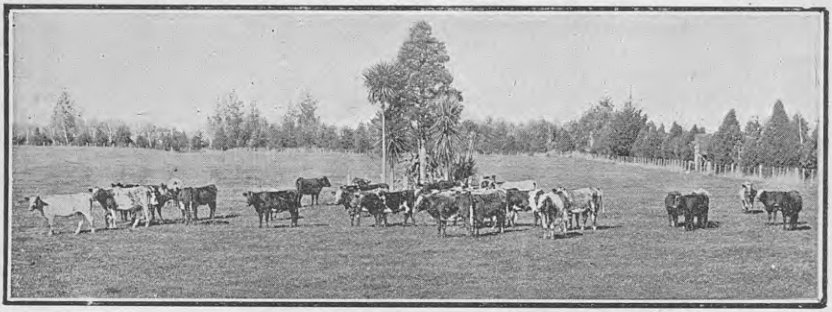

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TAKE-ALL DISEASE IN WHEAT.

INCIDENCE IN NEW ZEALAND.

R. WATERS, Biological Laboratory.

THE often disastrous effect of the disease here dealt with upon the wheatfields of certain of the Australian States has well merited the adoption there of the name "take-all." In England, France, and Germany it has been sufficiently serious to demand the careful attention of those interested in the conservation of wheat. The disease was reported in 1916 as not then known to be prevalent in the United States of America; since then, however, it has been reported in fresh localities there. So far as New Zealand is concerned, the descriptions of experienced growers indicate that take-all has been present for many years. Although this season traces of it have been seen in widely separated portions of the Canterbury District, and the damage from its attack has been very considerable in a few isolated cases, it has not yet become particularly serious. Nevertheless, the future possibilities arising from the neglect of this affection are such as to call for the immediate adoption of all available means of control.

CAUSE OF THE DISEASE.

The take-all condition in New Zealand is characterized by the presence amongst typically affected wheat of a microscopic fungus comparable to, but in the incipient stages less evident than, the mould frequently growing upon stale bread. Under favourable environmental conditions, particularly those of warmth and dampness combined, this fungus is capable of vigorous growth upon wheat, of the production of spores (too small to be seen by the naked eye), and of spreading to other wheat-plants in the immediate vicinity. The scientific name of the fungus is *Ophiobolus graminis* Sacc., the characteristic fruiting or sporing structures of which have recently been definitely identified in New Zealand. (Figs. 1, 2, 3.)

Other fungi, some of which have not yet been reported in New Zealand, are said to produce like effects abroad, and in some parts of the world it has not yet been possible to attribute take-all to any specific organism. Seeing, however, that *Ophiobolus* is the fungus commonly associated with the take-all condition in New Zealand, and that it is widely and definitely accepted as the cause of take-all elsewhere, it is presumed that this fungus is parasitic, until such time as definite inoculation experiments shall have proved or disproved its pathogenicity in the Dominion.

EFFECTS.

At various stages in the growth of wheat the fungus penetrates, discolours, and disorganizes the tissues of the roots and of the culms at ground-level. At these parts, late in the season, it produces a blackish weft of mould-like growth, easily seen by the naked eye. (This "mould" remains on the stubble after harvest, giving rise to the spores that may infect succeeding wheat crops.) The fungus appears to hinder the flow of sap to the parts above, to arrest the growth, and to finally result in the death of the roots, culms, leaves, and ears, the last three bleaching a dull ashy white in the sun. Later the heads and even the rest of such plants may become bespattered as if with soot—the effect of another fungus common on dead wheat. In all cases the grains are diminutive, often entirely useless.

Affected plants occur commonly in roughly circular or oval patches. The patches are up to several yards in diameter, and consist, at about the end of January, of a thin crop of stunted dull-white or sooty-looking plants easily pulled out of the ground. The surrounding healthy crop is taller and of a bright-yellow colour in the straw. Again, affected and healthy plants may be intermixed and of similar height, the colour of the former readily distinguishing them.

SIMILAR EFFECTS FROM OTHER CAUSES.

The effects upon a wheat crop of "creeping" grasses, such as fiorin (*Agrostis* spp.), twitch or couch (*Agropyron repens*), and creeping-fog (*Holcus mollis*), might possibly be confused with the general appearance of take-all injury. In many districts these grasses may be seen spreading thickly through the ground in more or less circular patches in which the wheat becomes stunted, the head being much smaller than usual. Unlike take-all patches, which consist of dead plants bleached white, the wheat in these weed-ridden patches at the end of last January was

