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WHEAT AND ITS CULTIVATION.

No. XI.—WHEAT VARIETIES.

(Continued from page 83.)

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

A large number of inquiries is received at the beginning of each year by the Department of Agriculture for information regarding the merits and qualities of different varieties of wheat grown in the wheat areas. It is proposed in the present article to give in simple language a brief description of a few of the more commonly grown varieties of wheat, and to briefly indicate such features of structure as will enable these varieties to be more or less readily recognised.

It might be mentioned, in passing, that a large number of attempts has been made from time to time by various observers to evolve a workable scheme of classifying the many varieties of cultivated wheat, but, so far, no satisfactory system of classification has yet been obtained. There is a general agreement on the division of the cultivated wheats belonging to *Triticum Sativum* into six sub-species*; but concerning the further classification of the varieties within these sub-groups there is the greatest difference of opinion. Eriksson† has evolved a scheme of classifying the varieties of wheat by the structure of the ear, and particularly by the length and density of the spikelets; but such a scheme must be more or less unsatisfactory when applied in practice, since the head is known to vary considerably from season to season, and with changes in the soil conditions.

Vilmorin‡ has made a very systematic review of French varieties of wheat, but the minor subdivisions of his classification are wanting in definiteness. Cobb,§ of New South Wales, some years ago proposed an ingenious scheme for the universal nomenclature of wheat, and

* *Vide* Wheat and its Cultivation, *Journal of Agriculture, Victoria*, Feb., 1912, pp. 92–93.
† Eriksson, Die landwirtschaftlichen, *Versuch Stationen*, Bd. 45, 1894.
‡ Vilmorin, *Catalogue Methodique Systematique des Froments*, Paris, 1884.
§ Cobb, Universal Nomenclature of Wheat, *Agricultural Gazette of New South Wales*, Dec., 1901, *et seq.*

suggested the classification of wheats by a microscopic examination of the aleurone layer. There are considerable practical difficulties in the application of such a method, and, moreover, the system rests on an insecure foundation, since it tacitly assumes that difference in environment and season would have a negligible effect on the aleurone layer.

That there is need for some systematic classification of the varieties commonly grown will readily be admitted. There are many instances of wheat varieties in various parts of Australia masquerading under quite a number of different names.

Until a systematic survey of the characteristics of the hundreds of varieties grown throughout the Commonwealth has been made, and the leading types of wheat standardized, it is expected that there will be considerable confusion with regard to minor varieties.

Some of the more important varieties grown in the wheat areas are the following:—

1. *Early Varieties.*—Bobs, Bunyip, Comeback, Firbank, Gluyas, King's Early, Steinwedel, Thew.
2. *Mid-season.*—Bayah, Correl's No. 3, Dart's Imperial, Federation, Jonathan, Zealand Blue.
3. *Late.*—American No. 8, Genoa, Huguenot, Marshall's No. 3, Medeah, Purple Straw, Yandilla King, White Tuscan.

The above division of commonly grown wheat varieties into early, mid-season, and late is adopted for convenience, and represents the average results of four seasons of observation under uniform conditions.

The line separating some of the early and mid-season wheats on the one hand, and the mid-season and late varieties on the other, is not, as might be expected, very clearly defined.

EARLY VARIETIES.

BOBS.—This interesting variety of wheat was produced by the late Wm. Farrer, in 1896, and is really a hybrid—being a cross between *Nepaul Barley and Early Lambrigg Wheat. It is one of the best* milling wheats yet produced under Australian conditions. Its grain is hard, shotty, and translucent, and yields a good percentage of flour *of very high strength. The flour is very suitable for blending purposes.* It is a very popular variety in New South Wales, and it has given very satisfactory yields in dry as well as cool, moist districts. *It is a very early, spare-stooling variety, with erect, light-coloured,* hollow straw. The ears are white, beardless, and smooth, somewhat lax in character, broad, and open in the chest, carrying small, shotty *plump, translucent grain which tends to shell out. On account of* the excellent milling quality of the grain it has long since been a favorite with millers, and prices in advance of f.a.q. rates have regu*larly been paid for parcels of this variety. Its yields in most of the* wheat areas of Victoria have not been very satisfactory; and, in spite of the enhanced prices, it has not generally given such good financial *returns as other more prolific varieties.*

BUNYIP.—This is a very early, upright, moderately tall, strong-growing variety of fair stooling power, and is a very useful variety to *sow in dry districts when the season is late. The ears are yellowish*

white, broad, awnless; but the upper spikelets have a slight tip beard. The grain is hard, plump, and attractive, of good milling quality, and yields a flour of high strength. It does not readily shell. On account of its extreme earliness it gives best results in normal seasons when sown in the middle or towards the end of the season.

COMEBACK.—This is an early variety, of fair stooling capacity, moderately tall, with clean, hollow straw, and makes a very nice sample of hay. The ears are creamy-yellow, beardless, and smooth, of moderate length, fairly compact, but with a long tapering tip. The grain is small, somewhat shotty in character, thus resembling Bobs, with hard semi-translucent endosperm. The grain is of high milling quality, and, like Bobs, is eagerly sought by millers, making a good percentage

MARSHALL'S NO. 3. GLUYAS. CORREL'S NO. 3.

of high-quality flour very suitable for blending purposes. It has been sold on the Sydney and Adelaide markets at various times at 3d. to 6d. per bushel above ordinary f.a.q. wheats. It has the reputation of being a shy yielder, but in some of the drier districts it has done remarkably well. There is a number of strains of Comeback in cultivation, and some of these are recognised as of more value than others. Among these latter might be mentioned Pratt's Comeback, originated by Mr. Pratt, of Two Wells, South Australia, to whom the late Mr. Farrer sent a sample of the original cross. Comeback is a crossbred wheat of Fife-Indian parentage, and may be considered the best milling wheat yet produced under Australian conditions.

FIRBANK.—This is one of the most popular bay wheats in the Riverina, and for some years past the demand for seed of this variety has been unprecedented. It is an early, tall-growing, erect variety of moderate stooling capacity, with good heavy flag. The straw is strong, yet hollow, and makes sweet hay of good quality, which retains its colour well. The ears are long, smooth, lax, open, and tapering, with slight tip beards. The chaff is of a yellowish-white colour, and holds the grain somewhat loosely, and possesses very short, stiff, terminal awns. The grain is large, plump, and soft. It is rather liable to flag smut and rust. It is essentially a hay wheat.

GLUYAS.—This variety is very popular in the Mallee districts of South Australia on account of its early maturity, general immunity from disease—particularly its rust-resisting powers—and its capacity for yielding well in dry seasons. It is vigorous, moderately tall growing, early variety, fair tillering power. * It is, however, somewhat weak in the straw, and has a tendency to go down, particularly in heavy weather. The ears are dark-bronze in colour, moderately compact, and possess a slight tip beard.

As the grain approaches maturity, the dark heads become pendulous, but do not shell on account of the firmly closed enveloping glumes. It is a very useful variety for sowing in dry districts in a late season.

KING'S EARLY.—This is another very popular early variety in Mallee country, which yields well in a dry season. It is a selection made many years ago by the late Joseph King, of Georgetown, South Australia. It is a vigorous, tall-growing variety of moderate stooling capacity, possessing semi-solid straw with a fair amount of flag. The ears are bearded, white, somewhat open; and the grain large, plump, and of low strength. In spite of its beard, it is prized as a hay wheat on account of the solidity and sweetness of its straw, and the capacity to retain its colour well. It is a very old variety; but during recent years it has been greatly improved in yielding capacity by Professor Perkins.*

STEINWEDEL is a very popular, early maturing variety, extensively grown in Victoria, South Australia, and New South Wales. It originated from a selection made from a crop of Farmer's Friend—one of the old Purple Straw varieties. It is a free stooling, moderately tall-growing variety, with drooping foliage and strong, hollow, purplish straw. The ears are smooth, white, bold and large, with broad spikelets and a slight tip beard. The grain is large, bright, plump, but soft and mealy. It is easy to mill, and the flour is of good colour but of low strength.

This variety has a strong tendency to shell, and the crop should, therefore, be harvested as soon as it reaches maturity in order to obviate losses. It is a good yielder in the drier areas, and can be relied on to do well in a dry spring.

THEW is a remarkably early vigorous-growing wheat, possessing good stooling powers. It is a moderately tall grower, with stiff narrow flag and medium-sized hollow straw. It cures a good colour, and in some early districts has given good yields of hay and green stuff. It has been singularly free from rust during the past few years, but

* *Vide* Improvement of Cereals, Perkins and Spotford, *Bulletin*, South Australian Department of Agriculture.

this may probably be due to its rapid maturity rather than the possession of actual rust-resisting powers.

It has a long tapering beardless head, with smooth white chaff, and somewhat lax spikelets, which, however, hold the grain well, and cause some difficulty in threshing. It is a crossbred wheat with improved Fife parentage, and is a very good hay wheat.

MID-SEASON VARIETIES.

BAYAH is a crossbred wheat with improved Fife and Jonathan parentage. It is a mid-season variety which very closely resembles

BAYAH. TRIUMPH. HUGUENOT.

Federation in the colour of the chaff and the short upstanding straw. It is a very vigorous grower, of good stooling capacity, with well-developed, shapely, dark-brown, compact ears with clubby tops. The chaff is smooth, but the spikelets near the tip are slightly awned. The grain is plump, soft, and white. On account of the short stiff straw it is not suited for hay, though its grain yields have been very satisfactory.

CORREL'S No. 3.—This is one of a number of varieties originated by Mr. J. Correl, of Arthur River, Western Australia, the originator

of the Le Huguenot Wheat. Correl's No. 3 is a tall-growing, vigorous variety, with good, strong, semi-solid straw, and a good stooler. It retains its colour well when cut for hay, and makes a very good sample. It possesses a good compactly-built ear, slightly awned at the top. The chaff is dark-brown in colour, and smooth, whilst the grain is large and moderately plump.

DART'S IMPERIAL.—This popular variety was originated by Mr. Thomas Dart, of Nhill, Victoria, formerly of Lucindale, South Australia, and is a selection from a purple straw variety. It is one of the oldest varieties in general cultivation at the present time. It is a good all-round grain and hay wheat, and is a very reliable yielder in most wheat districts. It is a tall-growing variety, with good stooling powers, but hollow stemmed, and possessing considerable foliage. The heads are well developed, square and compact, with broad, smooth, cream-coloured spikelets, somewhat crowded towards the tip, giving the top a club-like appearance. The chaff is smooth, but possesses slight awns towards the summit of the head. The grain is soft, white, and mealy, and not of high strength. The grain is easily milled, and it belongs to the weak flour group of wheats, though the colour of the flour is excellent. In Departmental variety tests the yields of Dart's Imperial have usually stood out prominently, and confirm the opinion that this variety is a good prolific standard type for most of the wheat areas.

FEDERATION.—This is, without question, the most popular and prolific variety of wheat in general cultivation at the present day. It was produced by the late Mr. Farrer, Wheat Experimentalist, of New South Wales, from a cross between Purple Straw and Yandilla. Yandilla is a cross between Improved Fife and Etewah, an Indian variety. The production of this wheat was probably the greatest of Mr. Farrer's many triumphs in wheat breeding, for none of his many successful crossbred wheats have enjoyed such a wide measure of popularity as Federation. Indeed, during the last six years the golden yellow characteristic of old time Australian harvest fields has been gradually changed to a dull bronze through the ever-increasing popularity of Federation wheat. This popularity has been won by sheer merit, for Federation, when seen in the field for the first time, is decidedly unattractive in appearance, especially when grown side by side with the showy wheats of the Purple Straw type. Most farmers in growing it for the first time have expressed great surprise at the yielding capacity when the wheat was taken off, for the yield invariably exceeded the expectations based on pre-harvest estimates. As a matter of fact, Mr. Farrer's main aim in producing Federation was to produce a variety suited to the Australian methods of harvesting with the stripper. Federation is a short, erect-growing variety of moderate stooling capacity, with broad, semi-erect, light-green foliage. It has short, upright, stiff straw, unaffected by some of the most violent storms. It may be regarded as a variety in which there is a maximum of grain to the minimum of straw. Its chief feature is its extraordinary prolificacy. It was not intended for nor recommended as a hay wheat. It is essentially a grain yielder. It possesses a bold, square, beardless, compact head, with a peculiar and characteristic bronze cast, broad, well-developed, smooth spikelets

As might be expected, there are numerous strains of Federation on the market. In many the original squareness and blocky nature of the head, characteristic of the variety when it emerged fresh from the breeder's hands, have to a large extent disappeared. The effect of rigorous selection in maintaining the yielding capacity of a given variety may be seen by the results at the Longerenong Agricultural College this season.

A small parcel of hand selected Federation (third selection), which was produced by the writer at the Parafield Wheat Station, South

FEDERATION. YANDILLA KING. KING'S EARLY.

Australia, was put in competition with two other Federation plots under precisely similar conditions. Whilst the yield of the hand-selected seed was 43.2 bushels, the two other plots gave 34.5 bushels and 32.8 bushels respectively. Federation is susceptible to fungus diseases—especially rust and flag smut, and, to a lesser extent, "take all" (*Ophiobolus graminis*). Were it a more disease resistant and earlier in maturing, it would be ideally suited for the more arid areas. The grain is very liable to suffer from bleaching, especially in a

showery harvest, owing to the fact that, unlike many of the older wheat varieties, the ear stands upright when ripe, and allows rain to readily penetrate the ear. Its grain is soft, white, and plump, and yields a good percentage of flour of creamy-yellow colour. Though the strength of the flour is considerably lower than Comeback and Bobs, it is higher than the Purple Straw Wheats.*

JONATHAN is another crossbred produced by the late Mr. Farrer, and is of Fife-Indian parentage—*i.e.*, the result of mating Improved Fife with an Indian variety known as "Indian G." It does better in moist cool districts than in hot dry regions. It is a fairly vigorous grower, with moderate stooling capacity, with sparse, erect, glaucous, narrow foliage, and hollow, slender, supple straw. It is fairly rust resistant, and has repeatedly escaped injury from rust when other varieties have been seriously attacked. The head is characteristic in shape, being broad towards the centre and tapering gradually at the summit with white, smooth, beardless, compact, closely adherent spikelets. The chaff adheres closely to the grain, and possesses sharp pointed tips. The grain is hard, and of excellent appearance, and yields a good proportion of flour of high quality and strength. It is a difficult variety to strip, on account of the closeness with which the grain is held.

ZEALAND BLUE.—A cross between Tardent's Blue—a good hay wheat—and Zealand—a variety of the Lammas type—bred by Mr. G. F. Berthaud, of Western Australia, and sent out as Crossbred 53A. It is a tall-growing, medium late variety, with good stooling powers, and strong straw. This variety has done well, both as a grain yielder and hay variety, especially in the cooler wheat areas. The head is long, beardless, slightly tapering, with characteristic velvety chaff. The grain is large, plump, and medium hard, of very attractive appearance, and of good milling quality.

Late Varieties.

AMERICAN No. 8.—A vigorous tall-growing variety, of good stooling capacity. This was the best of a large number of American varieties grown at the Parafield Wheat Station over a period of five years. It has done well both as a grain and hay yielder, and when thoroughly acclimatised it may prove a valuable variety. It is a somewhat late wheat, with firm, upstanding straw, and characteristic dark-brown heads. The ears are narrow, well formed, beardless, with rather densely packed spikelets, and the chaff very closely adheres to the grain. The grain is small, hard, and dark red, and of good milling quality. Last season a bag of this variety sown at Rutherglen Experiment Farm on stubble land gave 25½ bushels per acre.

GENOA is a late wheat with good stooling propensities and upright straw. It is one of the bunt-resistant crossbred varieties produced by the late Mr. Farrer, and its introduction suggests the possibility that the pickling of seed wheat for the prevention of bunt may in the near future be dispensed with. It does well in seasons when the spring rains are heavy. Thus, at the Rutherglen Experiment Farm last season, a 2-acre plot on stubble land yielded 21½ bags of grain, or 32.2 bushels per acre. It is more suited, however, to cooler districts

* *Vide* Milling Qualities of South Australian Wheats, A. E. V. Richardson, *Bulletin* 52, Department of Agriculture, South Australia.

than hot ones. The ear is long, beardless, slightly tapering, with characteristic rounded widely-spaced spikelets. The chaff is wide and smooth, and the grain soft, white, plump, and mealy.

HUGUENOT.—This wheat was originated by Mr. J. Correl, of Arthur River, Western Australia. Mr. Correl has been responsible for the production of a number of new varieties, most of which are hay wheats. He states that it was obtained in 1897 from a crop of Medeah

MEDEAH. JONATHAN. ZEALAND BLUE.

Wheat, and from the twelve distinct variations he obtained from the variety he selected in 1898. He supposes that his selection must have been a natural crossbred wheat between Medea and Purple Straw. Huguenot is a very tall-growing wheat of the macaroni or durum class, and is quite free from the long, coarse beards characteristic of Medeah. It stands up well, frequently growing to a height of 6 or 7 feet. Its straw is practically solid, and very sweet in character. It is a poor stooler, and must, therefore, be sown very thickly. This

is the more necessary on account of the large size of its grain. Its early growth is erect, and of light-green colour, and the leaves broad and stiff. Unless sown thickly the straw goes up like miniature bamboos. The head is very dense and compact, being dark brown in colour, with a cast of purplish black. The spikelets are densely crowded, and give the ear a club-like appearance. The grain, which is long, hard, horny, angular, and slightly pinched, adheres closely to the chaff, and makes the wheat difficult to strip. This difficulty is

GENOA. FIRBANK. AMERICAN NO. 8.

increased by the fact that the wheat is invariably a tall grower, and possesses very prominent top nodes, which latter often choke the comb of the stripper or havester. It is a macaroni wheat, and not a milling wheat. Its gluten content is high, but the colour of the flour is very objectionable. It is a very poor yielder, and will not pay to grow for grain at f.a.q. rates. It is essentially a fodder variety, being grown either for hay or ensilage. As a hay wheat it gives an exceedingly heavy cut, yields up to 4 and 5 tons per acre being frequent in South Australia. Mixed with varieties like Baroota

Wonder, Majestic, or Calcutta Cape Oats, it gives heavy cuts of good quality sweet hay. It is smut resistant, and relatively rust resistant. The cost of seed wheat of this variety is usually high, but it could not be produced with profit at ordinary f.a.q. rates on account of the low yield of grain per acre.

