consequent reduction of fruiting strength.

These remarks refer mainly to apple, pear, and plum trees; and, in the case of the first two varieties of fruit, it is generally advisable not to interfere with the laterals until they have formed their fruit spurs. A too thick or numerous lateral system may always be thinned out, but it must be remembered that once a lateral is removed entirely, it is very difficult to replace it, and impossible in some varieties of fruits. For peaches and apricots, it is always advisable to shorten back, and to continue to shorten back annually, all fruiting wood, as these trees produce their fruit on the new wood, and once the wood has carried fruit, its work is done, and it may be removed. Where an apricot or peach tree produces laterals carrying no fruit spurs, these may be cut right off, as basal buds are generally present to produce fresh lateral growth. Only in the case of early fruiting varieties may these growths be retained, as they will in all probability produce fruit spurs late in the season.

Vegetable Garden.

Asparagus beds should be well cleaned out, and as soon as any young seedlings appear they must be culled out and thrown away. The work of digging the beds should be continued, digging in manure that was previously spread on the surface. Any seedling vegetables may be planted out; and the seeds of various sorts, such as peas, broad beans, carrot, leek, lettuce, spinach, radish, &c., should be sown. Asparagus crowns, rhubarb roots, and tubers of Jerusalem artichokes may be planted out.

Flower Garden.

Digging in the garden should be continued. Before digging, the beds should be given a top dressing of lime or of stable manure, and subsequently these could be dug well into the soil. Care must be taken not to injure the roots of any shrubs, trees, or roses. Root cutting and root pruning will always dwarf any plant. In digging, it is not wise to discard any leaves, twiggy growths, or weeds. Unless they are required for the compost heap, they should always be dug into the soil. Leafmould is especially useful in any garden, and where such plants as Azaleas, Rhododendrons, Liliums, &c., are grown, or for pot-plant work, it is exceedingly valuable. In forming the compost heap, no medium whatever should be added to help the rotting down of the leaves, unless it be a little sand. Any chemical added will render the mould unsuitable for its special objects.

Any hardy annuals may be planted out, such as stocks, pansies, wallflowers, &c., and cuttings of roses and hard-wooded shrubs may also be planted.

After flowering in the autumn and winter, shrubs, including roses, may be well thinned out and pruned, especially removing any weak, upright, or old flowering growths; keep the shrub always at an outward growth, inclining it to a broad bushy type instead of to an upright habit. By this means, the lower regions will always be furnished with good growth. Shrubs and trees of all descriptions should never be allowed to become too crowded; they require to be opened, so as to allow sunlight and air into the interior, where it is most needed. This is one means by which this class of plants may be kept healthy and free from disease. Very few shrubs resent pruning, and the majority of them, including Australian shrubs, such as Acacias, are very amenable to the pruning knife.

In rose pruning, the rule is that strong-growing plants require less severe cutting than weak-growing ones. As roses always flower on new wood, it is essential that to have good blooms, the bushes must be pruned regularly. All weak growths, exhausted and worn-out wood, must be removed, retaining only the vigorous growths. It is generally advisable to prune to four or five eyes or buds, so as to have subsequent strong growths, always pruning into the previous season's wood. Spindly growths, especially in the centres of the bushes, should be removed, the plants being trained with an open and angular habit.

REMINDERS FOR AUGUST.

LIVE STOCK.

HORSES.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed in the day-time when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Calves should be kept in warm, dry shed. Those on the bucket should be given their milk warm. The bull may now run with the cows.

PIGS.—Supply plenty of bedding in warm, well-ventilated styes. Keep styes clean and dry, and the feeding troughs clean and wholesome. Store pigs should be placed in fattening styes. Sows in fine weather should be given a grass run.

SHEEP.—Ascertain rams required for coming season and apply to breeders this month. Arrange for any merino or crossbred ewes needed for next lambing season direct from station if possible. Cull stud breeding ewes carefully, and enter only the very best young ewes. Where possible market any lambs ready and avoid the rush later on.

POULTRY.—When yards become damp and difficult to clean they should be sprinkled with lime and then turned over with a spade or fork. Keep the breeders busy—straw litter with a little grain scattered about will make them exercise. As the hen eats twice as quickly as the male bird, feed the latter by himself; tack a piece of wire netting on a light frame, and place it across an angle to make a small enclosure for him whilst he is eating. Overhaul incubators; see that the capsule or thermostat acts properly; thoroughly clean lamps, egg drawers, and chimneys. Test machine for two days before putting valuable eggs in. It is also advisable to have thermometer tested. When additional incubators are required, it is more satisfactory to keep to the one make.

CULTIVATION.

FARM.—Second fallow where necessary for summer crops. If required, roll or harrow crops Plant very early potatoes in forward districts. Sow mangolds. Apply slow-acting fertilizers, such as blood and bone manures, for maize.

ORCHARD.—Complete planting and pruning of deciduous trees. Watch for peach aphis, and spray with tobacco solution, if present. Prepare for planting citrus trees. Spray for woolly aphis with strong tobacco solution.

FLOWER GARDEN.—Finish digging and pruning of roses, &c. Leave pruning of shrubs till after flowering. Keep weeds in check; weed out seed beds. Divide and plant out all herbaceous plants, such as phlox, delphiniums, rudbeckia, &c. Plant out gladioli. Complete planting of shrubs. Mulch young plants.

VEGETABLE GARDEN.—Top-dress asparagus beds; plant new asparagus plots. Plant herb divisions, and potatoes. Sow cabbage, cauliflower, peas, carrots, beans, radish, and lettuce seeds. Sow tomato seeds in a hot frame. Finish digging.

VINEYARD.—August is the best month for planting vines (grafted or ungrafted). This should be actively proceeded with and completed before end of month. Scions for field grafting may still be preserved as detailed last month, or better still by placing them in cool storage. They should all be removed from vines before end of month, at latest. Conclude pruning and tie down rods. Where black spot has been very prevalent, apply 1st acid iron sulphate treatment (see *Journal* for July, 1911). Apply readily soluble nitrogenous manures (soda nitrate or ammonium sulphate) during this month.

Cellar.—Rack again, towards end of month, wines which have as yet only been once racked (spring racking). Fill up regularly all unfortified wines. Clean up generally in cellar and whitewash walls, woodwork, &c.