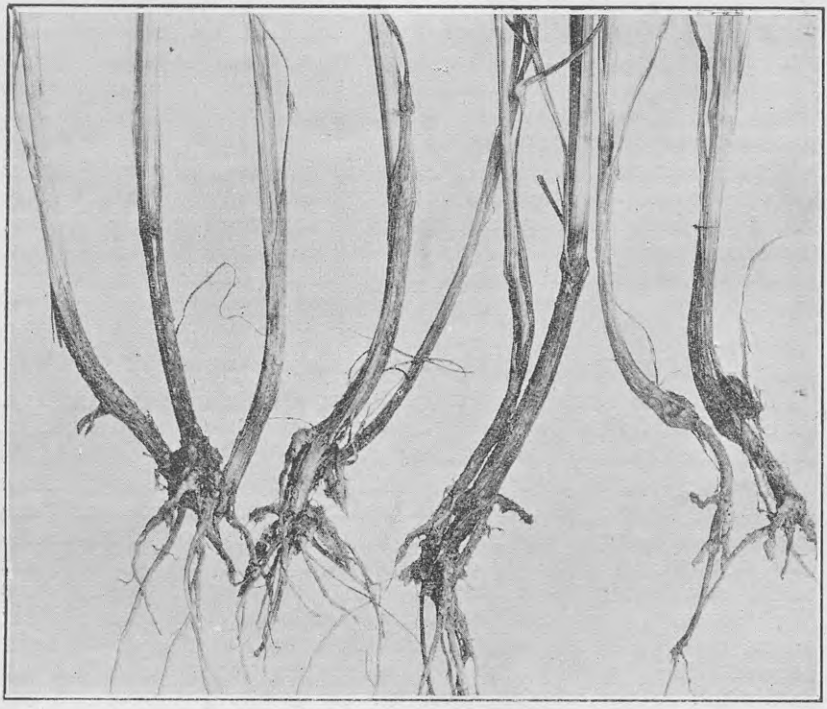


FIG. 1. WHEAT-PLANTS AFFECTED BY TAKE-ALL.

Showing the dead roots and blackened condition of the fungus-ridden leaf-sheaths about the first internode of the culms. Specimens from Canterbury. Natural size.

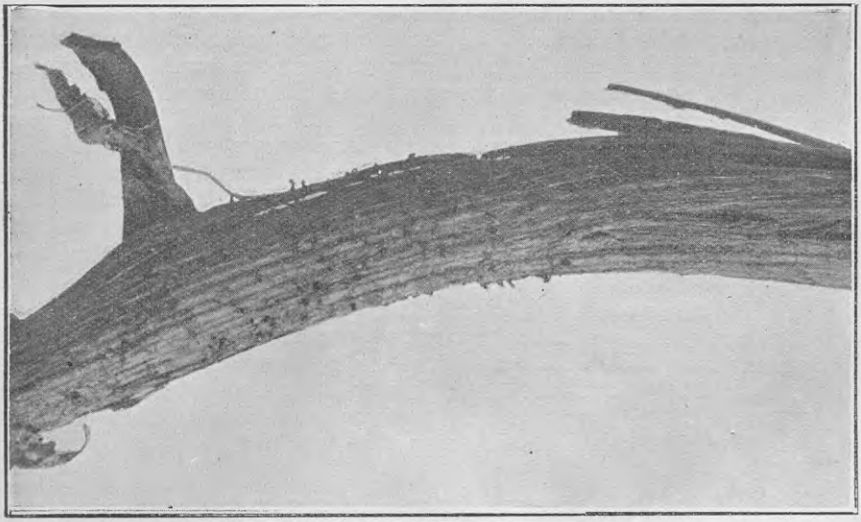


FIG. 2. PART OF THE FIRST (LEFT-HAND) STEM IN FIG. 1, MAGNIFIED 10 DIAMETERS.

Showing minute black protrusions through the affected leaf-sheath. These are the necks of the perithecia or spore-producing structures of the fungus *Ophiobolus graminis*.

[Photos by E. B. Levy.

usually green in the culm, leaves, and head, and grains of moderate size were formed. Wheat thus affected commonly remains greener than the surrounding unaffected crop, which at the same time will have more or less turned a bright yellow. This type of damage seems just as common at present as that caused by take-all.

Again, stunted wheat patches to be distinguished from take-all are to be found in depressions waterlogged after sowing, and on places said to be affected by grass-grub (*Odontria zealandica*). In all cases the occurrence of the dark "mould" at the base of the culm—particularly between the leaf-sheath and the culm—distinguishes towards the end of the season the take-all condition.

PERPETUATION AND SPREAD OF THE DISEASE.

No reliable information is at hand as to when and how take-all was introduced into New Zealand, but there seems little doubt that it has been in the Dominion for a number of years.