MEDEAH.—Like Huguenot, this belongs to the Macaroni class of wheats, and is a tall-growing late variety which stools very sparingly. The straw, like Huguenot, is practically solid, but coarse in character, *sweet, and bearing prominent nodes. It is difficult to harvest, par-*

COMEBACK. THEW. DART'S IMPERIAL.

ticularly when growing rankly, owing to the pendent character of the ripe heads, and the prominence of the last node causing the stripper to choke. It is a very suitable variety to sow for the production of a heavy crop of green fodder or ensilage; but for hay it is rather unsuitable on account of the coarseness of the straw and the heavily bearded heads. The difficulty in harvesting both Huguenot and Medeah may be obviated, particularly where it is liable to grow rank and tall, by sowing it early in the season and grazing the young plants, and allowing the second growth to mature for grain. The heads are compact, the spikelets densely crowded, brown in colour

with patches of bluish black, possessing long, black, serrated beards, and hard, horny, long, and angular grain. The milling quality of the grain is very low. It is essentially a forage variety.

MARSHALL'S No. 3.—This is one of a large number of varieties originated by that successful wheat breeder, Mr. R. Marshall, late of Templars, South Australia. It is a late wheat of good tillering capacity, but rather slow growing when young, with a somewhat spreading habit, and broad, dark-green, drooping leaves. It is somewhat rust resistant, but its late maturity is an objection for the drier districts. The straw, when ripe, has a purplish tinge, stands up well, and bears a beardless, somewhat open head of fair length carrying smooth, broad spikelets, with a slight tip beard. The grain is soft, white, plump, and of fair size, and of fair milling quality. It is very popular in South Australia, New South Wales, and Queensland, and has been very widely grown for hay.

YANDILLA KING.—This is another of Mr. Marshall's crossbred wheats, and is a half-sister to Federation. It was obtained by mating Yandilla and Silver King (a white-strawed variation of Marshall's No. 3.) It is a late wheat, with good stooling propensities, and, like Marshall's No. 3, is a somewhat slow grower in the early stages. The ripe straw is stiff, hollow, and upright, on the short side, bearing large, well-developed, shapely, beardless heads, creamy-white in colour, with broad, close-set smooth spikelets. The chaff adheres closely to the grain and renders stripping somewhat difficult. The ear is slightly tip bearded, and the grain large, plump, medium hard, white, and of good milling quality. It has been a consistently heavy yielder, and has done well in Departmental variety tests, and must be regarded as one of the most prolific grain varieties in general cultivation.

WHITE TUSCAN.—A very popular hay wheat, late, with good stooling powers. Possesses fine quality sweet straw, which retains its colour well when cut for hay. The head is rather open, beardless, white, and possesses a characteristic tapering tip. It gives a heavy cut of good quality hay.

The foregoing list of wheats represents some of the varieties which have done well in various parts of the wheat areas. The list is not intended to be exhaustive, but is intended merely to direct attention to varieties which have been proved to be satisfactory for forage, ensilage, hay, and grain purposes. The number of varieties grown in the various wheat areas under different local names is legion, but careful analysis of the properties and structure of many of these varieties reveals their identity with well-known standard varieties. It is to be regretted that, up to the present, no satisfactory scheme of descriptive classification of the Australian wheats has yet been evolved. Such standardization and classification is a work of the future, and might well be done by the co-operative effort of the State Departments of Agriculture.

Incidentally, it might be mentioned that the production and sale of pure varieties of seed wheat is very rarely a remunerative business. While large incomes have been made by the breeders of high-class stud stock, there are very few men who have profited from the production and sale of new varieties of seed wheat, or improved strains of old varieties. The men who have contributed to the wealth of Australia by the production of new and improved strains of wheat

have not benefited financially from such productions. The reason is obvious. Before a wheat can be popular it must have been tested over a wide area, and proved to be of value in a number of localities. By the time its value has been demonstrated the variety is possessed by many growers, and the monopoly of the variety cannot, therefore, be possessed by the breeder. Moreover, the productive powers of wheat are such that the total produce of one bushel in five years would be sufficient to seed the whole of the wheat area of Victoria.

Most of the State Departments of Agriculture and Agricultural Colleges have taken in hand the production and distribution of selected varieties of graded seed wheat.

A list of varieties of wheat available for distribution by this Department for the seasons 1913 and 1914 is announced in the advertising columns (p. vii).

Obviously, the production of high grade seed is most effective when the seed has been selected within the limits of "pure lines"; that is, the produce of a single typical high grade plant, and continuing the selection on the lines indicated in Article 9 of this series.* Selection on such lines has already been initiated at Rutherglen, Longerenong, and Wyuna, but at least three years must elapse before such seed will be available in bulk for distribution. Meanwhile, such varieties as are available in bulk for 1913 and 1914 are announced elsewhere.

(To be continued.)

BEE-KEEPING IN VICTORIA.

(Continued from page 4.)

By F. R. Beuhne, Bee Expert.

XII.—NUCLEI.

The word nucleus in bee culture means a small colony of bees taken from a normal colony and established separately in a small hive. The number of bees in a nucleus may vary from 500 to several thousands, the strength of population being regulated by the beekeeper according to the season or the purposes for which nuclei are formed. There are two distinct objects in making nuclei by the division of a stock of bees or of a swarm, one being increase, the other the mating of virgin queens. If the object is increase in the number of colonies, each nucleus should consist of not less than one-fourth of a normal colony, otherwise the end of the season will have arrived before these small colonies have developed sufficiently to winter safely.

For the mating of queens, nuclei are indispensable to the queen-breeder and the modern apiarist, but for this purpose the number of bees in each little hive may be much less, the object being merely to provide a separate habitation for each young queen, with a minimum of worker bees, consistent with taking care of their abode and resisting climatic influences.

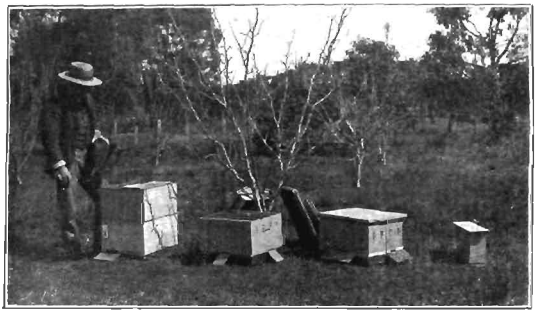
In the raising of queens for the purpose of superseding those which are either too old, or otherwise inferior, bee-keepers often encounter

* *Jour. of Agric. of Vic.*, Jan., 1913. Wheat Improvements.

difficulties in any one of a number of methods employed to get the *young queens safely laying*.

The most direct, but also the crudest and most wasteful way, is to *kill the old queen* and either *let the bees raise cells themselves* or *supply them with a queen-cell previously raised elsewhere*. If the queen killed were old, but had been a good one in her time, *the bees may raise a good young queen* from her brood, but in the case of an inferior queen no improvement, except in age, need be expected. When *a queen-cell of good stock raised under the proper conditions* is given, the result will be as good as by any other method, so far as the vitality and prolificness of the young queen are concerned.

In either case, however, there is a considerable loss in the reproduction of the worker-force of the hive, much less certainly, but still *considerable, when a cell, ready to hatch within two days, is given*. When allowing the bees to raise a new queen themselves after destroying or removing the former queen, it will be at least 21 days before



NUCLEI HIVES FOR MATING QUEENS.

the young queen commences egg-laying; when a cell is given, it will be twelve days during which reproduction is at a standstill. Now, as good queens cannot be raised, excepting under the very conditions which cause brood-rearing to be at its best, it follows that breeding is interrupted just when it should be at the maximum. Even a poor or old queen will at such a time lay 500 eggs per day, representing for 21 days a worker force of 10,500 bees and 6,000 for twelve days, but as young bees continue to hatch for 21 days after the old queen is removed, the weakening of the colony does not become evident till a month afterwards, by which time the circumstances have probably passed from memory.

It is a generally understood fact that there can be only one queen in a hive at a time and, with the one exception referred to further on, that holds good, as, on the average, from the time the young queen hatches till she begins to lay, ten days elapse, and a break in egg-laying for that period must of necessity occur. To reduce this interruption of breeding to a minimum, or to do away with it altogether,

different methods have been evolved and practised, principally by American bee-keepers in the first instance.

The plan which does away with stoppage of egg-laying altogether is to confine the queen to the combs of the lower chamber by means of a queen-excluding honeyboard. About half of the combs of brood are placed in the upper story, to which a separate entrance is provided. A queen-cell is given above and the young queen will take her mating flight from the upper entrance, and in due course will commence to lay while the old queen in the lower chamber still continues. The young laying queen may be removed and used elsewhere and another cell given.

This is an ideal method in theory, but success depends upon a combination of circumstances. These are: a colony covering the combs of two stories: a queen in the lower chamber at least two, but better three years old: and a free use of the upper entrance by the worker bees, otherwise the virgin queen when returning from her mating flight, finding no bees at the upper entrance, will be attracted by the lower one, will enter, and either kill the laying queen or be herself destroyed by the bees.

To reduce the total interruption of breeding to a minimum for the number of queens required, the usual practice is to divide one colony into a number of nuclei of two or three combs, each being given a queen-cell and placed apart from others. Many of the bees will, however, return to the former stand, leaving but young bees behind. These are unable to properly take care of the brood and the queen-cell and to defend the little hive against intruders.

There are several ways of overcoming this difficulty. The bees for each nucleus may be taken from any hive which can spare them; they are shaken into a small empty hive, such as the one shown on the right of the illustration. A wire screen is fastened over the top of the box, and it is placed in a dark, cool, well-aired position. On the evening of the day following, that is, about thirty hours later, the box is taken to the spot where it is to be located. A comb of brood and one or two combs containing honey and pollen are taken (without bees) from some strong colony and given to the nucleus, a ripe queen-cell in a cell protector, or a virgin queen, in an introducing cage, being inserted at the same time.

Another way of making nuclei is to break up into lots of two or three combs each, a colony which has just thrown a swarm. As a number of bees will return to the old stand, only one comb of brood should be left in each nucleus. Select for the purpose those combs containing the greatest amount of sealed brood, and place the combs of young brood in the hive on the old stand, where it will be cared for by returned bees.

A swarm may also be divided into nuclei. It is best to allow it to cluster somewhere; then hive it in an empty box and about sunset divide it amongst a number of nuclei hives, each containing a comb of the brood from which the swarm issued and one or two combs without brood. As bees which have swarmed and clustered will stay in any new stand, a greater number of nuclei can be made out of a swarm than a swarmed stock. The queen of the swarm should, however, be

removed, otherwise the bees are likely to crowd to the particular box she is in.

By any one of these methods from four to ten nuclei may be made out of a single stock, and thus brood-rearing is interrupted only to the extent of one queen for four to ten new queens. In order to still further economize, American bee-keepers some years ago adopted a system of very small nuclei with miniature frames and only a teacupful of bees in each. These are known as Swarthmore nuclei. Owing, however, to the liability of such very small hives being robbed out when near an apiary, and the erratic behaviour of these small communities in frequently swarming out, the few Australian bee-keepers who experimented with this system have abandoned it. For the raising of the best type of queen, it is essential that from the first start of the queen-cell to the commencement of laying of the young queen, the most favorable conditions should exist. In the case of very small nuclei these conditions are absent during part of the chrysalis and the adult stage of the queen's life. Even in nuclei on standard combs in thin walled boxes holding two or three frames, the period betwen the hatching and laying of the queen is often unduly extended by climatic influences and the vigour of the young queen impaired.

The influence of extremes of heat and cold may be reduced to a minimum by having three or four nuclei in an ordinary hive body, as shown by the uncovered hive in the centre of the photograph. A ten-frame body will hold four, an eight-frame three nuclei of two combs each. The compartments are made by thin, tightly-fitting division boards, extending upwards to the level of the top of the hive. Each has a separate entrance facing in a different direction and a separate thin cover board independent of the ordinary hive roof.

As it is always desirable to have some spare queens at the end of winter, to make good any losses of queens, these nuclei grouped together in one hive may be carried through the winter, provided there are enough bees in each to nearly cover the combs. When queens have been removed, the divisions may be withdrawn and the bees united under one queen.

Nuclei may be grouped in yet another way by standing, close together, two boxes of two compartments each, as shown in the second hive from the right in the illustration. The advantage of this method is that, after one queen is removed from each box and the bees united, a four-frame super may be put on each, allowing an extension of the brood nest upwards, as shown on the left. When all combs are occupied, an ordinary hive with entrance in the same position may be substituted for the four-frame boxes, the hives moved apart by degrees, and run as independent colonies.

For convenience the nuclei are numbered, the numbers being painted on tablets secured by a nail in the centre and used to indicate the state of each. The number is in normal position for queen laying; upside down, for queenless; diagonal upwards, for queen-cell; horizontal, for virgin; and for queen-fertilized but not laying yet, diagonal downwards.

(*To be continued.*)

CITRUS CULTURE IN VICTORIA.

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

INTRODUCTION.

Fruit-growing in Victoria is rapidly becoming one of the most important industries in the State. The area under cultivation is extending every year with fruits suitable to their geographical situation, and in the northern areas, under irrigated closer settlement, Citrus culture is making such progress that it bids fair to ultimately outstrip all other classes of fruit in area and production. For the benefit of those who are embarking on the production of oranges and lemons, this article will deal with Citrus culture in all its aspects. According to soils, situations, stock, varieties, planting and pruning,

PLATE 1.—INSTRUCTING SETTLERS AT TONGALA ON CITRUS CULTURE.

irrigation, cultivation, drainage, manuring, picking, packing, marketing, and diseases.

SOILS.

The suitability of the soil is a most important feature in connexion with the successful cultivation of the Citrus family. Perfect drainage is an absolute essential. Careful consideration is, therefore, necessary in the selection of a soil for the successful growth of Citrus trees.

The climate of Bendigo is quite as good for the production of the orange as the Murray frontages, but the soil is, in many instances, unsuitable. *Bendigo soils generally are* deep to fairly shallow, and consist of alluvial and colluvial soils. The subsoil is, in many places, retentive; consisting of red and yellow to grey clays, resting on vertical sandstones and slates, and are depicted in Plate 2, Fig 1. Such soils require perfect artificial drainage. These soils are found as far north as Raywood, Inglewood, and Goornong. North of the places

mentioned, and extending almost to the Murray frontages, and east through the Goulburn Valley, are found soils consisting of a shallow to deep red loam, overlying a retentive red clay of varying depth, lying over layers of silts, grey clays, and gravels. These soils are improperly drained unless the subsoil clay is broken through to the silt layer below. These red clays, however, compact again under irrigation, and can be classed as unsuitable. Plate 2, Fig. 2, depicts this class of soil.

Throughout this area, and all through the Mallee country, are found sand hills or pine ridges. These pine-ridge soils are generally, most suitable. Areas occur, however, where Citrus culture would prove a failure. These areas consist of soils of a very sandy nature, immediately overlying gravelly washes. These soils drain too freely, and dry out, and can be classed as unsuitable. Plate 2, Fig. 3 represents this class of soil.

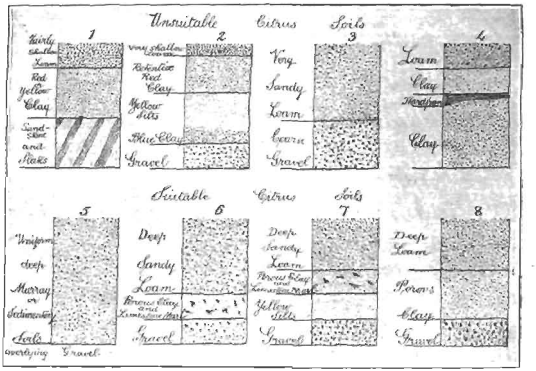


PLATE 2.—SOILS.

Suitable soils are represented by the sedimentary flats of the Murray fringe, the pine-ridge country of the Mallee and the deep loamy soils and porous subsoils of the Cohuna, Barnawin, and Tongala areas—of the first, the composition is all a mixture of clays, silts, and sands, carried by floods from the eroded highlands, and spread on the fringes of the Murray river. These soils are uniform in character and very deep, extending to as much as 20 feet, and overlie a sandy and gravelly drift. They are well drained, extremely fertile, and produce the finest growth of tree and type of fruit in the State. Plate 3 shows orange trees 25 feet high, 25 years old, at the orchard of J. Greenwood, Esq., Koondrook. The tree against which the owner is standing produced this year, 1912, 25 bushel cases of good marketable fruit; last year, 18 bushel cases; and in 1910,

class of soil is equally productive. Plate 2, Fig. 5, depicts this type of soil. Mildura is a name known everywhere. The soils suitable there consist of the typical pine-ridge country of the Mallee. Deep to very deep red sandy soils, generally overlying porous clays, which *are in many cases intermixed with limestone marl.* These clays sometimes overlie silts, and these in turn overlie gravelly drifts. Mr. J. T. Grossman, of Mildura, in a letter of 18th August, 1912, writes—"*Re* the general feature of the Citrus regarding prolific bearing, the very limy and gravelly soils should be avoided. A stiff land may be made to suit the orange, provided it is well drained and the trees *regularly manured, and the character of the soil changed by green* manuring. The more sandy and deep loamy soils are the more suitable. They are better drained, and allow deep cultivation." These pine-ridge soils are also found at Cohuna, Bamawm, and Tongala, and

PLATE 3.—ORANGE TREE, 25 YEARS OLD, AT J. GREENWOOD'S ORCHARD. YIELD, 1912, 25 BUSHEL CASES.

they extend right through the Mallee. Their drainage is good, and the type of fruit produced excellent. Plate 2, Fig. 6 represents this class of soil.

Another class of soil found in the northern irrigable areas consists of a deep red loam, overlying a porous clay, intermixed slightly with limestone marl. This porous subsoil overlies a yellow silt, which in *turn overlies alternate layers of gravels and silts. This class of soil* is distinct from that shown in Plate 2, Fig. 2, as the soil is deeper and more open in texture, and the subsoil is intermixed with sandy particles, which permit of perfect drainage and makes it very suitable for Citrus culture. Plate 2, Fig. 7 represents this class of soil.