However profitable or unprofitable it may be, it is well known that in the absence of this fungus healthy wheat has frequently been produced on the same land for many years in succession. With weather conditions unfavourable to the fungus comparatively healthy wheat might even be raised on land previously carrying an infected crop. The presence, however, of but a small proportion of infected plants means that the fungus will remain in the field on the stubble after harvest. Here it will eventually produce its spores, any subsequent cultivation or trampling by stock serving as a means of distributing the disease—at least, within the same paddock. Hence, with moisture and temperature suitable to the fungus, a succeeding wheat crop would be much more affected than the previous one—in fact, might be a failure. All badly diseased plots recently examined in Canterbury had been preceded by one or more wheat crops, among which in most cases growers could recollect having observed the same but less pronounced symptoms of the disease. No instance could be found of the rapid spread of take-all from crop to crop through the air like "rust"—though to a comparatively very small extent this manner of spreading is not inconceivable; in fact, seed sown on uninfected land was seen to produce an unaffected crop even in places where such land adjoined an area carrying a badly infected crop. On the other hand, the planting of wheat on previously infected land resulted in the most serious damage that was met with, and, in my opinion, the perpetuation of the parasite is mainly due to this practice in dealing with infected areas.

It is difficult to say exactly how the fungus is transferred to previously uninfected land. Stock or the wind possibly carry infected fragments from one paddock to another; but, whatever the means may be, there is no doubt that certain plants other than wheat are capable of "nursing" the fungus should it be carried to areas that have never been devoted to this particular crop.

SUSCEPTIBILITY OF OTHER SPECIES.

The extent of information under this head is not very wide or conclusive. The following plants other than wheat are recorded as

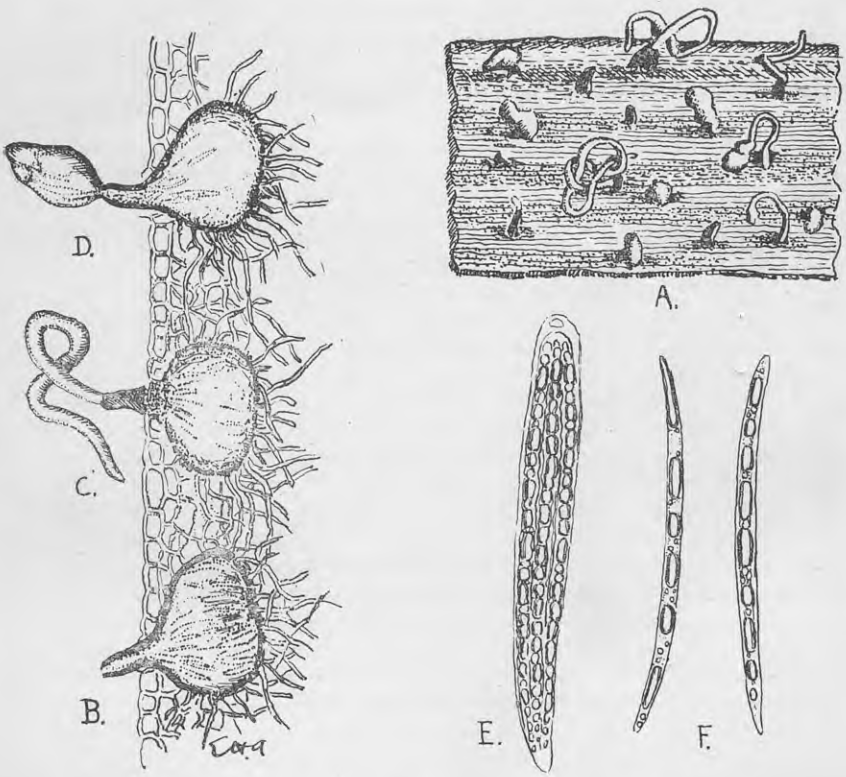


FIG. 3. DIAGRAMS OF FUNGUS OPHIOBOLUS GRAMINIS.

(A) Magnified somewhat over 60 diameters. Shows protruding through a portion of an affected leaf-sheath the necks of unripe perithecia and those of ripe perithecia, some expelling coils, and others masses of mucilaginous matter.

(B) More highly magnified. Showing a cross-section through an unripe perithecium. The body of the perithecium is immersed in the tissues of the leaf-sheath; about it, particularly at its base, are the threads of the fungus from which it arose, and within it is the mucilaginous matter, together with the asci or spore sacs, which later will be expelled through the neck that is shown protruding through the outermost tissues of the leaf-sheath.

(C) A similar cross-section, showing a coil of mucilaginous matter carrying the asci through the neck of a ripe perithecium under comparatively dry conditions.

(D) A similar cross-section, showing a mass of mucilaginous matter bearing asci similarly expelled, but under moister atmospheric conditions, which soften the mucilage and prevent coil-formation. Much moisture dissolves the mucilage completely, distributing and liberating the asci.

(E) Very highly magnified. Shows an ascus separated from a mucilaginous coil by water. Within the ascus are the long filiform or threadlike spores, and at the top of the ascus the aperture through which the spores escape at maturity.

(F) Very highly magnified. Showing two spores which have escaped from an ascus. These are the reproductive bodies of the fungus *Ophiobolus graminis*.

[*Diagrams by E. H. Atkinson.*

susceptible to the disease, and therefore as capable of perpetuating the fungus in infected land or of harbouring it on areas not devoted to wheat: Barley (*Hordeum sativum*); rye (*Secale cereale*); barley-grass (*Hordeum murinum*); brome-grass (*Bromus sterilis*); giant twitch, couch-grass, or spear-grass (*Agropyron repens*).

Red wheats, though not immune, are quoted as the most resistant kinds, while the earlier varieties are spoken of as the more susceptible.

METHODS OF CONTROL.

Various methods of combating take-all have been suggested:—

1. If by cutting the stubble longer, and, if necessary, by rolling it, a fire could be run over the ground a considerable proportion of the fungus and its spores would be destroyed. Infected land so treated would be much safer, but not entirely safe, for a succeeding wheat crop. Where there is no alternative than to grow another wheat crop on infected land this course might be adopted, together with late sowing, so as to avoid wet conditions, which favour the fungus. Deeper tillage would also assist in avoiding excessive soil-moisture. Wheat following a badly diseased crop is, however, a very doubtful proposition.

2. For the treatment of a few isolated patches in a paddock good results are reported from the recommendations of N. A. Cobb, of New South Wales, briefly as follows: Before harvest, when the disease is showing, mark the patches with stakes. After the harvest and before the following ploughing apply lime to these patches, at the rate of at least 1 ton per acre. As the disease is associated with excessive water in the soil the levelling-off of depressions in the ground and anything that can be done to improve the soil-drainage, such as deeper tillage, will be beneficial.

3. In considering a general line of treatment for larger areas the following points may be stated:—

(*a.*) Seeing that the fungus is retained on the land after harvest, and that its complete destruction by fire or by the application of a chemical compound may be impracticable, such methods as these should in general be employed, not as in themselves sufficient, but rather as subsidiary to other methods of control. Burning, where possible, in preparation for further treatment would therefore be a sound practice.

(*b.*) As, moreover, the fungus cannot be immediately destroyed in the soil, then the subsequent unhindered growth of wheat, barley, rye, barley-grass, brome-grass, or giant twitch would with suitable moisture and warmth probably serve to maintain, if not increase, the infection of the land. Susceptible plants must therefore be rigorously suppressed by cultivation or smothering, and any tendency to water-logging in the soil be anticipated by drainage or tillage.

(*c.*) As the parasite apparently depends for its existence upon the presence of a susceptible plant the complete destruction of such plants by fallowing long enough would eventually cause the fungus to perish for lack of sustenance. The cost of fallowing, however, would in most cases be prohibitive; the alternative, therefore, is a rotation of crops.

(*d.*) In the choice of a rotation any crop not known to be attacked may be selected, but especial preference given, where practicable, to oats and rape on account of their attributed immunity.

(*e.*) On land difficult to rid of twitch or other susceptible plants, prior to the establishment of temporary pasture, oats, rape, or other crop not subsequently cultivated, the use of a smothering-crop, such as autumn-sown oats and tares, is suggested.

(*f.*) Wheat would wisely be avoided in the rotation for at least two years.

(*g.*) There is a possibility of transferring the disease by means of stock, but several most valuable examples of healthy and badly diseased paddocks actually adjoining clearly show that healthy wheat can be produced on uninfected land even when it is adjacent to a badly infected paddock.

(*h.*) There is no positive evidence that the disease has been conveyed in the hairs of seed-wheat, nevertheless it would certainly be advisable to secure all seed from an undoubtedly healthy crop.

(*i.*) Straw stacks from badly infected areas are better destroyed by fire, more especially if there is no definite use for them.

LUCERNE-CROP COMPETITION.

THIS season a lucerne-crop competition was promoted by the Otakeho branch of the Farmers' Union, South Taranaki, in co-operation with the Fields Instruction Branch of the Department. The entries furnished particulars of the acreage, previous crop, seeding, date sown, manure, lime, and inoculated soil (if any). For judging purposes the scoring was arranged under the following headings: Freedom from weeds, evenness of crop, quality of crop, and colour and general appearance—a maximum of 10 points for each, or 40 in the aggregate.

On 31st January last the writer and Instructor Glasson judged the competition. There were six entries, and about twenty-five members of the union turned out in motor-cars and accompanied us over each field. After judging each crop the number of points awarded under each heading was announced, and we had a short discussion before proceeding to the next field. This was repeated on each farm visited, and altogether a very profitable day was spent. The winning crop gained 35 points out of the possible 40, while the others scored 30, 22, 21, 17, and 17 respectively. It may be mentioned that the winning crop was the oldest (some three years) among those entered, and was the only one in the competition to which inoculated soil had been applied at the time of sowing.—*J. W. Deem, Fields Instructor, Wanganui.*

Dufur Orchard.—The name of the large orchard in Oregon, referred to on page 112 of last month's *Journal*, is Dufur, not Deufar.