Other suitable soils of limited areas may be quoted, such as deep granitic soils, overlying porous subsoils of friable clays, and sedimentary *soils overlying gravelly washes along the fringes of creeks and*

rivers. Generally speaking, a suitable soil for Citrus culture should be a deep loamy soil, overlying a porous subsoil, which in turn overlies a gravelly wash as shown in Plate 2, Fig. 8. Red soils, as far as my experience goes, do not make any difference in the deeper red colour of the rind. The rich red tinge of the Navel variety appears equally in all the classes of soils indicated in Figs. 5, 6, 7 of Plate 2.

Tests of the subsoil of any area to be planted should always be made before planting, so as to thoroughly understand its character, quality, regularity, and freedom from any hardpan or impervious layers of cements, as shown in Plate 2, Fig. 4. Its porosity can be determined by digging a hole 4 feet square and 2 feet deep, under *absolutely dry conditions in the summer months, January or February.* The hole should then be filled to the surface level with water, and in two days this water should have thoroughly drained away naturally, if it does not do this, the soil requires under-drainage.

SITUATION.

The aspect of the orchard should be well considered. Citrus trees like a well sheltered and warm situation. The generally flat surfaces of the suitable areas do not lend themselves to much choice, but advantage should always be taken of any eminence. The orchard *should be given, as near as possible, a northerly and an easterly aspect,* and should be protected from the south and west. The climatic conditions of the north and east are congenial. The cold winds of the south and the west are very severe on young trees, as well as on the young growths of old trees. On the plains of the north frosts are rarely severe enough to do any serious damage. Any fall of temperature below 29 degrees Fah. may injure the lemon, but the orange will withstand more severe conditions of frost. Only on rare occasions have very low temperatures occurred, as can be shown by the following table. Taking the three places named as typical of the climate of the Citrus areas:—

Place.	Temperatures for 1910.		Greatest High and Low known.	
	Highest Maximum.	Lowest Minimum.	Highest Maximum.	Lowest Minimum.
Mildura	108°, Dec. 29th	30°, 21st July ..	123°	23°
Bendigo	105°, 26th Jan	32·8°, 4th June..	117°	21°
Echuca	109°, 26th Jan.	32·6°, 21st July	115°	23°

In the midlands and the south, although every advantage is taken of soil and situation, the orange produces a fruit of thick rough rind, with much rag, and of poor quality. The lemon does much better, and can be grown, practically, all over the State under congenial *soil conditions—Doncaster and some parts of Gippsland being especially favorable.* The suitable irrigable areas of the north successfully produce all classes of Citrus fruits.

Under irrigation, and on Closer Settlement blocks, mixed culture is the general practice. Blocks are as a rule small, and the holder has to produce many varieties of produce—lucerne, fodder crops,

vegetables, and fruit. Wherever practicable, suitable areas should be given over wholly to the production of special crops. There should be Citrus areas, deciduous fruit areas, and vine areas, distinct from lucerne areas, and mixed fodder crops. This would modify, to a large extent, the danger of over-irrigation, and under seepage, so injurious to Citrus trees, caused by the laying out of closer settlement blocks on wrong lines. Under intense culture, Citrus trees should be planted on the highest portion of the land. The highest portion is usually the sandiest and best drained, and along the highest points the irrigation channels are brought to command the block.

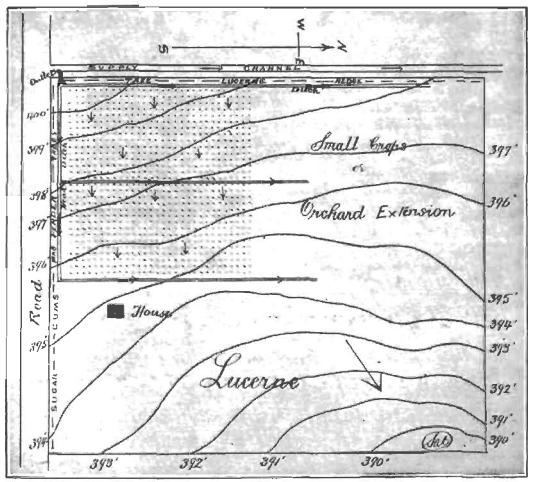


PLATE 4.—PLAN OF IRRIGATION BLOCK, SHOWING 10-ACRE CITRUS ORCHARD PLANTED ON THE SQUARE SYSTEM.

Trees 22 feet apart; scale 10 chains to 3 inches.
Explanatory.—Arrows denote flow of water; 400 to 390 contour lines.

Citrus trees require more frequent irrigation than deciduous fruit trees or vines, and, economically, the planting of the highest land with Citrus follows as a natural deduction. Lucerne requires more water than fruit trees, and if planted on the high ground, and the fruit trees planted adjacent to and below the lucerne, under-seepage is likely to occur with great damage to the orchard block. The older irrigators of this State will have recognised these conditions long ago. Plate 4 represents a closer settlement block set out according to soil and situation for the guidance of new settlers.

To shelter the orchard from the south and west it is advisable to aid the situation by suitable wind breaks. Sugar Gums and Pepper trees planted, alternately, at a distance of 20 feet apart will make a suitable breakwind as far as shelter is concerned. The Sugar Gum grows high, and the Pepper tree has foliage right to the ground. These trees should never be planted nearer the orchard than 50 feet. Tagasaste (Tree Lucerne) is most suitable, and can be planted half a chain away from the orchard. It is a quick grower, long lived, makes a dense hedge, and can be trimmed, nor is it a robber of the soil. These trees should be planted in the early spring (August), at a distance of 8 feet apart. Olives can also be used as a breakwind. They do not grow rapidly, but form a valuable adjunct to the orchard, and should be planted 30 feet apart, half a chain away from the orchard. Varieties suitable—Black Italian, Blanquet, Bouquettier, Verdale, Lucca, Manzanillo, Hardy's Seedling No. 1. Cork Oaks (Quercus Suber) could also be used, planted 30 feet apart, and half a chain away from the orchard. They are evergreen, and should eventually be of commercial value for the cork they produce.

(To be continued.)

A CONSIDERATION OF THE CAUSES OF STERILITY IN FEMALE DOMESTICATED ANIMALS.

By G. Heslop, L.V.Sc. (Veterinary Staff).

Sterility may be defined as the incapacity on the part of an animal to reproduce its species. It may be absolute or permanent, relative or transient.

Absolute when fecundation does not take place.

Relative when fecundation occurs only very occasionally, and when development of the young animal is arrested by accident or abortion. A relative sterility may occur in animals in low condition, when, owing to malnutrition, there is imperfect development of ovum in the ovary and absence of sexual desire. It may also occur in fat, obese animals, where there may be fatty changes in the generative organs themselves.

Relative or transient sterility is produced by causes which are removable, and is, therefore, amenable to treatment. Absolute sterility, as the name implies, is incurable.

Fertility in animals is dependent upon normal structure and function of the generative organs, and any abnormality may be productive of either partial or complete sterility.

In order to understand the various abnormalities which may give rise to sterility, it will be necessary to give a short description of the female generative organs. For the purposes of this article these organs may be said to comprise:—(1) the ovaries; (2) the womb; (3) the uterine tubes; and, (4) the vagina.

The ovaries are two bean-shaped structures (about the size of a hen's egg in a mare) situated about a hand-breadth behind the corresponding kidney. They are situated in the abdominal cavity, and are suspended from the abdominal "roof" by a large expansive mass of ligament. They are concerned in the development of ova or eggs at the various periods of "season" throughout the generative life of the animal.

The womb is a hollow muscular sac, which, like the ovaries, is suspended from the abdominal roof by large folds of ligament. It is *Y-shaped, being made up of a cylindrical body from which, in front,* two horns (right and left) are given off, and these run forward towards their respective ovaries. At the forward termination of these horns, and connecting them up more or less completely with the ovaries, are the uterine or fallopian tubes. These tubes convey the ova or eggs from the ovary to the womb, where, if the ovum is fertilized, further development will take place.

Portion of the hinder part of the womb projects outwards into the cavity of the vagina, and is somewhat constricted where it joins the vaginal wall, forming the so-called os, or neck. In a normally developed os this constriction does not bring about perfect occlusion of the passage between the vagina and the womb, although a very great reduction in the size of the opening is thus occasioned.

The vagina is a tubular passage, about 6 to 8 inches in length in the mare, leading from the neck of the womb, and opening externally.

The generative organs of the domesticated female animal are only in a state of greatest activity during the prime of life. The most notable characteristic of their functions is their quality or state of being regularly recurrent.

Prior to the attainment of puberty the generative organs are inactive and incapable of reproduction; but, when the age of puberty is reached, this period of inactivity gives place to one of periodical activity. This change occurs in both sexes, but is earlier attained in the female than in the male, and marks the animal's arrival at sexual maturity.

The age of puberty is variable and indefinite in that it is controlled *by a number of outside influences, such as climate, work, and food.* For instance, animals bred in hot countries reach sexual maturity earlier than those animals of the same species bred and reared in cold countries.

With the advent of puberty, changes take place in the generative organs, one of the most important of which changes is the occurrence of Season or Heat. The occurrence of season in animals is dependent upon the attainment of puberty, and upon the development of a ripened ovum in the ovary. It has been shown by experiment that if the ovaries are entirely removed from a female animal by an operation, such as spaying, season will not occur. This is an interesting fact, as it enables us to understand a number of the phenomena associated with some forms of sterility, one of the symptoms of which is total absence of season or heat.

Immediately prior to the appearance of season, an ovum or egg undergoes ripening in the ovary and escapes along the uterine tube, being conveyed towards the womb. If a male and female animal

become mated at this time the egg will become fertilized by one of the living particles contained in the semen of the male. The union of these male and female elements will result in the formation of a new individual, which will subsequently undergo development in the womb of the female until expelled at birth.

PREVALENCE OF STERILITY.

In the absence of statistics it is impossible to arrive at any conclusion regarding the prevalence or otherwise of sterility. In certain individual studs pregnancy and sterility figures have been kept, and these furnish the only information that is available, as far as I can ascertain. As these figures refer principally to pure-bred animals, they cannot be taken to apply generally, as it is a well-known fact that the degree of sterility is greater in pure-bred stud animals than in animals less subjected to artificial conditions of feeding and exercise.

In female animals other than mares it has been impossible to collect any reliable data from which fertility and sterility tables could be worked out.

Statistics furnished by English authorities go to show that from 25 to 30 per cent. of mares used for stud purposes fail to produce foals. I am unable to ascertain if artificial insemination was practised in the studs from which these figures were obtained. In all probability it was not, for figures supplied by one of the large German Studs go to show that the percentage of sterility in that stud was 28 before artificial insemination was practised, and that after artificial insemination was introduced this percentage of sterile mares was reduced to 21 per cent.

The degree of sterility varies in different breeds. For instance, in Great Britain, in Shire mares the average percentage of sterility was shown to be about 37, while in Clydesdales the percentage was about 32, and in Welsh and polo ponies the percentage was about 30.

An examination of the figures available goes to show that an enormous annual loss is occasioned by this high degree of sterility in the larger domesticated animals, and, therefore, any means to remedy the evil will commend itself to breeders.

CAUSES OF STERILITY.

Injudicious breeding and mismanagement.—A great number of cases of sterility have as their casual agent some error in dieting and exercising. "Condition" in an animal intended for stud purposes bears an entirely different relationship to "condition" in an animal intended for slaughter and food. Grossness should never be confounded with good-breeding condition, it being a well-established fact that very fat animals, especially females, often fail to conceive when mated.

Sterility is frequently seen in animals specially prepared for show purposes, where obesity and grossness are often associated with idleness and lack of exercise.

In race-horses there is often noticed a remarkable degree of sterility, especially in females. As these animals are not usually

allowed to breed until after the completion of their racing career, a condition of sexual inertia is established; in addition, the hard, dry food given in a racing stable tends to hold in abeyance the powers of procreation. Such animals, in the majority of cases, require a long spell at grass before they are mated, in order that they may be capable of reproduction. Food, although probably only an accessory cause, exercises a remarkable influence upon the production of sterility. Unbalanced rations containing excesses of foods which are rich in carbohydrates (starch and sugar) are capable of producing varying degrees of sterility; such a food as brewers' grains being especially notorious in this respect. Foods, such as peas, beans, lucerne, and clovers, containing large quantities of nitrogenous substances, are said to increase fertility. This they probably do to a limited extent by increasing sexual desire and assisting in rousing up a sluggish and inert condition of the ovaries to the production of ova and season.

Poverty and overwork are conditions which are often associated, and which tend to lower the fertility of the animal by bringing about ovarian inertia.

The influence upon fertility exercised by age is worthy of consideration. The ability to reproduce the species becomes gradually less as age increases beyond the period of full physical development, until, finally, in old age, the sexual function ceases altogether. Animals which have been mated soon after the attainment of puberty are more likely to conceive than animals which have been kept sexually idle until old age is reached and then mated.

In-breeding exercises an influence upon fertility, it being found that continued in-breeding results in the production of animals possessing varying degrees of barrenness.

Hybrids, such as mules, are generally regarded as being sterile. Cases have been recorded where mules of both sexes have been capable of reproduction, but these cases are exceptional, the rule being that hybrids are sterile.

In mares of an exceedingly excitable temperament it is often noticed that immediately after service the semen is ejected by a series of violent straining motions of the genital organs. In these cases the effect of exhaustive work before service is beneficial. This fact was probably first noticed by the Arabs, as it was a common practice with them, in dealing with excitable mares, to submit them to a fatiguing gallop immediately before service, and afterwards to leave them quietly at rest.

In vicious draught mares, brisk exercise and the pouring of cold water over the hind quarters and loins after service has proved of benefit in preventing the ejection of semen.

Climate, as well as exercising an influence upon puberty in animals, may influence fertility. Animals subjected to sudden changes of climate are often rendered temporarily sterile until acclimatised. It has been noticed that animals are more fertile in countries where the climate is fairly even, and is not subject to sudden extremes of temperature.

In animals affected with chronic debilitating diseases or fevers a temporary and sometimes a permanent sterility is present, in which there is dullness of sexual desire and faulty development of ova in

the ovary. In the treatment of this condition, certain drugs having a stimulating action upon the generative organs are indicated. These drugs include strychnine, compounds of phosphorus, arsenical compounds, and several non-official drugs. Another favorite drug amongst some horse-breeders, but one falling rapidly into disuse amongst veterinarians, is cantharides (Spanish flies).

In the use of any of these drugs for ovarian inertia the breeder should be guided by the advice of his veterinarian, for, owing to injudicious use, they have been responsible for the production of sexual and other disorders more serious in their consequences than those for which they were originally administered.

A large number of cases of sterility have their origin in alterations in, and diseases of, the ovaries. This is especially true of the majority of cases of sterility occurring in cows, where alterations in the ovarian substance are common. These alterations usually take the form of cysts, which, by enlargement and pressure, destroy ovarian tissue and prevent the development of ova. It is not usual for both ovaries to be cystic at the same time, excepting in well-advanced, old-standing cases. Where one ovary is cystic and the other one healthy it is quite possible for the healthy ovary to take up the whole function of production of ova and for the animal to conceive. Usually, however, a cystic condition of an ovary gives rise to irritation in other parts of the genital tract, causing straining and expulsion of the semen at the time of service. *The remedy for this condition is surgical, and has* for its object the breaking of the cyst wall and the liberation of its contents; or, in some cases, the removal of the diseased ovary and cyst, leaving the normal ovary to carry on the whole function of development of ova.

In pampered, obese animals a condition of fatty degeneration of the ovaries frequently exists. Fat animals are notably infertile, and where fatty changes take place in either the ovaries or the uterine tubes the animal is permanently sterile. Except in the early stages the condition is incurable. Dieting on foods poor in starch, sugar, and fats, together with constant and properly regulated exercise, is about the only treatment likely to have any beneficial effect.

Diseases of the generative organs, such as tuberculosis, and malignant tumors or growths affecting the ovaries, are rare, but when present give rise to sterility. In the case of growths the only effective treatment is surgical removal.

Among sterile mares the majority have at some time in life been pregnant, or have been capable of procreation; the number which have been totally barren throughout life being relatively small. The cause of these cases of sterility in one-time pregnant animals is referable to the previous parturition, at which there was either partial or complete retention of the afterbirth, with or without injuries (abrasions and lacerations) of the genital organs themselves. Retention of the afterbirth is attended with much more serious consequences in mares than in other animals on account of the susceptibility of mares to "blood poisoning" and "founder." Retention of the afterbirth usually occurs in those births in which the expulsion of the young animal from the womb is unduly hurried. It may also occur in cases where birth has been unduly retarded. The semi-attached afterbirth

becomes putrid owing to bacterial infection, and this gives rise to catarrhal conditions of the lining membranes of the womb and vagina. The presence of this catarrh may, in some cases, be demonstrated by the occurrence of discharges of more or less thickened fluid material from the vagina. In the majority of cases, however, owing to closure of the neck of the womb by plugs of catarrhal material the fluid is retained within the womb and no vaginal discharge may be seen. Sometimes a catarrhal condition of the membranous lining of the vagina may co-exist with catarrh of the womb, in which case the discharge is profuse. In chronic catarrh the lining membranes become considerably thickened, and permanent sterility results. Even in mild cases the presence of this catarrhal fluid, which is usually acid in reaction, is fatal to conception on account of its destroying action upon the living elements contained in the sperm of the male. If pregnancy does occur it is usually followed by early abortion. Treatment should consist of frequent flushing of the womb with weak antiseptic and alkaline solutions to destroy the bacteria or germs and to correct the acidity.

Occlusion of the opening at the neck of the womb, which may be present in catarrh of the womb, or may occur as a separate condition, acts as a mechanical barrier to the passage of semen towards the ovum, and fertilization cannot take place. Under normal circumstances when season is present in a female animal there is sufficient dilatation of the os to allow the semen to pass along into the womb and meet with and fertilize the ovum elaborated at this time. Very often occlusion is brought about by injuries, such as tearing and abrasions, received at the time of a previous parturition, when, on healing of these wounds taking place, there is formation of thickened tissue around the os which obliterates the opening communicating between the vagina and womb. Some of these injuries are caused by the straining efforts of the mother in expelling the young animal at birth, while others are produced by the injudicious use of ropes, hooks, knives, and other instruments by persons in attendance upon the mother at the time of parturition. In simple occlusion of the os, unaccompanied by catarrh of the womb or vagina, the treatment adopted should be in the direction of dilating the passage. This can usually be accomplished by passing the hand, previously well oiled, into the vagina and directing it forward until the fingers come in contact with the neck of the womb. By gentle pressure with one finger over the centre of the os, at the same time giving the hand a rotary motion, an opening can be made which can be further dilated by insertion of other fingers until it is large enough to allow the whole hand to pass through into the womb. Perfect cleanliness is necessary in order to insure success. The vagina should be flushed out with weak antiseptic solutions both prior and subsequent to dilation. The hands of the operator should be well washed and disinfected, and the nails trimmed in order to prevent injury to the womb. The use of instruments in order to bring about dilation, in the majority of cases, is quite unnecessary, and, unless used with extreme caution, may bring about fatal results. Their use should not be undertaken by any one other than a qualified veterinarian. In cases of occlusion of the os, the use of the inseminator is of considerable value in bringing about pregnancy.