Limestones.—Samples of limestone recently tested by the Chemistry Section gave the following percentages of carbonate of lime: Wharekopae, Gisborne, 95; Marakanui, Central Otago, 93; Gladstone, Wairarapa, 90; Kara, North Auckland, 71; Martinborough, Wairarapa, 65; Hokianga, North Auckland, 62.

MILK AND CREAM FOR FACTORY SUPPLY.

THE PRODUCTION OF SOUND RAW MATERIAL.

G. M. VALENTINE, Dairy Instructor, Auckland.

PRACTICALLY speaking, the value of dairy-produce, especially butter, is determined by its flavour and keeping-quality, and both these points are almost entirely dependent on the state of the raw material when delivered to the factory.

It has been shown by experiment that milk drawn from a healthy cow, in perfectly clean surroundings, will keep for an indefinite period without material change if sealed up in a sterile vessel. While such conditions are not to be found on the average farm, the nearer they can be approached the better will be the condition of the milk produced. The most likely sources of contamination are dirty utensils, hands, or udders, and an impure atmosphere resulting from dirty sheds and dairies. Fully 90 per cent. of the defects in milk and cream are due to these causes, and neglect of cooling.

In the production of high-quality milk and cream four things are necessary—namely, a good set of brushes, plenty of boiling water, a good cooler, and, lastly, the inclination to use them.

Under present-day dairying conditions, where milking-machines and separators are in everyday use, quite a number of brushes are required if all the various parts connected with these machines are to be kept thoroughly clean. Without them it is impossible to get into the numerous corners where stale milk collects, with the result that each milking is inoculated by the germs which have developed since the previous one. Direct contact with dirty utensils is without doubt the most frequent cause of bad milk and cream.

The boiling-point of water at sea-level is 212° F., and no other temperature will do the same work. Hot water may be any temperature from just above blood-heat, which is quite suitable for washing utensils, but for scalding no temperature lower than boiling-point will give the same results.

The temperature at which milk is drawn from the cow is ideal for the development of the germs with which the atmosphere of even the cleanest shed is laden. By cooling the milk the growth of these germs is checked, and the development of bad flavours, which are the result of their action, is prevented.

Of the four requirements mentioned the last is the most important, as shown by the fact that where conditions are not of the best a liberal use of the first three may result in a good class of milk being produced. The labour entailed under such conditions is very much greater than where proper conveniences are provided, and as labour accounts for from one-third to one-half of the total cost of producing butterfat this aspect of the question cannot be ignored.

THE MILKING-SHED.

The advent of the milking-machine resulted in a complete change in the construction of sheds, as the new system called for much more rapid handling of the cows. As the first machines installed were bucket plants, milking two cows at once, the double bail was required, which was soon followed by the run-through shed, experience having shown that there was too much interference with the buckets when the cows had to back out of the bails. Practically speaking, there are only two styles of sheds being built to-day—the race shed and the run-through or half-race shed.

The race shed: In many districts the race shed has been almost generally adopted, one claim being that it is cheaper to build, and another that young heifers can be better handled than in a run-through shed. Provided the race shed is properly built, it is doubtful whether the first claim can be sustained. The floor-space in an eight-cow shed of this pattern is 30 ft. long by 15 ft. wide, including the gutters at each side. The floor-space for a run-through shed to hold the same number of cows is 29 ft. 6 in. by 15 ft.—practically the same. Very often the gutters are left out altogether in building the race shed, and the manure is shovelled out under the wall-plate on each side and left there indefinitely. The air coming into the shed passes over this heap, with the result that the whole atmosphere is impure. Even when proper gutters are provided it is the exception rather than the rule to find them kept as they should be. Taken as a whole, the race shed is more difficult to clean than the run-through, and for that reason the surrounding atmosphere is not as a rule so pure. If the lee side of the shed is built of rails instead of being close-boarded the result is much more satisfactory.

Dairymen who have had experience of both sheds claim that the race type is slower, as a hard cow in front will hold up the other three. The number of sheds which have been converted from race to run-through recently seems to bear out this claim.

The run-through shed: For a clean sanitary milking-shed which is easily kept in order and gives quick despatch in the handling of the herd the open-fronted run-through plan can be confidently recommended for either hand or machine milking. The plan shown on pages 148–9 makes provision for all the requirements which experience has shown to be necessary for the production of a first-class article, whether the milk is to be separated on the farm or delivered direct to the factory. The building is comparatively cheap, and any make of milking-machine can be installed satisfactorily. The cows go straight through, which reduces the wear on the floor, and if the doors are kept open between milkings a pure, sweet atmosphere is easily maintained. Every dairyman may not be in a position to carry out the whole plan as shown, but if the right lines are followed it may be possible to complete it at a later date.

SITE, DRAINAGE, AND WATER-SUPPLY.

The ideal site for a milking-shed is not available on every dairy farm, as several points have to be met in making the selection. The method often followed of erecting the shed as an addition to an existing

building is a bad one, as some essential feature has usually to be sacrificed. Stall feeding is not practised over the greater part of New Zealand, and consequently the close grouping of farm buildings is not necessary. The germ-laden atmosphere of the old-style farm-yard can be avoided, and the shed built in such a position that the milk is produced under the best possible conditions.

When the shed is built close to the rest of the farm buildings it very often happens that the fowls, pigs, and other farm-animals make free use of it between milkings. In this connection it is well to note that the Dairy Industry Act requires that pigs shall not be kept within 50 yards of a dairy, while no fowlhouse, manure-heap, cesspit, or closet shall be kept within 30 ft. The word "dairy" includes the shed and yard. On the other hand, it is a mistake to build the shed so far from the dwelling that proper attention cannot be paid to the stirring of milk and cream between milkings.

If possible, a dry level piece of ground with sufficient elevation to provide fall for drainage should be chosen. Should it be necessary to build the shed on a slope it is best to have the fall from the back of the shed to the yard, but abrupt slopes should be avoided if possible. Where the slope is from the shed to the yard it is best to excavate the shed-site to a firm bottom. Fillings are liable to sink and crack the concrete floor. A drain must be provided at the foot of the bank formed by the excavation, to carry off surface and storm water and prevent it running through the shed. Where the slope is in the opposite direction—that is, from the yard to the shed—a gutter will be required along the front of the building, otherwise the dirt from the yard will work down into the shed, especially if the yard is not concreted.

The practice of discharging drainage into a creek has several objectionable features. It is a waste of valuable manure, and, further, it will contaminate the water, which is probably being used by some one lower down. The water-supply of many dairy factories is drawn from open streams, so that a serious position might easily arise from this cause. A liquid-manure tank of concrete, or a portable one on a sledge, is much better.

An adequate and permanent water-supply is an absolute necessity in a dairy, and consequently this point must be considered in choosing a site. Where a gravitation supply is available it can be piped to the site which has the most advantages in other respects, but where the supply depends on pumping its source is of first importance. Defects in other respects can usually be got over, though it may cost a little more money, but a defective water-supply is a never-ending cause of expense and annoyance. A shed with a poor supply of water is usually a dirty one, and the milk received from it is consequently defective. A rain-water supply is seldom satisfactory, as it usually gives out just when it is most needed. Well-water is best, on account of its suitability for cooling milk and cream, but, failing that, a running stream is a good substitute.

In laying out the building the shed should be placed so that the prevailing wind will come from the back, or at an angle over the far corner of the separator-room. This will blow any smell from the shed or engine-exhaust away from the separator-room.

HAND-MILKING SHED FOR DIRECT SUPPLY.

The following is a detailed list of the material required for the shed, yard, and race only, for hand milking, in which case the 6 ft. passage shown on the complete plan can be used for washing-up purposes.

Shed and Passage.

Concrete, 11 yards. (Aggregate: Sand and shingle, 12 yards; cement, 54 standard bags.)

Timber—

	Ft.
Plates, 4 x 2—2/10, 2/15, 1/6; studs, 4 x 2—8/9; rafters, 4 x 2—10/16; rails, 4 x 2—8/13	262
Studs, 4 x 3—16/8	128
Studs, 4 x 4—5/8, 5/9, 3/10	154
Plates, 6 x 3—2/15, 1/7	56
Purlins, 3 x 2—5/19, 5/17; rail, 3 x 2—2/15; bars, 3 x 2—8/10; plates, 3 x 2—4/15	175
Rails, 6 x 2—6/11	66
Boarding, 9 x 1 (weatherboards, barges, doors, &c.)	700
Total	1,541

Rafters set over each post and one between, about 3 ft. 6 in. apart.

Ledged doors (8) with pivot hinges and fasteners, and bar with two notches for "open" and "shut." Chains, 8 pieces of ⅜ in. chain, 4 ft. long, with strong hooks and eyes. One pair of ledged doors with hinges and fasteners. One gate 5 ft. wide with hinges and fasteners.

Nails, 30 lb. of 3 in. and 20 lb. of 2 in.

Galvanized corrugated iron, 20 sheets 9 ft. long, and 20 sheets 8 ft. Lead-head nails, 15 lb. Ridging, 40 ft. 16 in. wide, lead-edged one side.

Yard.

10 yards concrete (12 yards sand-shingle and 54 bags cement).

Race.

4 yards concrete (5 yards sand-shingle and 23 bags cement).

Posts, rails, and large gates are not included in these quantities.

MACHINE-MILKING SHED FOR DIRECT SUPPLY.