Abortion is a frequent source of sterility. Two forms of this malady are recognised, namely:—(1) a contagious form, due to a germ which gains entrance at the external genital opening, or through the digestive system; and (2) a non-contagious form. This non-contagious form may be due to a number of causes, the chief of which are—(1) external violence inflicted upon the mother during pregnancy; (2) the action of certain drugs which exert contractile influences upon the muscular structure of the genital organs; (3) ingestion of food-stuffs affected with various forms of moulds or fungi. Commonly associated with abortion is retention of the after-birth and bacterial infection of the genital tract, also internal injury to the womb, os, and vagina. The relations of these conditions to the causation of sterility have been previously referred to.

Cows which are known as "bullers," and are practically always in season, are invariably sterile, and are suffering from a condition which is incurable. In cows the removal of the ovaries by an operation such as spaying controls to a great extent the morbid sexual desire, thus rendering the animal capable of being rapidly fattened and slaughtered.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

MONTHLY REPORT, ENDED 14TH FEBRUARY, 1913.

By H. V. Hawkins, Poultry Expert.

The results obtained from the Competition Pens during the past month, despite trying conditions existing, were highly satisfactory. On two occasions the thermometer rose above 105 in houses, necessitating the constant use of the hose in the pens and on the birds themselves. Fortunately, no death from heat apoplexy occurred, and the health of the birds is excellent. Two useful showers of rain fell, which helped to soften the ground and put good heart into the birds. Mr. S. Brown's White Leghorns are still well in the lead with a total of 1,318 eggs. Mr. E. Waldon's White Leghorns now occupy second position with 1,246 eggs. Neither pen has had any replacement, and both teams look remarkably fit, though Mr. Brown's are inclined to loosen in feather, which is an indication of moult. It is anticipated that there will be a very close finish between the first three pens.

Feeding.—Care had to be exercised in feeding during the hot weather. On several occasions the mid-day meal was withheld, and the evening grain reduced; wheat being used almost exclusively, and an increased supply of green feed.

Broodiness.—There has been an increased tendency during the last week for the birds to show broodiness, this being attributed to the humid condition that existed, and which hastened many birds into the moult.

The total number of eggs laid up to date is 71,668—an average of 1,038.6 eggs per pen, which must be considered as highly satisfactory.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition.			Position in Competition.
			April 15 to Jan. 14.	Jan. 15 to Feb. 14.	Total to Date (10 months).	
40	White Leghorns	S. Brown	1,178	140	1,318	1
20	"	E. Waldon	1,103	143	1,246	2
47	"	J. E. Bradley	1,117	118	1,235	3
31	"	G. Edwards	1,105	124	1,229	4
42	"	R. W. Pope	1,084	119	1,203	5
28	"	F. G. Eagleton	1,100	98	1,198	6
25	"	R. L. Appleton	1,060	135	1,195	7
70	"	C. J. Beatty	1,053	131	1,184	8
23	"	W. McLister	1,077	101	1,178	9
37	"	C. B. Bertleamont	1,067	110	1,177	10
1	"	J. Campbell	1,055	118	1,173	11
39	"	W. G. Swift	1,032	138	1,170	12
13	"	W. B. Crellin	1,042	126	1,168	13
33	"	H. McKenzie	1,017	146	1,163	14
9	"	J. Spotswood	1,065	94	1,159	15
45	"	Wooldridge Bros.	1,011	140	1,151	16
49	"	W. Purvis	1,019	123	1,142	17
36	"	R. Moy	1,010	123	1,133	18
29	"	J. B. Brigden	1,009	124	1,133	
53	"	H. Hodges	992	139	1,131	20
63	"	Percy Walker	983	143	1,126	21
24	"	Serpentri Poultry Yards	1,013	107	1,120	22
48	"	Griffin Cant	1,008	110	1,118	23
14	"	J. H. Wright	997	111	1,108	24
44	"	A. W. Hall	981	116	1,097	25
5	"	J. H. Brain	966	123	1,089	26
7	"	A. H. Padman	962	111	1,073	27
50	"	A. Abpee	980	92	1,072	28
32	"	S. Brundrett	917	143	1,060	29
6	"	J. B. McArthur	949	111	1,060	
10	R.C. Brown Leghorns	S. P. Giles	922	137	1,059	31
46	Black Orpingtons	H. A. Langdon	955	94	1,059	
61	"	Jas. Ogden	955	102	1,057	33
19	White Leghorns	Cowan Bros.	934	123	1,057	
2	"	B. Bowlinson	956	100	1,056	35
12	"	Mrs. Kempster	937	117	1,054	36
43	"	Morgan and Watson	916	134	1,050	37
64	"	H. Merrick	921	128	1,049	38
15	"	Mrs. Steer	921	119	1,040	39
35	"	C. H. Busst	918	121	1,039	40
30	"	Mrs. Stevenson	918	106	1,024	41
12	"	T. H. Stafford	881	138	1,019	42
51	"	H. Hammill	896	111	1,007	43
3	Black Orpingtons	King and Watson	919	87	1,006	44
58	White Leghorns	M. A. Monk	893	111	1,004	45
65	"	A. H. Thomson	885	105	990	46
43	"	G. Purton	854	127	981	47
57	"	B. Walker	843	135	978	48
60	"	Miss R. E. Ryan	865	110	975	49
66	"	J. Moloney	833	125	958	50
11	Black Orpingtons	T. S. Goodisson	845	112	957	51
4	White Leghorns	J. Blackburne	831	118	949	52
27	"	E. Nash	833	109	942	53
54	"	F. R. DeGaris	843	87	930	54
41	"	A. Stringer	831	97	928	55
55	Brown Leghorns	J. Matheson	795	125	920	56
16	Silver Wyandottes	R. Jobling	802	115	917	57
68	White Leghorns	W. J. McKeddie	780	122	902	58
8	Black Orpingtons	D. Fisher	813	78	891	59
58	White Leghorns	W. J. Stock	799	76	875	60
21	"	J. O'Loughlin	757	100	857	61
17	"	S. Childs	746	106	852	62
52	Minorcas	Chalmers Bros.	783	58	841	63
22	White Leghorns	W. N. Ling	740	96	836	64
67	Anconas	A. E. Manning	743	91	834	65
59	White Leghorns	W. J. Seabridge	721	102	823	66
34	"	R. F. B. Moore	689	117	806	67
18	"	B. Mitchell	677	99	776	68
38	Old English Game	E. J. Barrett	670	91	761	69
26		(Reserved)	—	—	—	
		Totals	63,782	7,886	71,668	

GENERAL NOTES.

WESTERN WOLTHS RYE GRASS—

This new grass, said to be a sport from the ordinary Italian rye-grass, is an extremely rapid and vigorous grower, and some account of a first year's test with it is given in the *New Zealand Journal of Agriculture*. At Ruakura Farm it surpassed all rye grasses, making a rapid dense growth, and providing excellent spring feed. Sown on 14th May, it was ready for feeding about 1st October. It is said to be superior as a forage crop to, say, peas and oats, because it gives several good after-cuttings. The dairy herd did as well on this grass as on a mixture of peas and oats, and it is suggested that the new rye should provide excellent hay for horses. Being related to Italian, it is not suited for sowing to pasture as it dies out, but its place is that of a forage crop in the rotation. It is adapted to wet districts and good soils, and, as stated, it has the merit of producing several cuts in one season. At the time of writing, 15 tons to the acre was being cut at Ruakura.

THE DAIRY COW—

A cow requires food whether she is milking or not. The amount of food necessary to maintain a dry cow in fair condition, so that she will neither lose nor gain in weight, represents what is called her "maintenance requirement." The maintenance requirement of healthy cows of similar weight does not vary much. If a cow is milking, however, she must consume and digest food in excess of her maintenance requirement. Otherwise she will lose in weight. The food consumed by a cow yielding milk is thus utilized for two different purposes. One part is required for maintenance, and this may be set down as working expenses. The other part is utilized to fill the milk-pail—it is the raw material from which milk is produced. What is a good cow? It is one which can digest and assimilate for milk production an amount of food which largely exceeds her maintenance requirement. But cows vary widely in this respect. From the University of Missouri there comes an interesting discussion of this topic in *Experimental Station Bulletin No. 2*. During two years the herd-testing at the station showed No. 27 cow to be a good milker, and her half-sister, No. 62, a bad one. They were registered Jerseys. In the third year it was decided to compare the food requirements of these cows, and for this purpose both were calved, as it happened, the same week. During the lactation period the food to each was regulated so that the live-weights remained constant, and the amounts of milk and butter fat were then compared with the amounts of food consumed by each cow. In the results it was found that the good milker was consuming about 2½ times as much food, after deducting her maintenance requirements, as did the bad cow, and she also produced about 2½ times as much milk. Altogether, with the good cow, 35 per cent. of the ration went for maintenance and 65 for milk; with the bad one the figures were 56 and 44. Ten bad cows may yield as much milk as five good ones, but they will require twice as much food for maintenance purposes. As it is only the food utilized in excess of maintenance that leaves a profit, the benefits of herd-testing are hereby emphasized.

LUCERNE HAY—

When lucerne is carelessly handled in hay-making there may be considerable loss in weight, and still more in actual feeding value. In *Bul. 35 of the Colorado Exp. Sta. it is stated that in average lucerne* from 40 to 60 per cent. of the crop consists of stems, the balance being leaves. As the hay dries the leaves become brittle, and, together with the finer stems, are easily broken off in the process of hay-making. *It is calculated that in Colorado the loss from this cause ranges from* 15 to 66 per cent. of the total crop by weight. These leaves are the most nutritive part of the crop. In his standard work on "Farm Foods," Wolff states that in clover the leaves contain more than half *the flesh-formers of the whole crop.* A similar estimate may safely be assumed for lucerne, and the importance of saving the leaves during haying is thereby emphasized. In making lucerne hay, the crop as left by the mower should be drawn into wind-rows before it reaches *the brittle stage, and allowed to dry still more in that position until* it is ready for carting. In rows the material will be sufficiently compact to hold most of the leaves when ready to lift, and, moreover, this kind of drying will preserve the colour better. Where a crop has been left too long in the swathe of an afternoon a dewy morning next day will often allow it to be raked together with little loss. On dry bristling lucerne the horse-rake is a bad implement, and it is worst naturally when the crop is light.

FARM COTTAGES—

It is a fact to be much regretted that on very many of the larger farms in this State no provision is made for the housing of married workers. In most districts of England and throughout Scotland all the farms of any considerable size have cottages as part of the regular equipment, and in the men who occupy these cottages the farmers have the best and most reliable of their workers. The married man is the sheet anchor of the British farmer. In Victoria, if a farm worker marries—and it will often be the best who marry—he is practically forced out of the ranks of hired labour. There appear to be three courses open to him. He may give up farm work altogether to take up other work in the city where he can get a house. He may hold on at farm work intermittently by living apart from his wife. In the third place, he may take up a small block on his own account where the returns to his labour will tend to be limited by the capital and appliances at his command. From the point of view of production none of these is a contingency which the farmer as a class can desire; and the want of farm cottages which is characteristic of the State makes it difficult to retain the best class of agricultural labour permanently in the service. Plans and specifications of farm cottages were given in this *Journal* of Aug. and Nov., 1909, and in Jan., 1910, by A. S. Kenyon, C.E., Engineer for Agriculture, and the cost of materials and labour was fully detailed.

THE USE OF PHOSPHATES IN VICTORIAN AGRICULTURE.*

By John W. Paterson, B.Sc., Ph.D., Experimentalist, and P. R. Scott, Chemist for Agriculture.

Phosphorus is an essential constituent of living protoplasm. It is absorbed by plants as phosphoric acid or phosphates, which are highly oxidized compounds of phosphorus and are non-poisonous. Phosphorus is always concentrated in those parts of the plant where cell growth is most active, and is abundantly present in ripe seeds. It is intimately connected with the vital processes of reproduction and growth, and the amount of phosphoric acid removed by crops is more constant than of any other single constituent of crop ash.

Being a mineral constituent, phosphoric acid must be obtained from the soil. In his Presidential Address to this Section (Adelaide, 1907), Dr. Cherry showed that Victorian soils are commonly deficient in phosphoric acid as judged by European and American standards, and a large number of soil analyses were quoted showing that this was so.

The subject has been dealt with by the same author in the *Year-Book of Agriculture* (1905) of this State. Analyses of 186 soils are quoted, and the results are averaged under six distinct types or local groups as follows:—

	PHOSPHORIC ACID PER 100,000 DRY SOIL
Hill soils (30 samples) ...	63
Northern Plain (34 samples)	61
Coastal Plain (85 samples)	61
Volcanic soils (24 samples)	61
Mallee (5 samples)	47
Drained swamps (8 samples)	76
Average (186 soils) ...	62

In his book on "The Soil," Hall quotes analyses of ten typical English soils which average 98 parts per 100,000, which is 58 per cent. above the Victorian average, and also 58 (approx.) above each of the Victorian groups. Maercker (Germany) classes soils as follows in regard to phosphoric acid content:—Poor, 50 parts per 100,000; medium, 50 to 100 parts; normal, 100 to 150; good, 150 to 250; and rich, over 250. Hilgard (America) says that in virgin soil less than 50 is seriously deficient unless accompanied by much lime; sandy loams, with fair supply of lime, 100; sandy loams, with poor supply of lime, 200; and clayey soils not less than 200. According to English, German, and American standards, therefore, it appears that Victorian soils fall seriously below the permissible limit when they are viewed as groups.

The method of averaging soil analyses however is not satisfactory, and while, in practice mixing soils has commonly a good effect, as much cannot be said for mixing the figures. We have therefore arranged the above 186 soils showing what percentage of the soils of each local group falls within stated limits of phosphoric acid. The steps selected

* Addres delivered at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science.

rise by 10 parts per 100,000 up to 100 parts, then by 50's up to 200, while the few over 200 are classed together.

PERCENTAGE OF SOILS FALLING WITHIN CERTAIN LIMITS OF PHOSPHORIC ACID CONTENT—BY DISTRICTS.

	Under 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	90 to 100.	100 to 150.	150 to 200.	Over 200.
Hill soils (30) ..	..	..	26	10	7	16	10	7	7	3	7	..	7
Northern Plain (34)	..	..	12	3	12	29	12	17	6	3	3	3	1
Coastal Plain (85)	2	8	22	15	11	..	9	5	7	4	11	2	4
Volcanic soils (24)	4	..	4	21	26	8	8	8	..	..	21	..	..
Mallee (5) ..	..	..	20	20	..	20	20	20	..	..	..	..	..
Drained swamps (8)	..	..	13	13	13	13	..	22	..	..	13	13	..
All soils (186)	2	4	18	13	12	10	9	9	5	3	10	2	3

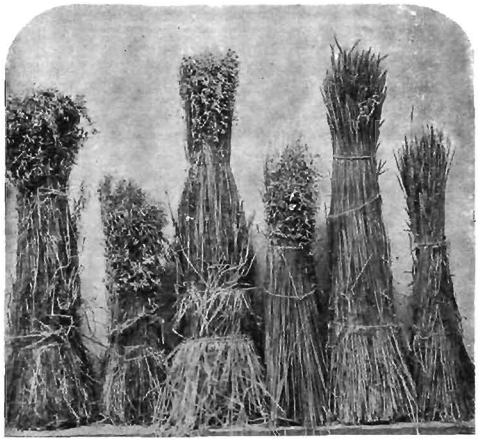


FIG. 1.—SHOWING EFFECT OF SUPERPHOSPHATES ON A FIELD CROP COMPARED TO NO MANURE. (SMALL SHEAVES FROM UNMANURED PLOTS.)

Looking to the totals it is seen that 49 per cent. fall below 50 parts, 36 per cent. fall between 50 and 100, while only 15 per cent. of the soils examined are soils which, as judged by the standard of other countries, might possibly be sufficiently supplied with phosphoric acid.

In a state of nature fertility is never stationary. On good soils it is cumulative; on poor soils it declines. In the earlier settlement of this country the best soils naturally were selected first. These were

well supplied with phosphoric acid, and good crops could be got without the use of manures. In later times the need for adding phosphates to the land has become clearly defined, partly through the depletion of usable phosphoric acid in old soils by continued cropping, but chiefly owing to the gradual extension of cultivation to the medium and poorer soils of the State.

Luckily, within recent years, appreciation of the effect of phosphatic manures has been increasing faster than the growing need for them. *According to Returns issued by the Government Statist, 7 per cent.* of the area under crops was manured in 1898; 19 per cent. in 1901; 36 per cent. in 1903; 56 per cent. in 1905; 66 per cent. in 1909; *and 69 per cent. in 1910. We estimate that from 92 to 95 per cent.* of the manures were used to furnish phosphoric acid, being principally dissolved phosphate.

In 1910 the manured area totalled 2,714,854 acres, and the artificial manure used 86,316 tons. This gives an application of 71 lbs. per acre. In 1901 the manured area equalled 556,777 acres, and the *artificial* manure used was 23,535 tons. This gives an application of 95 lbs. per acre. Farmyard manure increased by 33 per cent. and the cropped area also by 33 per cent. between these two dates, so that *there is no reason to believe that farmyard manure was replacing* artificials. It appears, therefore, that although farmers have been using artificial manure more extensively they have been applying *smaller* dressings per acre. It is not possible to reckon from the figures what is the average application made for cereals; but as wheat, hay, oats, and barley at each date together formed 93 per cent. of the cropped area the applications presumably approached within a few pounds of the amounts stated. The relatively small area under green forage, roots, and orchards would be somewhat more heavily manured than the area under cereals.

The phosphatic manures used in Victoria have three sources of origin—(1) imported ready for sowing; (2) raw material imported and manufactured locally; (3) raw materials found locally and manufactured locally. By far the greatest bulk of the material comes under the second class, and a small portion only under the third.