For a shed in which machines are to be installed, but no separator is required, the engine and pump will, of course, be put into the room in which the separator is shown on the plan. The quantities required for this room are :—

Concrete, 3 yards. (Aggregate: Sand and shingle, 4 yards; cement, 18 bags.)

Timber—

	Ft.
Plates, 4 x 2—4/13, 2/9; studs, 4 x 2—12/9, 12/8; trimmers, 4 x 2—1/9; rafters, 4 x 2—4/20	242
Purlins, 3 x 2—4/13	26
Anglebores, 4 x 1—4/9; 3 x 1—4/9; scribers, 3 x ½—8/9	39
Boarding, 9 x 1 (weatherboards, barges, doors, &c.)	600
	907

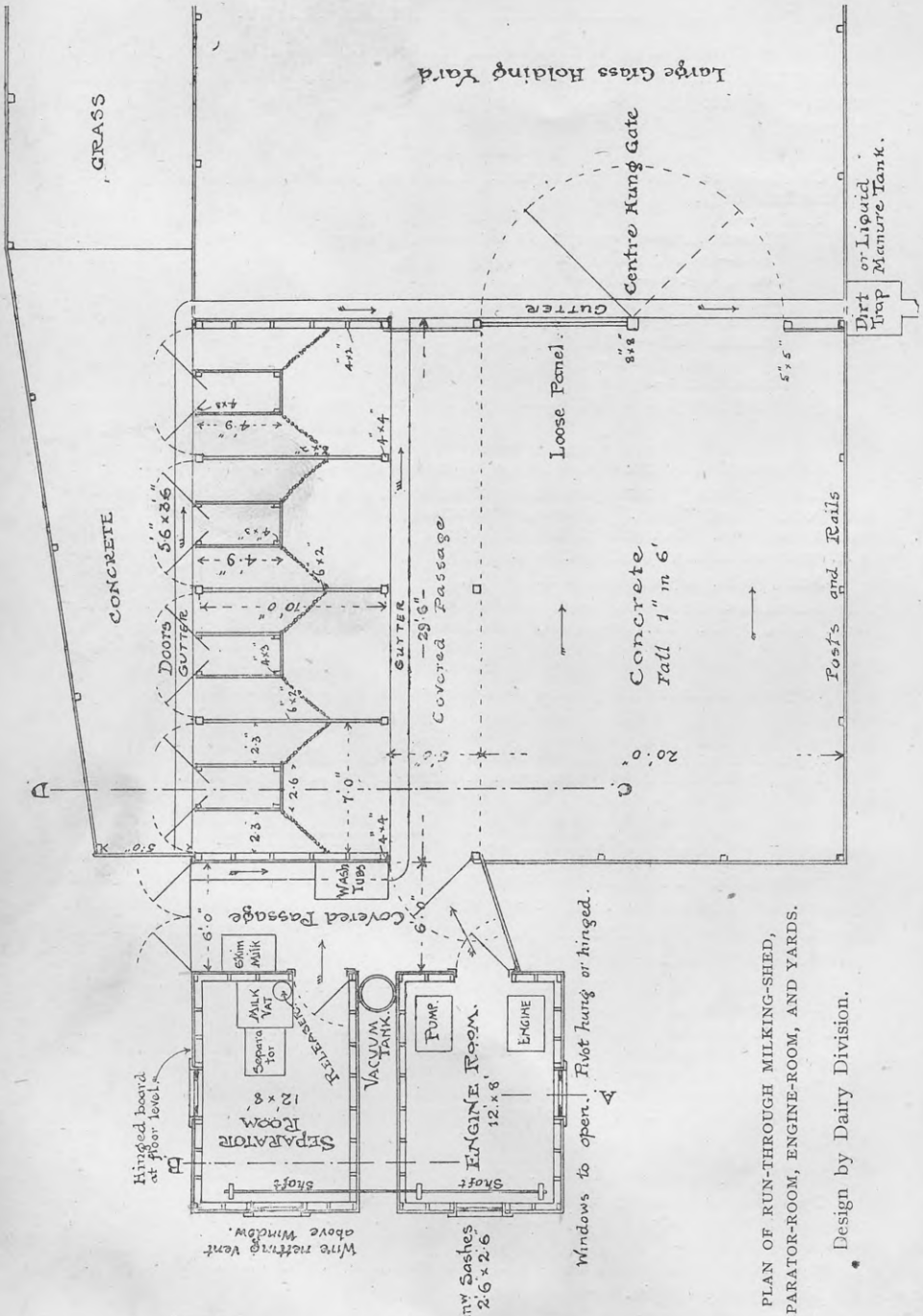
Rafters to be about 3 ft. 6 in. apart.

Two window-frames, with external architraves, stops, and scribers, &c., complete; two sashes (4 light)—2 ft. 6 in. by 2 ft. 6 in.—glazed with 16 oz. glass, with fastenings, &c.

One ledged door, with external architraves, linings, and fasteners complete.