In 1910 there were 24 firms in Victoria engaged in the manufacture of artificial manures, but as detailed returns for manure works other than bone-mills are not available, we may review the manure supply briefly for the Commonwealth. The figures in 1910 were as stated below:—

EXPORTS AND IMPORTS OF VARIOUS MANURES, 1910.

Commonwealth.	Bonedust.	Guano.	Supers.	Rock *Phosphates.*	Other Manures.
	cwts.	cwts.	cwts.	cwts.	cwts.
Imports	12,740	788,304	1,196,613	2,112,127	377,327
Exports	80,602	2,812	260,261	11,190	229,841
Excess imports ..	..	785,492	936,352	2,100,937	147,486
Excess exports ..	67,862	..	..	..	..

Imports have increased over 250 per cent. in ten years. The chief items are phosphates. Of bones alone do exports exceed imports. The guano is almost entirely of the insoluble kind, and is used for making superphosphates. Of the manufactured super., over 70 per cent. came from the United Kingdom; Japan and Germany contributed smaller amounts. The largest item is rock phosphate, about 78 per cent. of which comes from Ocean Island, and the balance from Christmas Island. This is entirely used for dissolved manure and superphosphate, and no ground rock practically is used as such. Deducting imports from exports of raw phosphate, and allowing 1.9 ton superphosphate for each 1 ton of rock phosphate and guano, Australia in 1910 manufactured 275,000 tons of mineral super.—which was 85 per cent. of the total quantity employed. The "Other Manures" in the Table is partly made up of nitrogenous and potassic materials which do not supply phosphates.

FIG. 2.—MINING PHOSPHATES, OCEAN ISLAND.

The chief export of manures is from Victoria. Prices in Victoria compare favorably with those of adjoining States, but not so well with prices in Great Britain. The following Table compares the Unit Values of phosphoric acid in Victoria with the figures for phosphate, calculated to phosphoric acid, in Scotland† in 1912.

UNIT VALUES FOR PHOSPHORIC ACID (1912).

Phosphoric Acid as—	Victoria.	Scotland.
	s. d.	*s. d.*
Water, soluble	4 9	3 10
Citrate, soluble	4 0	..
Fine bone	4 6	3 3
Coarse bone	4 0	..
Insoluble in bone-super. and slag phosphate	3 0	2 6 (slag)
Insoluble in other manures	2 0	..

† *Trans. High & Agric. Soc.*, 1912.

In Great Britain citrate soluble and insoluble are not paid for in mineral superphosphates, but paying for them helps to give a drier manure, which is an advantage. It offers less inducement to use excess of sulphuric acid in making the superphosphate. A common grade of superphosphate in Victoria contains 17 per cent. of water soluble, 1 of citrate soluble, and 2 of citrate insoluble phosphoric acid. At the present time this would sell here at £4 8s. 9d. per ton; on the Scotch Units at £3 5s. 2d. The Victorian price is thus 136 per cent. of that ruling in Scotland. Superphosphate is the manure principally employed in this State, either in its natural state or in bone super., of which the price is largely determined by the price of superphosphate.

Official statistics showed that in 1910 the manured land received 71 lbs. of manure per acre. Seventy pounds of superphosphate to the *acre will supply about 14 lbs. of phosphoric acid. In 1910 the Victorian* wheat average was 14.52 bushels. A bushel of wheat contains about 48 *lbs. of phosphoric acid, and, therefore, the wheat crop of 1910 removed* 7 lbs. of phosphoric acid per acre. This would be supplied by 35 lbs. *of superphosphate. There are many cropped soils in Victoria which* will not grow a crop worth harvesting without manure. We find *many notable examples in our work.* It cannot be expected, however, that on such soils 35 lbs. of super. will produce 15 bushels of wheat, provided the other conditions are right. The straw will require the equivalent of 10 lbs. manure; and in no case can the manure applied be wholly absorbed by the first crop. At Rothamsted, 36 per cent. of the phosphoric acid used was recovered in the mangel crop, but we have no figures as to the maximum utilization possible by wheat on poor soils. The method of drilling is favorable to absorption, but probably this never reaches 50 per cent. It will generally be less. It is fortunate, therefore, that the amount of manure necessary to give the largest profit must incidentally contribute to the enrichment of the soil by what the crop is physiologically unable to utilize. This places the phosphate supply of cultivated soils on the up-grade.

An acre of soil to a depth of 1 foot will weigh about 3,500,000 lbs. Taking 64 lbs. of phosphoric acid per 100,000 of soil (an average amount), this would equal exactly 1 ton per acre. If 70 lbs. superphosphate be applied per acre, to allow for 50 per cent. of absorption by a 15-bushel crop, then 320 years would be required to double the phosphoric acid content of the soil. The effect seems trifling. As is well known, the manurial residue, however, is more valuable than the native soil phosphate because, particularly if applied in soluble form, it is thinly spread out. This effect is enhanced when the first rains after drilling are heavy. Farmers say their land grazes better when the preceding crop was well manured.

In Britain it is common to apply up to 4 cwt. superphosphate to cereals, and up to 8 cwt. for roots. The manure is generally sown broadcast. This practice is calculated to soon enrich the soil in a sensible degree. In Victoria such large dressings are not profitable with cereals. It will seldom pay to apply much over 80 lbs. of superphosphate to a cereal. The difference may be partly due to climate, but it is probably due in larger measure to the Australian method of

drilling in with the seed. This method has certain advantages, and is doubtless the best means of employing manure in small quantities. It does not follow, however, that it is a safe guide as to the best quantity of manure to apply, except in cases where the manure is left in contact with the seed. For each quantity of manure there is doubtless a best method of applying it, and the subject is one for systematic investigation. Will 140 lbs. of manure placed 2 inches below the seed give a better net return than 70 lbs. applied at the same depth as the seed; and will the former crop be deeper rooted, and *stand dry weather better?* That the land will *graze better later* does not admit of doubt; and that the phosphate supply of the soil can be increased by a method of application admitting of heavier dressings with profit follows as a matter of course. Victorian soils are for the most part highly deficient in phosphates, and the incidental results which will follow the discovery of a method whereby heavier applications of manure can be made immediately profitable to the farmer are, we might say, of national importance.

Looking to the beneficial effect of phosphates upon cereals, even on virgin soils, it is remarkable that almost no attention is given to the manuring of pasture grasses. Being generally shallow-rooted, *their needs are presumably the greater.* More particularly on second class land devoted to dairying might a good return be expected from a moderate application of phosphates.

(*To be continued.*)

FERTILITY OF WHEAT LANDS—

Fallowing is an excellent means of storing up soil moisture and cleaning the land, and on this account it pays for doing. But in the long run the wheat-fallow-wheat system can only be viewed as a temporary expedient. Where it is well done, the soil is seriously depleted in organic matter by fallowing. In California the conditions *somewhat closely resemble those of our own northern areas*, but cultivation is of older date, and the experience of California, therefore, is for us fully significant. The subject is dealt with in an exhaustive *Bulletin* (211) issued by the State University. "Continued grain culture under shallow preparation over a long period has seriously affected the naturally low humus supply of the grain lands of California. This condition has been rendered worse by the burning of the straw and biennial culture necessitated by a limited rainfall. Humus in ample quantity in a soil means success; its lack means disaster, and this is particularly true in dry-land farming." The *Bulletin* quotes a number of experiments, showing the excellent effect of ploughing in green manures as preparation for wheat, and states that the wheat yield of California can be doubled by following this system, coupled with deeper cultivation. As ploughing-in crops, rye is recommended as a start, to be followed later by an admixture of rye and peas, or vetches, when a foundation has been laid. Rye has been found the surest. "Whatever crop is used it should be seeded as soon as it is possible to shallow-plough or disc the land in autumn, and the crop should be turned under in early spring, before the land is too dry for deep ploughing, and while it is still moist enough to start humification, or decay of the material ploughed in."

REPORT ON THE EXPERIMENTAL POTATO FIELDS, 1911-12.

By Geo. Seymour, Potato Expert.

During last season this work was carried on at a limited number of centres, as the blight caused a large decrease in the amount of available seed. Variety tests were carried out at the following centres:—Tourello, Pootilla, and Alberton.

Also at Leongatha, for the purpose of testing the relative resistance to Irish Blight of different varieties. Two plots were also established for manure tests exclusively—one at Daylesford and one at Romsey.

Table I. shows the plan of the plots at Pootilla, Tourello, and Alberton. Table II. shows the plan of the plots at Romsey and Daylesford.

TABLE I.

Plan of Experimental Plots at Tourello, Pootilla, and Alberton.

Variety and Manure Tests.

5 chains.

2 chains.	Thomas' phosphate, 265 lbs. per acre.
	No manure.
	Thomas' phosphate, 265 lbs. per acre.
	Superphosphate, 224 lbs. per acre.
	No manure.
	Superphosphate, 224 lbs. per acre.

TABLE II.

Plan of Plots at Romsey and Daylesford.

Artificial Manure Tests.

1	2	3	4	5	6	7	8	9	10
Superphosphate, 224 lbs. per acre.	Thomas' phosphate, 265 lbs. per acre.	No manure.	Blood manure, 140 lbs.	Sulphate of ammonia, 112 lbs. per acre.	No manure.	Sulphate of potash, 112 lbs. per acre.	Kainit, 336 lbs. per acre.	Superphosphate, 224 lbs. Sulphate of potash, 112 lbs. Sulphate of ammonia.	Sulphate of ammonia, 112 lbs. Sulphate of potash, 112 lbs.

The plot at Leongatha was manured with a dressing of superphosphate at the rate of 224 lbs. per acre with an unmanured check section.

TOURELLO.

The season was very unfavorable for heavy yields, being unusually dry during the tubering period. The field at Tourello was on fairly good potato land. The varieties used in this plot may be divided into two classes, *i.e.*, white skins and red skins; the former represented by Clarke's Main Crop, State of Maine, and Cruffle; the latter, a variety now largely grown in Gippsland, which promises to be a useful addition to the main crop sorts of this State. Last season it stood the disease in the Leongatha plot, and has proved itself a consistent cropper under all conditions. Of the other varieties, Clarke's Main Crop gives fairly steady yields; State of Maine is a medium-early variety, the crop was planted on the 16th November, and on 24th January (ten weeks afterwards) the plants of this variety were carrying tubers of a considerable size, and by the 1st March were fit to harvest.

TABLE III.

MR. J. A. TROUP'S PLOT, TOURELLO.

Variety.	Thomas' Phosphate.						No Manure.						Superphosphate.						No Manure.					
	Marketable.			Small.			Marketable.			Small.			Marketable.			Small.			Marketable.			Small.		
	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.
B. River ..	2	3	84	0	11	16	2	6	50	0	12	33	1	8	33	0	9	8	1	4	16	0	13	74
Cop. Skin ..	2	5	85	1	1	9	2	13	11	0	19	14	1	18	28	1	1	9	1	4	66	1	1	96
Black Prince ..	2	5	85	0	18	49	2	10	67	0	13	74	2	5	84	0	15	3	1	10	6	0	12	33
Old Pinkeye ..	2	7	91	1	4	66	2	3	86	1	4	66	1	16	22	1	5	107	1	10	6	1	7	36
Scruffle ..	3	6	105	1	4	66	3	4	23	1	4	66	3	2	69	1	7	36	1	18	28	1	7	36
C. Main Crop ..	3	4	23	1	4	66	3	0	12	1	4	66	3	4	99	0	17	85	2	17	42	0	15	3
State of Maine ..	2	15	56	0	3	100	2	6	22	0	4	89	2	11	67	0	4	56	2	3	22	0	4	22
	2	12	91	0	18	44	2	12	5	0	17	74	2	6	89	0	17	27	1	15	49	0	17	42

The returns obtained from the red skins go to show that these varieties have had their day, as far as the old potato districts are concerned.

POOTILLA.

The plot at Pootilla was on a light, gravelly, buckshot soil, not typical of the potato land in this district. The main, indisputable feature of this plot is the effect of the manures. The dressing of Thomas' phosphate resulted in an increase of 9 cwt. 25 lbs. per acre, whilst the super of the same value only increased the yield by 1 cwt. 84 lbs. The soil of this plot was of a very even character, as shown by the returns from the unmanured section, which was in favour of the phosphoric acid section.

ALBERTON.

The most satisfactory returns were obtained on the Alberton plot. The soil is alluvial river flat. Twelve varieties were planted in this plot, amongst them were the following red skins:—Brown's River and

Black Prince. These are two varieties very suitable for export. Over 8 tons per acre were obtained from the Brown's River, and a slightly better yield from the Black Prince. This class of potato has almost disappeared from the old districts, as it no longer gives satisfactory returns. Further experiments are contemplated in the coming season at the Alberton plot, and, should these returns be confirmed, it will point to the fact that the cultivation of these varieties would pay handsomely, as there is always an assured market for shipment to other States.

TABLE IV.

MR. IBBOTT'S PLOT, POOTILLA.

Name of Variety.	Thomas' Phosphate. 265 lbs. per Acre.						No Manure.						Superphosphate. 224 lbs. per Acre.						No Manure.					
	Market-able.			Small.			Market-able.			Small.			Market-able.			Small.			Market-able.			Small.		
	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.
Up-to-date ..	1	4	76	0	17	46	0	18	33	0	5	78	2	1	58	0	18	8	0	16	8	0	8	4
N.Z. Pinkeye ..	2	1	88	1	0	10	1	12	16	0	10	78	1	14	96	0	9	40	2	0	2	0	13	44
Clarke's Main Crop	2	8	21	0	12	6	1	10	15	0	17	46	1	6	88	0	16	8	1	6	88	0	13	44
Brown's River ..	2	8	21	0	14	82	1	16	8	0	10	78	1	13	54	0	14	82	1	4	12	0	10	78
Wilson's Premiers	3	4	106	0	18	83	1	17	56	0	16	8	1	17	56	0	16	68	1	12	16	0	10	78
Green Mountain ..	0	18	83	0	3	60	0	9	40	0	2	76	0	6	78	0	4	2	0	8	79	0	1	38
Adirondack ..	1	16	93	0	14	7	0	17	46	0	10	78	0	14	82	0	11	43	0	14	17	0	12	6
Chancellor ..	2	4	24	0	10	78	1	2	86	0	8	4	1	4	12	0	6	78	1	4	100	0	5	38
Brownell's Beauty	0	14	82	0	8	4	0	8	4	0	6	78	0	11	43	0	9	4	0	10	78	0	6	78
Sutton's Abundance	2	6	38	0	18	10	2	13	66	1	2	86	1	15	48	1	4	100	1	19	32	0	16	97
Copperskin ..	1	12	6	0	10	78	1	6	88	0	13	44	1	16	8	1	0	10	1	6	88	1	6	88
State of Maine ..	1	13	54	0	10	78	1	6	88	0	13	44	1	16	8	1	12	6	1	4	12	1	6	88
White Prolific ..	2	0	2	1	3	44	1	2	86	1	2	86	1	16	8	1	3	44	1	6	88	1	2	86
Fox's Seedling ..	1	15	54	0	14	82	1	4	2	0	10	78	1	16	90	0	13	44	0	18	33	0	10	78
Average ..	1	17	93	0	14	7	1	6	13	0	9	45	1	8	104	0	9	94	1	3	94	0	13	28

LEONGATHA.

This plot was established for the purpose of testing the resistance to Irish Blight of different varieties. Thirteen different varieties were planted; but, in consequence of the very dry season, the Blight did not make its appearance, therefore no information was obtained on this point. As before stated, this plot was dressed with 2 cwt. of superphosphate per acre, with a check section without manure. This moderate dressing of phosphoric acid, costing about 9s. per acre, increased the yield by over 13 cwt., which, at the market price at the time of harvest, was worth about £4. It should also be stated that the average sample from the manured section was much superior to those in the unmanured. This plot was on lea ground, having been under grass for some years, and, as often happens with such land, the crop was attacked by Eel Worm. It is interesting to know that the manured section was very free from the disease, whilst the unmanured land was badly affected, the difference amounting to quite 50 per cent. If these results are confirmed by future experiments, it will prove worthy of the attention of growers who have had trouble

from this pest, notwithstanding the fact that it is advisable to take a crop of oats or maize off a field before using the land for potatoes.

ARTIFICIAL MANURES.

DAYLESFORD AND ROMSEY.

The decline in the yield of the potato crops in the older districts of this State makes the question of manures a pressing one. Every grower knows well that farmyard manure is the best, because, in addition to supplying all the necessary ingredients of plant food, it has a beneficial effect on the mechanical condition of the soil on account of the organic matter it supplies; but the difficulty is to get sufficient of this material to cover any considerable area, consequently artificial manures are resorted to. These have many points to recommend them, such as the saving of time and labour, as with the ordinary seed drill 7 or 8 acres per day can be dressed. An ordinary dressing of dung entails an enormous amount of heavy work, as about 80 per cent. is water. A 16-ton dressing contains 144 lbs. nitrogen, 66 lbs. phosphoric acid, 132 lbs. potash, and 282 lbs. lime.

TABLE V.

ALBERTON PLOT.

Variety.	Thomas' Phosphate. 282 lbs. per acre.		No Manure. "		Super-phosphate. 224 lbs. per acre.		No Manure. "	
	Table.	Small.	Table.	Small.	Table.	Small.	Table.	Small.
	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.
Green Mountain ..	9 3 84	1 2 0	5 16 28	1 2 56	9 7 56	1 10 0	8 12 0	1 2 56
Sutton's Abundance ..	5 2 28	0 9 42	4 8 14	0 13 54	6 12 0	0 11 28	5 6 98	0 11 28
Brown's River ..	8 8 4	1 6 28	3 4 100	0 7 56	8 16 28	1 2 56	6 11 26	0 11 28
Black Prince ..	8 10 26	0 15 0	11 8 84	0 18 84	9 3 80	0 16 95	9 16 10	0 18 84
Carman ..	3 1 88	0 6 56	4 10 0	0 7 28	6 0 0	0 6 56	6 18 84	0 15 0
Burbank ..	8 6 35	0 10 66	6 18 32	0 15 0	6 12 21	1 2 56	6 15 0	1 2 56
Adirondack ..	8 18 70	0 8 90	5 18 14	0 18 84	9 1 84	0 13 24	4 10 0	0 18 84
Foxe's Seedling ..	6 3 84	1 0 84	3 15 0	0 11 28	5 14 4	0 13 24	4 19 42	0 11 28
Clarke's Main Crop ..	6 13 24	0 16 95	6 18 84	0 15 0	7 11 84	1 2 56	5 5 0	0 8 90
Wilson's Premiers ..	5 1 28	0 8 90	4 17 28	0 7 28	6 8 48	0 15 0	5 1 28	0 8 90
Snowflake	4 17 56	0 7 28	3 18 34	0 3 70	4 17 56	0 7 28	3 7 28	0 7 28
Old Pinkeye ..	2 18 14	0 15 0	1 17 56	0 11 28	3 3 56	0 15 0	1 17 56	0 11 28
Averages ..	6 8 91	0 13 15	5 13 104	0 12 31	6 2 43	0 16 72	5 15 2	0 13 106

There are several factors controlling the action of artificial manures, but it depends chiefly upon an ample supply of moisture. This sometimes depends upon—

1. Climatic conditions, such as a bountiful rainfall during the growing period, or a cool moist region where the evaporation is low.
2. Soil conditions—
   - (*a*) bottom land, which is often saturated in winter;
   - (*b*) a retentive subsoil;
   - (*c*) previous methods of cultivation, especially when pasture is included in the rotation.

TABLE VI.

LEONGATHA PLOT.

Name of Variety.	Superphosphate. 224 lbs. per acre. 9s.		No Manure.	
	Marketable.	Small.	Marketable.	Small.
	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.
Early Northern	2 6 74	0 17 98	1 7 45	0 5 0
Champion	3 4 102	0 8 54	1 14 7	0 11 74
Commerson's Violet	*0 17 43*	0 2 51	*0 11 86*	0 3 83
Burbank	1 10 72	0 5 89	2 5 86	0 15 0
Early Fortune	2 1 101	0 3 9	0 18 8	0 4 56
Cruffle	*3 0 0*	*0 4 84*	*0 4 56*	*0 10 56*
Adirondack	1 15 16	0 4 0	0 19 32	0 8 4
State of Maine	1 17 5	0 5 24	1 4 42	0 2 56
Up-to-date	2 11 40	0 5 16	2 13 40	0 13 0
Green Mountain	0 10 80	0 0 64	1 16 0	0 0 64
Sutton's *Abundance*	1 8 44	0 5 22	0 13 81	0 5 45
Clarke's Main Crop	2 2 54	0 3 8	0 16 98	0 4 42
Wilson's Premier	2 8 44	0 3 8	1 2 21	0 7 21
Snowflake	1 17 80	0 6 96	1 6 48	0 6 48
Averages	2 19 53	0 5 44	1 5 13	0 7 7
	0 5 44		0 7 7	
	3 4 97		1 12 20	
Gain			1 12 77	

TABLE VII.

Section	*Quantity and Manure used.*	Cost per Acre.	Daylesford. Yield per Acre.	Romsey. Yield per Acre.
		£ s. d.	tns. cwt. lbs.	tns. cwt. lbs.
1	224 lbs. superphosphate	0 8 9	5 1 20	2 12 76
2	265 lbs. Thomas' phosphate	0 10 6	5 7 56	2 12 76
3	No manure		4 17 56	3 0 60
4	140 lbs. blood manure	0 7 6	5 2 56	3 5 70
5	112 sulph. amm.	0 15 6	5 2 56	3 15 0
6	No manure		5 2 56	3 7 106
7	112 *sulph. potash*	*0 14 43*	*7 10 28*	3 7 71
8	336 kainit	0 15 6	6 12 56	3 6 108
9	224 lbs. superphosphates 112 lbs. sulph. potash 112 lbs. sulph. amm.	1 18 1½	7 1 28	3 11 28
10	112 lbs. sulph. amm. 112 lbs. sulph. potash	1 9 43	5 2 56	3 1 18

One noticeable feature of these plots was the vigorous growth of the plants on all the sections manured exclusively with a dressing of *phosphoric acid, which was only surpassed by the* sections receiving a dressing of sulphite of ammonia. The yields of these sections in the Romsey plot were not in keeping with the early growth of the plants, whilst in the Daylesford plot the beneficial action of the phosphoric acid is evidenced by the increased yield, the only difference in these plots being the rotation practised. The Daylesford plot was comparatively new land, whilst that at Romsey had been constantly

under cultivation for fifty years, and was lacking in humus, consequently very liable to dry out in the summer. The function of phosphoric acid in plant growth is to hasten maturity. In a wet season or on moist soils phosphoric acid will increase the yield, and in a dry season on land that dries out quickly it will decrease the yield.

TABLE VIII.

COMPARATIVE RETURNS—THOMAS' PHOSPHATE AND SUPERPHOSPHATE.

Manure ..	Thomas' Phosphate.	No Manure.	+ Increase.	Superphosphate.	No Manure.	+ Increase.
Weight ..	265 lbs. per acre	Nil ..	– Decrease	224 lbs. per acre	Nil ..	– Decrease
Cost ..	10s. ..	Nil ..	..	9s. 6d. ..	Nil ..	..
Plot.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.
Tourello ..	3 11 23	3 10 0	+0 1 23	3 4 4	2 12 91	+0 11 25
Pootilla ..	2 11 100	1 15 58	+0 16 42	1 18 86	1 17 10	+0 1 76
Alberton	7 1 106	6 6 23	+0 15 83	6 19 3	6 8 108	+0 10 7
Average	4 8 39	3 17 27	+0 11 12	4 0 68	3 12 107	0 7 73

NEW SEEDLING VARIETIES.

A parcel of pedigree seed was received from Dr. Wilson, St. Andrew's, Scotland, who visited this State with the Scottish Commission. It comprised six different crosses, most of which are the result of working a red-skinned variety, sent to him from New Zealand, on a number of British sorts. They were as follow:—

No. 88.—Main Crop (3), New Zealand variety (2).
No. 99.—Up-to-date, a New Zealand variety (2), Myatt's Kidney, Main Crop.
No. 128.—*British Queen, Myatt's Kidney, Main Crop* (2), New Zealand variety (2).
No. 139.—Main Crop (2), New Zealand variety (2), Myatt's Kidney.
No. 155.—Cramond Blossom, Main Crop, New Zealand variety.
No. 177.—British Queen, Main Crop, New Zealand variety.

A few seeds of each variety were planted on 23rd February, in pots. Germination was very satisfactory. The plants were removed from the pots on 6th April, and planted in a well-prepared garden plot. Early autumn frosts and dry weather interfered with the growth, with the result that the tubers produced were very small. No definite information can be formed as to the value of these new varieties for a season or two. It may be stated, however, that the flesh of most of them is yellow. By 1st June, all the plants except Nos. 155 and 177 had ripened off. The two latter appear to be very hardy plants. They resisted the frosts better than the others. The

whole of the plants were lifted on 27th June, when the following particulars were noted:—

No. 88.—Tubers round, colour white, late maturing, stolons long.

No. 99.—Tubers round, colour of potato white, medium early, stolons long.

No. 128.—One plant tubers, kidney shape, all others round, white, early.

No. 139.—Tubers all kidney shape, white, early, stolons very short.

No. 155.—Tubers round, white, late, vigorous plant, resisted frost.

No. 177.—Tubers all aerial, white, very late, vigorous plant, resisted frost.

LOCALLY RAISED SEED.

A small parcel of seed was saved from a field of potatoes grown by Mr. Scott, of Noss, near Casterton. The crop on this field was remarkably free from blight. The following plants belonged to a very productive strain, and showed remarkable resistance to blight. This seed was kindly grown by Mr. Thomas Pocket, Malvern, and from it 70 plants were obtained. Three of these did not produce any tubers, 6 showed a very stringy growth, 31 were rejected on account of undesirable features. Thirty, however, produced potatoes that were regarded as having desirable features. Of these, 7 were apparently early, 16 mid-season, and 7 late. Some were carried on long stolons, and others were produced quite close to the stems. One desirable feature of this parcel is that the whole of the varieties are very white in the flesh.

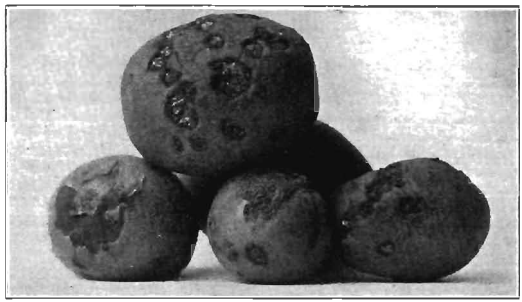
REPORT ON DISEASES.

Potato crops were generally very free from disease of all kinds. In the early crop a little Irish Blight was noticed towards the end of October; but very dry weather set in and checked the spread of the disease, and, owing to a very dry summer and autumn, the late crops were quite free from the blight.

POTATO MOTH.

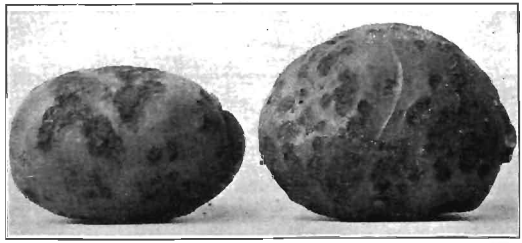
More damage was done during 1911-12 by the potato grub to the mid-season crop than by the blight in 1910-11. In some cases it amounted to fully 50 per cent. No satisfactory method has yet been devised for coping with this pest. The use of tarred canvas screens to trap the moth when on the wing, and spraying with arsenical preparations, are recommended. The latter will probably give the most satisfactory results if commenced in time. In many cases where the crop was lifted before the plants dried off, tubers which were apparently sound when put into the bags and covered with green tops, when the sap dried out of these, the grubs forsook them and attacked the tubers in the bags, which are often left in the field for a week or ten days. The result was that when the tubers reached the market they were found to be so badly tunnelled with the grub that from

50 to 75 per cent. were unfit for use. Deep planting has been recommended—*5½ to 6 inches*; but this of itself is not sufficient, as it is the habit of some varieties to form their tubers near the surface. The best protection is, probably, fairly deep planting and thorough moulding of the plants. If the moth appears in the field, this should



SCABBY TUBERS.

be done as soon as the tubers are well grown. To get satisfactory results from moulding, the drills should be not less than 30 inches apart. If the tubers are large enough for table use they should be harvested and disposed of as quickly as possible. If intended for



SCABBY TUBERS.

seed, it would be advisable to dip them in a solution of corrosive sublimate (*1½ ozs. to 7 gallons of water) for one hour and a half.*

Scab and Eel Worm.

The question of scab and eel worm has, in the presence of Irish Blight, been almost lost sight of; but these diseases will force themselves on the attention of growers, especially those who desire to keep their fields clean. The treatment recommended for the various forms

of scab due to the attack of fungus diseases is that of dipping the potatoes in corrosive sublimate or formalin. It is to be regretted that many growers are not inclined to go to the trouble because they see a neighbour who does not treat his seed have a clean crop. This often occurs, in spite of the most striking evidence of the benefit of dipping. The results of some experiments made in 1909-10 were recorded in the *Journal of Agriculture*, June, 1910. These experiments were continued during the following season (1910-11). The pots were put aside after lifting the tubers in 1910. The soil was not interfered with in any way, and in November, 1910, a clean Carman potato which has been dipped in formalin for two hours was planted in each pot, Nos. 1, 2, and 3. The produce of these was harvested in February, 1911. The following results were recorded:—No. 1, all tubers perfectly clean. No. 2, all tubers more or less scabby. No. 3 (duplicate of No. 2), all scabby. It was not intended to carry these experiments any further, but in the spring of 1911 it was discovered that a tuber had been left in each pot. The produce of these was harvested in February, 1912. The accompanying photographs will show that the results of the previous season were repeated.

SPRAYING FOR BLIGHT.

The results from spraying are dealt with in a separate article in the *Journal of Agriculture*, December, 1912.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page* 123.)

PART V.—OVERSEA EXPORT TRADE.

By E. Meeking, Senior Fruit Inspector.

PROBLEMS AFFECTING THE KEEPING OF FRUITS.

The unsatisfactory condition in which a large proportion of our fruits arrive on the British and Continental markets, and the consequent loss which results from this each season, has furnished much subject-matter for controversy amongst growers, shippers, and others interested during the past few seasons. Many theories have been advanced as to why our fruits deteriorate during transit. Some of the disputants, for instance, aver that want of due care on the part of the shipping companies in the matters of carrying the fruit at too high a temperature, and also of permitting the temperature to fluctuate during transit, the lack of providing insulated chambers for the fruit taken on at each port, the rough methods of handling by stevedores (both at this end and at the port of destination), the neglect on the part of the Railway Department to provide suitable cool-car accommodation for conveying the fruit from the orchard to the port, are each responsible for the unsatisfactory results. The great fault has been that, in most instances, those concerned have confined their

arguments to one aspect of the case only, and appear to consider that one of the factors mentioned above has been solely responsible for the deterioration of fruit during transit. Some consider that the pre-cooling of fruit prior to shipment is the only panacea. Others, again, think that if the shipping companies attended carefully to the various matters which come under their control, such as careful handling, stowage, and proper attention to temperatures during transit, the problem of landing the fruit in uniformly good condition will be solved without pre-cooling or any alteration in our present methods of harvesting, packing, handling, and rail transportation. As a matter of fact, the problems connected with the maintenance in good order of fruit from the orchard to market are so many and intricate that it would appear a complete alteration of our present methods in harvesting, packing, and handling, and in transportation by rail and sea, is necessary to ensure, in all instances, the landing of our fruits in oversea markets in a sound and saleable condition. The series of systematic and careful investigations which have been carried out during the past decade in the United States of America and Canada (the two largest fruit-exporting countries in the world) confirm this belief. It would appear from these experiments that none of the individual disabilities which at present exist in our methods of harvesting and transportation can be held solely responsible for the loss and waste which ensues each season, but that improper methods of picking, packing, handling, and transportation all contribute in a greater or lesser degree. The scope of investigation in the United States and Canada has covered, *inter alia*, such problems as the following:—

(*a*) The effects of various methods of picking and handling fruits.

(*b*) The influence of different methods of packing, both with respect to the systems under which the fruit is packed, and, also, the style of package used.

(*c*) The results of applying cool storage at various periods after fruit is picked.

(*d*) A study of the physiological and chemical changes which take place in fruits, both under cool storage transportation and under ordinary conditions.

(*e*) The effects of punctures, bruises, and abrasions of the skin on the keeping qualities of fruits.

(*f*) The reason why fruits vary in keeping qualities, even when subjected to similar treatment regarding cultivation, harvesting, packing, and transportation.

It will be readily understood that these problems, of necessity, cover a wide field of investigation, and have claimed much time and attention. They have had the effect of altering many pre-conceived notions concerning the factors which detrimentally affect the keeping qualities of fruits. Moreover, as the investigations have advanced, the opinions formed as a result of these in their initial stages have also undergone much modification in many directions.

As the experience gained from the experiments conducted in America should be of great value to the trade in this country, more especially in connexion with the policy to be adopted in

developing the industry on proper lines, it may not be out of place to give a summary of the results obtained for the benefit of those who are possibly unacquainted with the same. Taking the investigations in their sequential order, it will be as well to commence with the picking, packing, and preliminary handling of fruits.

PICKING, PACKING, AND HANDLING.

Although it may be stated that from time immemorial it has been recognised that fruits generally, and more particularly soft fruits such as peaches, plums, and the more delicate varieties of pears, require to be handled with great care, and that this fact was as well known on the American Continent as elsewhere, yet the importance of carrying this out entirely was never recognised to its fullest extent until the investigations proved how very easily fruit could be rendered almost worthless as a *result of apparently slight mechanical injuries.* The experiments, after being conducted for some years, show that, from all the causes which contribute to the deterioration and decay of fruit, no less a proportion than 65 per cent. is due to mechanical injuries inflicted during the preliminary picking, packing, and handling.

It was demonstrated that the more common kinds of mould, which are responsible for the largest proportion of decay in fruits from the orchard to the market, were unable to penetrate the sound unbroken skins of the fruit. Squeezing the fruit when picking, dropping it roughly into the picking receptacle, tipping it from these receptacles on to the packing tables, conveying the fruit in springless waggons over rough ground from the orchard to packing house, the presence of dirt, gravel, or other foreign materials in the boxes, and scratches made by finger-nails of pickers and packers, were all found to be amongst the causes which contributed to the injury of the fruit. As a matter of fact, comparing the relative values of cool storage and careful handling in connexion with the keeping of fruit in a sound condition over *long periods, it may be stated that the latter is of* greater importance than the former. In this respect it has been discovered that the value of the application of proper cool-storage temperatures is very much lessened if due attention is not paid to careful handling and picking. It has been shown that unbruised and sound apples will remain in good condition for a longer period in an ordinary storage room than will apples in cool storage if these have been previously rendered unsound as a result of careless handling.

Although the development of moulds and other forms of decay, whose spores have found access to the fruit through abrasions of the skin, may be checked to a great extent by the prompt application of cold temperatures, yet the value of a sound skin in providing a safeguard against the entrance of decay cannot be too strongly emphasized. Even such relatively hard-fleshed and tough-skinned fruits as apples and citrus fruits should be handled with the utmost care—when being picked and packed for export they require more careful handling than eggs. Even a slight pressure of the fingers will often serve to give the fruit a bruise, which, although unnoticeable at the time, will, in the course of a few days or weeks (with greater or less rapidity,

according to the surrounding conditions), develop unsightly bruises, and eventually render the fruit unsound and unmarketable.

Concerning the particular period which elapses from the picking of the fruit to its arrival on the market at which it receives the largest proportion of injury, it appears certain that the greatest percentage of bruises takes place in the initial stages of harvesting and packing. This is so because fruit when packed properly and tightly is less liable to injury than when stacked loosely on the packing-table or in the receptacles used by the pickers.

COOL STORAGE, PRE-COOLING, TRANSPORTATION, ETC.

Although careful picking, packing, and handling have been shown to be such important factors in keeping fruits in good condition over long periods, rapid and properly applied refrigeration is also a primary essential. The development of moulds and other forms of decay proceeds with greater rapidity under high temperatures; and this development is proportionately retarded with every degree of reduction in the temperature. It is now well known that at or near the vicinity at which water freezes (31-32 degrees. F.) the development of decay is almost completely suppressed, or, at least, proceeds with great slowness. In view of this fact, it is of the utmost importance that fruit should be chilled as soon as possible after severance from the tree; and, also, because the ripening processes are accelerated after the fruit has been picked. The higher the temperatures at which fruits are picked, the more speedily should they be placed in cold storage; and in all instances fruit should be maintained at low temperatures until such time as they are placed on the market. For many years it has been the practice of the shipping companies to carry fruits at temperatures ranging from 35 to 40 degrees, F., and there can be little doubt that the keeping of fruit for so long a period as is occupied during the voyage to the United Kingdom and Europe at such improper temperatures has contributed in no small degree to the waste and deterioration which has occurred. Notwithstanding this fact, the want of rapid pre-cooling after harvesting must also bear its share of responsibility. The chief advantages which are obtained under the system of chilling fruits as soon as possible after harvesting, and keeping these chilled until their arrival on the market, are as follow:—

1. Means are furnished whereunder fruit may be allowed to mature before harvesting and shipment.
2. The development of moulds and other forms of decay (including Bitter Pit) is prevented.
3. The shipper is enabled to land his fruit in a sound and unshrivelled condition.
4. The shipping companies are assisted in maintaining the fruit at low temperatures during transit.

The advantages of being able to allow the fruit to remain on the trees until full maturity has almost been reached are so obvious that little comment is required. It may be as well to point out, however, that the superior appearance of fully-matured fruit over that of immature fruit on its arrival at the market greatly enhances its value.

Regarding No. 2, the advantages of checking the development of Bitter Pit, which, as is well known, often occurs during transit, would alone justify the establishment of the pre-cooling system. That the development of Bitter Pit in the stages in which it manifests itself after the harvesting of fruit may be retarded has been amply proved by the experiments carried out by Mr. D. McAlpine, during recent years. The result of experiments carried out at the Government Cool Stores, Melbourne, has also shown that even such rapidly developing forms of moulds as the ordinary green and blue moulds of citrus fruits (*Penicillium* spp.) are almost completely checked at the freezing point of water; and are, apparently, entirely retarded at a temperature of 29 degrees. As the freezing point of most fruits is somewhere between 28 and 29 degrees, F., the application of temperatures at which the development of these diseases are kept in abeyance may be safely applied to fruit.

(*To be continued.*)

ROOFING HAY STACKS WITH GALVANISED IRON.

R. R. Kerr, Dairy Supervisor.

Many tons of valuable hay are lost annually through defective roofing of hay stacks. Where the hay shed is not available, covering with corrugated galvanized iron is the most effective method, and, provided the stack is well built and the iron properly secured, no rain will penetrate.

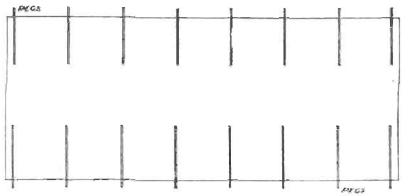
If reasonable care is taken the iron will last many years. The writer knows an instance where the same iron has been in use for twenty years, being removed and replaced every year, and still in fair order.

In building hay stacks it is much better to lay a proper foundation—one that will permit of a free current of air underneath; this will minimize the dampness that generally occurs. Having decided on the size to build the stack, place some stout pieces of wood on the outside—old posts, for instance—and fill the centre with any pieces that may be lying about, so arranging them as to allow of the air current already mentioned. With the foundation laid, secure some solid pieces—such as old rails—and place them at intervals of about 7 feet, allowing them to project 1 foot over the sides of the foundation, having one close to each end (see plan 1).

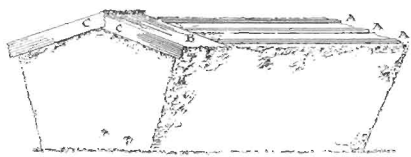
The whole secret of successful stack building is that the stack is always full in the centre and gradually increases in length and breadth as it becomes higher, the idea being that the water will at once drop off the butts of the straw, instead of trickling down the sides of the stack.

When building the roof the sheaves should be so arranged that the butts will meet in the centre.

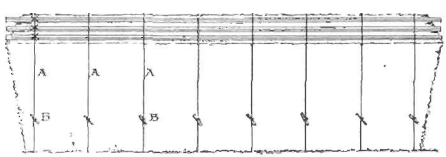
A steep roof is not necessary when covering with iron, and a fall of 2 in 12 would meet the case.



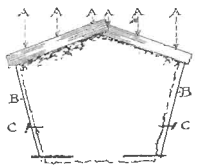
PLAN No 1
Pegs in position for attaching wires



PLAN No 2
A- 4' × 2' for nailing iron to
B- first sheets of iron
C- iron doubled over on side



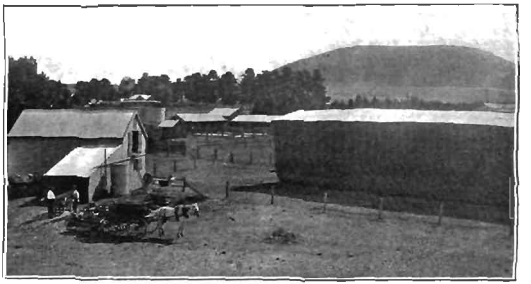
PLAN No 3
X - wires stapled on wood
A - wires in position
B - pegs in stack where wires are tightened



END VIEW
A - 4' × 2'
B - wire
C - twitch stick

With the stack completed, procure some pieces of 4-in. x 2-in. hardwood in lengths appropriate to the length of stack—in most cases 15 feet will be found the most suitable—and lay them lengthways on the roof of the stack, allowing an overlap of about 6 inches; three rows being necessary on each side of the roof (see plan 2) one just below the ridge, one at eave, and the third midway between.

With the wood in position to suit the length of iron—a stack 21 feet wide at the bottom would require four sheets of at least 7 feet iron to reach across the roof—attach wires to the projecting pegs already mentioned in plan 1—fencing wire will do, galvanized for preference. If no provision has been made for these pegs, it will be necessary to drive some into the stack; they must be strong and at least 5 feet long. After attaching the wire to the first peg, throw across the stack and tie to the corresponding peg on the other side, and so on right along the stack; the wire should be tied fairly slack and then stapled to the wood on the roof, the staples being only partly driven in; one



wire should come in the centre of each length of hardwood, and another where the lengths overlap each other.

It is now necessary to arrange a Spanish windlass. Secure some strong round pegs about 3 ft. 6 in. long and 2½ inches in diameter; drive them into the stack, leaving about 1 foot exposed. This should be done about 5 feet from the ground and at the side of each wire. Now get other pieces a little less in diameter and about 3 feet long—1½-in. piping answers well and is everlasting—with this piece take a twitch round the wire and then a turn round the peg in the stack, then likewise on the opposite side until all are secure—if the wires are tight some difficulty will be experienced in getting the first turn on—more turns are now taken until the wires are tight, the turning stick is then secured to the main wire with a little hayband, fine wire, or held in position by another peg driven into the stack.

The wires are tightened at intervals as the stack settles down.

With the lengths on the roof in the right position and the wires tight, drive the staples well into the wood so as to avoid slipping (plan 3).

When purchasing iron, get the sheets of sufficient length to allow of overlapping about 6 inches on the ridge of the roof on the weather side, and plenty to spare to throw the water clear of the walls of the stack. Great care must be exercised in placing the first sheets of iron that the corrugation be perfectly straight all along the stack. Always start on the weather side, and after placing the first sheets double one over the end, as in plan 2. This will prevent the wind and rain beating under. These doubled sheets are secured by weights or pegs.

Two men accustomed to the work can cover a large stack in less than a day.

Always endeavour to have the stack about the same width, so that the iron will always come in right.

When opening the stack, the iron is removed in sections, one or two benches being made according to the amount of hay required; by this means little hay is open to the weather at any one time. When removing the roof care must be taken that the timbers are not allowed to stand too far out from the end, else the weight will act as a lever and cause a buckling of the remainder of the roof.

When removing the spring-head nails from the iron, procure a half-round piece of wood to fit in the corrugation beside, and so act as a fulcrum for the hammer; this will prevent denting of iron which would occur by pulling against the iron only.

All iron removed, together with all pegs, should be carefully put away for use in the following season.

SOIL MOISTURE AND WHEAT.—

The form and size of a mature wheat plant indicate, to a large extent, the character of the season in which it was grown: it is a kind of self-registering meteorological instrument. The difficulty is to interpret all the readings properly. At the University of Göttingen (*Inaug. Diss.*), wheat was grown under different conditions of soil moisture to see how the development of the plant was affected. In some cases the crops were kept rather dry (45 per cent. W.H.C.) during the first vegetation period, and in the second rather wet (70 per cent.); in other cases those conditions were reversed. In the results, tillering was influenced by the water supply. Tillering reduced the subsequent weight of straw and heads only under lack of moisture at later dates. In the straw the length of the upper internode was influenced by the water supply, particularly at the time of shooting, while the length of the lower internodes depended on the water content during the first vegetative period. The water supply during the first period governed the length of head and the number of kernels per head. Increased moisture at the time of shooting gave the smallest number of barren spikelets. Grain formation was favoured by an increase in the amount of water during the last vegetative period, and the weight per 1,000 kernels varied with the soil moisture on good soils. Where poor soils did not receive the necessary manures, the benefits of increased water supply were in large measure lost.

TOBACCO CURING.

Temple A. J. Smith, Chief Field Officer.

CIGAR LEAF.

In order to make the tobacco leaf grown in Victoria more attractive and saleable, greater attention is required during the curing process; this takes place from the time the tobacco is harvested until the final fermentation has been completed, just before the leaf is packed for market. Simply drying tobacco leaf is not curing it, and colour, flavour, and general quality are all affected and greatly improved under a proper system of curing. Different kinds of tobacco require different systems to develop certain qualities for various purposes, and even variation in seasons will influence more or less the methods adopted. Tobacco harvested in cold wet weather will neither cure nor ferment as well as if cut after a few genial warm days, when there is not an excess of moisture in the soil. The proper curing of tobacco is partly chemical, partly a life process, and is not simply due to the drying out of surplus moisture. Tobacco, when just harvested, contains from 70 to 80 per cent. of moisture, and if this were simply dried out by heat, the leaf would remain more or less green, and be quite unsmokeable, with bad burning qualities and no flavour, the starches and other constituents in the leaf remaining unchanged, and the tobacco would have no value. During a proper system of curing, which is partly chemical and largely due to micro-organisms in the leaf cells, the outer skins of the leaves are broken and oxidation takes place, the colour of the leaf changes from green to brown, red or yellow, according to the class of tobacco treated. These changes are caused by enzymes or ferments in the leaf cells, which during the process split up existing chemical forms through their power of taking oxygen from the air and supplying it to the contents of the plant cells, and forming new products. These enzymes are easily destroyed by too much heat or too great cold. Temperatures of over 130 degrees Fahrenheit kill them, and at less than 60 degrees Fahrenheit their operations are stopped, while at freezing point they are destroyed. The most beneficial temperature is from 80 to 100 degrees, under which they do a maximum amount of work; also a certain degree of moisture is necessary for their proper working. It is, therefore, of great importance that the conditions suitable to them should be studied closely to insure success. If the cure be too fast the work is not properly done, and if too slow the process may go too far. Quick curing is, however, more dangerous than slow curing, and unless the matter is thoroughly understood by the operator it is wiser to cure somewhat slowly, especially in the early stages of the treatment. Enzymes are easily destroyed by too much heat and too rapid loss of moisture, but if the tobacco is made to dry slowly they multiply quickly and force their way through the outer skin of the leaves, thus encouraging oxidation at a greater rate. Should they, however, be killed through scarcity of moisture, or by too much heat, they become enveloped in the insoluble protein in the leaf, and

will not then be of use during the fermentation process which takes place later on, and the result will be a poor fermentation and consequent poor quality tobacco. Leaf of fine growth and appearance, if badly cured, may be utterly useless for manufacture, while the same tobacco given a proper cure and fermentation can be made a fine manufacturing commodity with all the desired qualities for a good smoke. The various tobaccos used in factories require different treatments according to the purpose for which they are intended, as, for instance, cigar wrapper leaf for outside covers must necessarily be thin and silky, with good colour, fine veins, and a further virtue known to the trade as strength and stretch. Such leaf needs very careful treatment in both the cure and fermentation, as it will be too dry and brittle if cured fast, while if over-cured or fermented is liable to suffer in colour and elasticity. Only experience, combined with a knowledge of what the buyer requires, can determine exactly how far the treatment should go. Cover wrapper leaf is not *sought after so much for its smoking qualities as for its appearance*; it constitutes only a very small proportion of the cigar—about 5 per cent. of the whole—but it must have the characteristics mentioned otherwise it will not sell well. The bunch wrapper, which is the portion of the cigar immediately under the cover or outside wrapper leaf, comprising 20 per cent. of a cigar, need not be as good in appearance and so fine in texture, but should have good flavour, and burn or combustion with a nice grey ash, its mechanical purpose being to hold the filler leaf in shape before the cover wrapper is put on; such leaf must be sound and also be strong enough in texture to stand a fair amount of pressure without breaking. It must be free, as far as possible, from organic matter in the shape of starch and sugar, otherwise it will be liable when made into cigars to absorb moisture whenever the atmosphere is damp, and become soft, a bad sign in a cigar.

The filler leaf which comprises the greater bulk of the cigar (75 per cent.) must have good flavour and burn, be free from organic matter, *and of fine texture, but colour is not of such great importance*, though to insure high prices a dark-brown or lighter shade, which should be uniform, is desirable. Soundness, so far as holes or broken leaf is concerned, is not of great importance unless very pronounced, as the leaf is broken up by the manufacturer before being made into cigars. Flavour and freedom from organic matter, together with good combustion, are the chief points in cigar tobacco. A good aroma in all kinds of leaf is desirable, and this quality is largely developed in the cure and subsequent fermentation. Colours may vary considerably, and yet be good; a very light-coloured cigar wrapper is unusual, though the present taste leans towards the lighter shades, smokers being under the impression that a light-coloured cigar is a light smoke; this does not follow, as the filler may be any colour from light to very dark, and as 75 per cent. is filler that portion has the greatest influence. When we take into consideration the fact that the soils the tobacco is grown in produce leaf of varying descriptions, requiring a more or less fast or slow cure, also that seasons affect the condition of the tobacco, and that the various tobaccos are needed for

different purposes, it will be realized that a thorough study is necessary by the individual grower as to the special treatment required to develop to the highest possible effect the different qualities of leaf with regard to the tobacco he is producing, especially in a new country where fresh districts are being exploited. A good crop of tobacco can be absolutely ruined by bad treatment in the curing and fermentation, or by good treatment made a valuable and highly profitable crop. The foregoing remarks apply equally to pipe tobacco in the main, except that cigar leaf requires more careful handling, especially in fermentation, than pipe leaf. The proportionate amounts of wrapper, bunch wrapper, and filler leaf in each are approximately the same, and exercise the same influences in their way.

A description of the different methods in use in America and elsewhere will be dealt with, taking cigar leaf first.

In curing cigar leaf, the changes which the leaf must undergo are controlled by the regulation of heat and moisture in the shed, and until very recently fire or flue curing has not been followed, excepting in cases where continual fogs or heavy moist atmospheric conditions have existed. Curing proceeds slowly in cold dry weather, but drying takes place; while in warm moist weather the changes in the leaf constituents that are necessary take place, and tobacco cures fast. Thermometers should be kept both with wet and dry bulbs to ascertain the temperature and relative moisture in the air, both inside and outside the building. It has been found that the best temperatures at which the leaf cures in dry weather are when the inside temperature is over 70 degrees Fahrenheit, and the outside temperature is 10 or 12 degrees less; while a difference of 15 degrees Fahrenheit in wet weather is best. Tobacco will cure well at any temperature between 70 and 100 degrees Fahrenheit, but, as previously stated, it is safer to cure slightly on the slow side. While the leaf is curing fairly fast ventilation must be provided to carry off surplus moisture, especially in wet weather, or when the outside air is surcharged with moisture. The relative percentage of moisture should be between 50 and 60 degrees. In Victoria the climatic conditions are not as cold as in many tobacco countries, but the air is in some districts drier, consequently artificial methods of supplying moisture may be found advisable, such as watering an earthen floor, or covering with a few inches of straw and applying water, which as it evaporates increases the atmospheric contents. In dry cold weather the shed should be kept closed, with no current of air, or a very slight one, but the top ventilators should be sufficiently open to take off the moisture evaporating so that it will not settle from the top on the tobacco, the idea being to keep the tobacco during a cold spell from drying out, while not curing. The life will remain at such a time dormant, and directly the right degree of temperature—65 to 70 degrees Fahrenheit—obtains again curing will be recommenced. Cigar leaf during the process should not be allowed to get so dry that the leaf will break upon being handled, and should be so managed that at least once in every 24 hours it becomes soft until finished, this can be regulated by the currents of air admitted through the ventilators. It will be realized that no hard-and-fast rules can be laid down in this respect, as the treatment

will vary according to weather conditions and the stage reached by the tobacco. In the early part of the cure the moisture is driven off fast if weather conditions are suitable, but if cold and dry the shed should be kept closed to prevent its loss at too fast a rate. It may take four weeks only to cure a shed, and in some seasons twelve weeks, the latter period being more usually required unless artificial heat is applied. Only experience will tell the operator in charge when the leaf is ready for its special purpose before bulking down for fermentation. The colours should be fairly even throughout, the texture of the leaf thin, pliable, and devoid of vegetable matter, with not more than a 10 to 20 per cent. moisture content. Leaf for filler purposes and for bunch wrapper will generally require a longer and more thorough cure than cover wrapper leaf, the natural tendency to thinness and lighter body in the latter having less organic matter to be disposed of. Here, again, the operator is the sole judge as to when the cure has gone far enough for his purpose; the tendency amongst Victorian growers is, however, to cure too fast and not quite enough.

As soon as the leaf is cured the shed should be kept closed and dark; if light is freely admitted the colours are liable to suffer. Some growers favour putting the leaf down in bulk at once after curing, re-hanging later on, while many prefer leaving the tobacco hanging in the shed until ready for fermentation. Tobacco leaf can be put down in bulk in cold weather with 20 per cent. of moisture, but is liable to ferment when warm weather ensues, and should consequently be watched, and if heating it should be turned, otherwise it might go so far as to rot, and the season's labour be lost. The main matters to be carefully watched are:—

1st. To so control the air currents so as not to dry, or cure, too fast in the initial stages of treatment.

2nd. To keep, whenever possible, the inside temperature 10 to 12 degrees Fahrenheit above that of the outside shade temperature.

3rd. To close the shed when curing is finished, and, if much damp weather follows and the leaf is inclined to become mildewed, open the ventilators on a dry day, or put slow fires underneath sufficient to drive off superfluous moisture.

The curing by the aid of stoves has been recently adopted in the Connecticut Valley and Florida, in America, in regard to cigar leaf, and a useful pamphlet written by W. W. Garner, of the United States Department of Agriculture, in which the following directions for curing cigar leaf by artificial heat are given:—

"No heating system will give satisfactory results in a barn or shed which is not reasonably tight, because the temperature cannot be raised sufficiently without drying the tobacco too fast. On the other hand, a system of ventilators which can be opened or closed at will is necessary for the removal of excessive moisture in the shed in wet weather. If there is no ventilation the air soon becomes saturated, and heat alone will not drive it off. When artificial heat is used it is not desirable in filling the shed with tobacco to leave open spaces from top to bottom, as these will only act as channels for the escape of heat to the top, while to be effective it must be forced to pass through the tobacco.

The heating system must have sufficient capacity; a little heat is frequently worse than none, particularly in the control of pole sweat. Experience has shown that a satisfactory system must be capable of maintaining a temperature in the shed of from 15 to 20 degrees higher than that of the outside air when moderate ventilation is used. It is only necessary to maintain this temperature when there is danger of pole sweat; under ordinary conditions a difference of 10 to 12 degrees between inside and outside air is sufficient. The heat must be supplied from the bottom of the shed and be evenly distributed in order that, so far as possible, all the tobacco may receive the same treatment.

Open fires of clean burning wood and charcoal can be used, but it is necessary that special precautions are taken in case of fire, and only clean burning wood is used, as very heavy smoke from fires is apt to injure the tobacco. Charcoal is expensive, and there can be no doubt that the stove and flue curing system is best, as temperatures can be better controlled, and there is less danger of injury from excessive smoke and fire.

Coke and coal are not suitable fuels, as they generate injurious fumes, chiefly sulphur dioxide, which will damage the tobacco.

Should open fires be used, it will be found necessary to have many small fires in preference to a few larger ones, in order to distribute the heat more evenly, and appliances in the shape of deflectors in the shape of sheets of iron over the fires have good effect.

The use of artificial heat can be resorted to at any time after the tobacco has been placed in the shed, from the first day until nearing the end of the cure. Many successful tobacco-growers prefer to have the tobacco in the shed a week before using fires, especially if good natural curing weather obtains. Others say that as soon as the leaf is wilted firing should commence. Practically all the cigar types are air cured, but judicious management of artificial heat will result in a more perfect product."

The fermentation of cigar leaf and system of making flues and stoves will be dealt with, also a description of the types of sheds for curing cigar and pipe tobaccos.

ORCHARD AND GARDEN NOTES.

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

The Orchard.

PLANTING.

In preparing land for planting out—and this should be commenced right away, so as to allow the soil to sweeten—it should be subsoiled, so as to produce good results in after years. Subsoiling will add to the age and vigour of the trees; it will materially increase the crop; and it will considerably lessen the expense of fertilizers. Reference has previously been made in these notes to the success attained from growing fruit trees in subsoiled land; but the fact may be again *pointed out that many growers in Victoria to-day are reaping the* benefit of increased crops without artificial feeding where the soil was subsoiled before planting. Drainage is another most important factor in successful fruit culture; but while, perhaps, drainage may be delayed for a few years, if the other initial expenses are extensive, it must again be emphasized that proper subsoiling cannot be carried out after the trees are planted.

GREEN MANURES.

The exceedingly hot dry months of January and February will *have had the effect of considerably weakening the soils, and reducing* the humus content. It will be advisable wherever at all possible to put in a crop of green manure to supply humus, nitrogen, and other beneficial factors to the soil. This should be done as soon as the fruit is off the trees, and the earlier the better.

An early crop is a distinct advantage. The cover crop should make good growth before winter sets in, as the plants make very little headway in the cold weather, and they require to be ploughed in as soon as the ground is dry enough in early spring. It will thus be seen that it is necessary to get a good autumn growth, as dense as possible, and one which will well cover the surface before winter.

PESTS.

No codlin moth affected or diseased fruit of any kind should be left on the ground after the crop has been gathered. These should all be destroyed by boiling.

Rust-infected plum and peach leaves, as well as all foliage of stone fruits that have been attacked by this and other fungus diseases, such as shot-hole, &c., should be burned, if possible. This will minimize the possibility of future attacks. The same treatment should be given to foliage where either red spider or the bryobia mite have been in evidence.

NEW FRUITS.

The following descriptions of some of the new fruits may be useful to growers. These have been fruited at the Burnley Gardens, and have all proved very interesting varieties:—

Pear.—Marguerite Marilliat.—This is a very large and showy pear, well coloured when ripe, luscious and juicy. It will probably prove to be one of the largest of pears, being larger than either Beurre Bosc or Uvedale's St. Germain. But, being a dessert pear, this will probably be a fatal objection. It comes in about the middle of February, and, being inclined to mealiness, does not promise to be a good keeper.

Apples.—The Houblon.—This is a fairly flat apple of good size, well streaked, coloured with red, showing apparent Cox's Orange Pippin parentage. Flesh very firm, crisp, and juicy; of first class flavour, and solid fleshed right through from skin to core, with very small core. It has become a very popular apple in some parts of England.

Rival.—An apple approaching conical shape, with a beautiful bright yellow colour at base, and with rich red streakiness near the crown. The flesh is yellow coloured, well fleshed to the core; core fairly open. The flesh is crisp, and the flavour good and mellow.

Coronation.—An apple of good size, green skin, well mottled with scarlet markings; flesh very firm, greenish, well filled to the core. The flavour is very good—a good, juicy apple.

Charles Ross.—A fine coloured well streaked apple, especially on the sunny side; under skin a good yellow. The fruit is a good size, very juicy; the flesh is yellowish, crisp, and a first class flavour.

James Grieve.—A well coloured yellowish apple, skin well streaked on the sunny side. A good firm flesh, inclining to mealiness, of mild excellent flavour.

Vegetable Garden.

All vacant plots should be given a liberal surface dressing of stable manure, and then well and deeply dug. For winter growth, the beds should be elevated somewhat above the ordinary summer level. That is, the path surface may be on a lower level, the plot soil being well thrown up and boldly ridged. This will give a certain amount of drainage, and will insure warmer and better soil: the vegetables should succeed more in this class of bed than in any other.

The vegetable garden and also the seed beds should be kept free of any weeds, and a good cultivation kept up all through.

Seedlings of cabbage, cauliflower, lettuce, and celery may be transplanted out; and seeds of cabbage, cauliflower, lettuce, early peas, swede turnip, carrot, parsnip, and early onions may be sown.

Flower Garden.

One of the effects of the hot summer has been to considerably reduce the growth of some garden plants, particularly where the water

supply was not copious. This should be remedied, as far as possible, by a good autumn cultivation, mulching, and watering, if the rain does not come in sufficient quantity. The stable manure mulch should not be stinted at this season of the year, and garden plants should be given every encouragement. This especially applies to such plants and shrubs that will be blooming in autumn and winter. If these are strengthened by food and water supplies, good growths will result, which means a copious supply of blooms.

Dahlias and chrysanthemums may be fed with liquid manure, or mulched with stable or poultry manure—the latter is preferable. In any case, the feeding should not be too strong nor too frequent, and it should always be withheld before the flowers come. If the manure is supplied in the form of mulchings, it will be well to occasionally fork over the ground so that the soil does not become sour. The same instructions may be taken for the autumn growing of roses.

All classes of spring flowering bulbs may now be planted. In bulb planting the bulbs should not come in contact with any manure. *The manure should have been some time previously dug well in and* mixed with the soil, and all heat should have disappeared. If much manure is required it should be placed below the bulb, so that the roots may ultimately penetrate to it. Bulbs thrive in sandy soils, and *where the soil is heavy a little sand may be added with advantage.* Bulbs should not be planted too deeply; the depth to plant is generally regulated by the size of the bulb. Such bulbs as freesias may be covered with only an inch of soil, while larger bulbs may be somewhat deeper.

All hardy annual, biennial, and perennial seeds may now be planted; among these are dianthus, candytuft, sweet peas, Iceland poppy, anemone, ranunculus, stock, wallflower, columbine, foxglove, *phlox*, penstemon, pansy, gaillardia, &c.

Wherever aphis and red spider occur the plants should be sprayed with benzole emulsion, nicotine, "Pestend," "Soaperine," or some other preventative, in order to protect the coming flowers. Mildew attacks on the rose should also be warded off by the use of sulphur. The sulphur may either be dusted on the plant, or it may be scattered on the ground around and under the plant.

March is the month when the showy and fine summer annuals are at their best. The asters and zinnias should be very fine; and these, combined with salpiglossis, miniature annual and herbaceous sunflowers, phlox, and many other popular hardy annuals, are all now at their best. These will require a fair quantity of water and manure mulching; and the plants will be considerably helped if the blooms that have passed their prime are kept cut off.

March is one of the best months for the transplanting of evergreen *plants of all classes, trees, shrubs, and palms. The roots of the trans*planted plants should be disturbed as little as possible, while the roots of those transplanted from pots should be well uncoiled and set out before planting.

The soil is now warm, and the roots will quickly take hold and grow. They are thus established for the winter, and will give little or no trouble in the subsequent summer heat and dryness.

Perishable and Frozen Produce.

Description of Produce.		Exports from State (Oversea).		Deliveries from Government Cool Stores.	
		Quarter ended 31.12.12.	Quarter ended 31.12.11.	Quarter ended 31.12.12.	Quarter ended 31.12.11.
Butter	lbs.	18,064,584	24,450,852	18,379,256	24,917,984
Milk (dried) ...	cases	3,508	1,996	...	...
Milk (cond.)	"	5,045	2,730	50	51
Cheese	lbs.	22,320	15,480	200	500
Bacon	"	11,520	62,500	...	...
Poultry	head	5,695	6,510	643	4,759
Eggs	dozen	...	...	...	500
Mutton and Lamb	carcases	694,412	1,118,555	29,794	66,454
Beef	quarters	7,099	5,457	127	...
Veal	carcases	915	935	91	79
Pork	"	...	1,491	230	858½
Rabbits and Hares ...	pairs	57,204	171,342	9,793	11,763
Sundries	lbs.	...	...	65,645	52,365

R. CROWE, *Superintendent of Exports.*

Fruit, Plants, Bulbs, Grain, &c.

Imports and Exports Inspected for Quarter erding 31st December, 1912.

Description of Produce.	Imports.		Exports.	Description of Produce.	Imports.		Exports.
	Inter-State.	Oversea.	Oversea		Inter-State.	Oversea.	Oversea
Apples ...	9,205	—	30	Loquats	303	—	—
Apricots ...	—	—	332	Logs	95	4,657	—
Bananas, bunches ...	59,141	49,617	—	Maize	268	13,945	54
Bananas, cases ...	7,542	31,168	2	Mangoes	184	—	—
Barley ...	26,820	—	7,682	Marrows ...	165	—	
Beans	33	552	—	Melons	219	—	—
Bulbs	—	246	1	Nutmegs ...	—	396	—
Cherries	—	—	4,119	Nuts	236	2,655	—
Chillies	10	40	—	Oats	10,307	26,042	—
Cocoa beans ...	—	2,031	—	Oat Hulls ...	698	—	—
Cocoanuts ...	56	160	—	Onions	—	1,698	—
Coffee beans ...	—	809	—	Oranges	10,260	1,495	641
Copra	—	1,337	—	Passion Fruit ...	1,418	—	—
Cucumbers ...	7,744	—	85	Paw Paws ...	22	16	—
Dates	—	22,472	—	Peaches	—	—	310
Figs	—	553	—	Peas, dried ...	337	15	205
Fruit—				Pepper	—	249	—
Canned ...	—	—	1,392	Pineapples ...	11,621	78	392
Dried ...	—	2,210	3,735	Plants	126	334	70
Mixed ...	—	49	—	Plums	—	—	480
Gooseberries ...	614	—	—	Potatoes ...	1,502	10,386	400
Green Ginger ...	—	108	—	Rice	4,120	8,554	—
Hay	—	115	—	Seeds	691	7,106	45
Hops	1	631	—	Spice	—	511	—
Jams, Sauces, &c. ...	—	—	1,051	Tomatoes ...	2,931	—	20
Lemons ...	1,627	3,130	856	Vegetables ...	2,332	342	—
Lentils	—	186	—	Wheat	4,050	1	—
Linseed ...	—	305	—	Yams	2	1	—
				Totals ...	164,680	194,200	21,911

Total number of packages inspected for quarter ending 31st December, 1912 = 380,791.

F. MEEKING, *Senior Fruit Inspector.*

STATISTICS.

Rainfall in Victoria.—Last Quarter, 1912.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Basin or District.	October.		November.		December.		4th Quarter.	
	Total.	Average.	Total.	Average.	Total.	Average.	Total.	Average.
	points.	points.	points.	points.	points.	points.	points.	points.
Glenelg and Wannon Rivers	178	279	212	179	239	154	629	612
Fitzroy, Eumerella, and Merri Rivers	210	287	246	184	235	166	691	637
Hopkins River and Mount Emu Creek	160	245	247	183	232	169	639	597
Mount Elephant and Lake Corangamite	158	239	275	183	220	169	653	591
Cape Otway Forest ...	294	338	309	230	280	232	883	800
Moorabool and Barwon Rivers	140	242	266	188	259	196	865	626
Werribee and Saltwater Rivers	84	237	232	188	258	223	574	648
Yarra River and Dandenong Creek	214	333	382	262	431	327	1,007	922
Koo-wee-rup Swamp ...	199	337	363	244	401	281	963	862
South Gippsland	235	376	238	257	292	329	765	962
Latrobe and Thomson Rivers	257	359	371	256	263	319	891	934
Macallister and Avon Rivers	121	227	321	184	187	269	629	680
Mitchell River	191	273	305	198	248	250	744	721
Tambo and Nicholson Rivers	181	289	279	178	330	282	790	749
Snowy River	169	346	323	204	242	282	724	832
Murray River	82	175	410	134	272	145	764	454
Mitta Mitta and Kiewa Rivers	183	312	525	253	421	247	1,126	820
Ovens River	172	324	626	228	433	235	1,231	787
Goulburn River	85	234	450	173	272	177	807	584
Campaspe River	50	200	251	160	255	176	556	536
Loddon River	38	164	197	135	234	124	469	423
Avon and Richardson Rivers	44	140	139	116	190	93	373	340
Avoca River	33	146	181	123	232	113	446	382
Eastern Wimmera	60	192	216	151	196	128	472	471
Western Wimmera	85	189	167	133	199	94	451	416
Mallee District	32	116	150	92	163	83	345	291
The whole State	114	227	277	165	246	174	637	566

100 points = 1 inch.

H. A. HUNT,

Commonwealth Meteorologist

REMINDERS FOR APRIL.

LIVE STOCK.

HORSES.—Those stabled should be fed liberally. Food of a more stimulating nature can now be given to get them well over the "changing coat" season. Those doing fast or heavy work should be clipped; if not wholly, then trace high. The legs should not be clipped. Those not rugged on coming into the stable at night sweating freely should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Weaned foals should have a little crushed oats daily, if available.

CATTLE.—As the nights become colder the dairy cows should be rugged. The rugs should be removed in day-time when the shade temperature reaches 60 degrees. If new grass is plentiful, give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows may now be spayed.

PIGS.—Sows not already served should be put to the boar. Supply all pigs with plenty of bedding, and see that sties are warm and well ventilated. Supply sows liberally with grain. Castrate young boars.

SHEEP.—Where early lambs are being bred for local markets, transfer ewes and lambs to best pasture as soon as dropped. Castrate ram lambs when a few days old; defer tailing them until the ewe lambs are ready. After first rain (when dust is settled) clear wool from the eyes of young merino sheep; whilst yarded put weak weaners in hospital paddock, and any unprofitable woolled sheep in fattening paddock.

POULTRY.—*Do* not feed much grain this month—soft food aids moult; add a teaspoonful of linseed to each bird's ration once daily. The more exercise the hens get the better they moult. Remove all male birds from pens. Add Douglas mixture to drinking water. Keep a sharp look-out for chicken pox. Forward pullets should now be in their winter quarters, with plenty of scratching litter, and fed liberally—including ration of animal food. Grit, shell, and charcoal should always be available.

CULTIVATION.

FARM.—Dig potatoes as they mature. Cart out and spread stable manure. Prepare and plough land for main cereal crops. Sow Chou Moellier seed in beds for transplanting. Sow the following mixture per acre for green feed during the winter months for the dairy herd:—1½ bushels, New Zealand Black Oats; ½ bushel, Cape Barley; ½ bushel, Tick Beans; ½ bushel, Vetches. Sow Giant Drumhead Cabbage for transplanting (1 lb. sufficient for 1 acre, in rows 3 feet apart); provided the soil is in good friable condition, plants from seed sown last month should be planted out. Sow wheat and oats according to locality; also rape for winter feed or green manuring. Prepare clean seed-bed for lucerne; and sow Hunter River, Arabian, Turkestan, or Peruvian seed, free from dodder, in drills 7 inches apart and at the rate of 10 lbs. of seed per acre. Sow permanent pastures with grasses and clovers.

ORCHARD.—Prepare land for planting; plough deeply and sub-soil. Plant legumes for green manure. Plant out strawberries. Clean up Codlin Moth from trees as soon as all fruit is gathered.

FLOWER GARDEN.—Plant out evergreen shrubs, trees, and Australian plants, divisions of herbaceous plants, seedlings, layers, and rooted cuttings. Feed chrysanthemums with liquid manure weekly until flowers begin to open. Prepare land for future plantings of roses and shrubs.

VEGETABLE GARDEN.—Plant out seedlings from the seed beds. Dig all vacant spaces roughly. Sow onions for early crop; also peas and broad beans. Clean out asparagus beds wherever the seeds are ripening.

VINEYARD.—Consideration must be given to manuring: early application is strongly urged. Peas, &c., for green manuring should be sown as soon as possible.

Cellars.—Cleanliness is emphatically urged. Carefully remove all fermentable refuse—skins, lees, skimmings, &c. Such odds and ends favour multiplication of vinegar flies (*Drosophila funebris*). If present, destroy these with formalin or insecticide powders. A little bisulphite or sulphurous acid in washing water is recommended; also free use of lime on floors, &c.