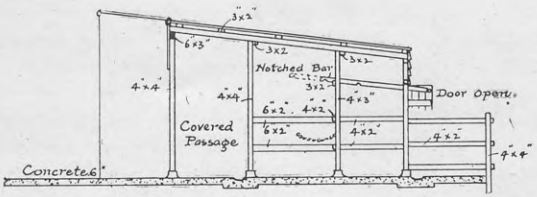
Nails, 30 lb. of 3 in. and 20 lb. of 2 in.

Galvanized corrugated iron, 8 sheets 9 ft. long and 8 sheets 8 ft. Ridging, 13 ft. of 16 in. lead-edged on one side. Lead-head nails, 12 lb.

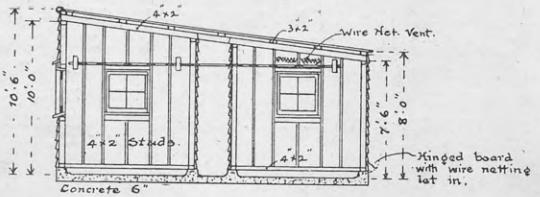


PLAN OF RUN-THROUGH MILKING-SHED, SEPARATOR-ROOM, ENGINE-ROOM, AND YARDS.

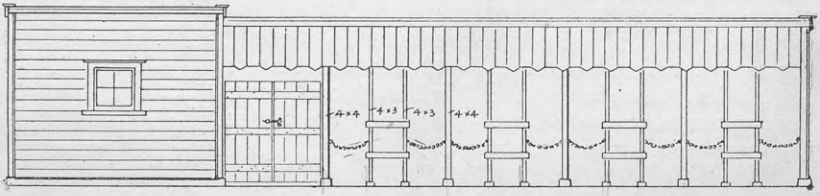
Design by Dairy Division.



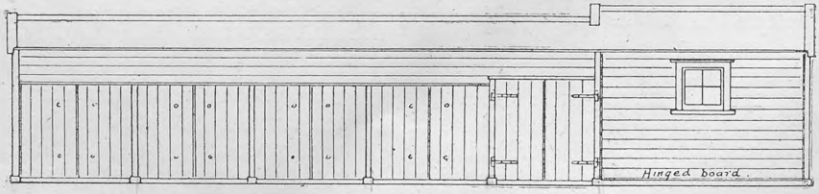
SECTION ON LINE C—D.



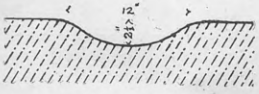
SECTION ON LINE A—B.



FRONT ELEVATION.



BACK ELEVATION.



SECTION OF GUTTERS.

In this case it is assumed that the shed will be carried on the full 15 ft. wide. If that is done it will be better to have the door of the engine-room in the side instead of in the end of the room as shown. The releaser can be erected in the 6 ft. passage between the engine-room and the shed. The covered space in front of the engine-room can then be used for washing-up, &c. Where a milking plant with automatic release and pulsation is to be installed a small saving can be made by building the engine-room across the shed, at right angles to the position shown. With a mechanical pulsation this is not so suitable, as it necessitates an angle drive.

HAND-MILKING SHED FOR HOME SEPARATION.

In a hand-milking shed for home separation the separator-room may also be placed at right angles to the position shown in the plan. For hand separation a room 8 ft. wide by 10 ft. long is quite big enough, and as this will leave a covered way nearly 5 ft. wide in front of the separator-room a 2 ft. air-space between the shed and room will be sufficient. This will further reduce the amount of material required.

MACHINE-MILKING SHED FOR HOME SEPARATION.

For the carrying-out of the complete plan as shown it will be necessary to add the same amount of timber required for the engine-room to the quantities already given, and also about 2 yards of concrete and eight 6 ft. sheets of iron. Concrete for the foundations of the engine and pump is not included in the estimates, as the amount required will vary with the type of machine installed. It may be found that there are some "unders" or "overs" in the quantities here given, due to the fact that they are progressive estimates, but they are approximately correct.

POINTS IN DESIGN AND ARRANGEMENT.

In the plan certain principles are embodied which are essential and which cannot be omitted without spoiling the whole thing, as they are the result of careful investigation on the farm into certain defects found in milk and cream received at the factories. Other points may be altered to suit the circumstances, which will vary with almost every case.

Among the essentials may be mentioned the provision for air-spaces. Frequently the defects mentioned have been found to be the result of the practice of building the separator-room on to the end of the shed with only a partition between. In many cases the partition is not even carried up to the roof, and even when it is there is a door in it, which for convenience during milking is kept open. If the shed is wet and dirty the smell is carried into the separator-room and absorbed by the cream. In a dirty dry shed, in addition to the smell, a fine dust is raised by the cows, which gets directly into the milk and cream, and is one of the causes of fermented cream and gassy cheese.

Exhaust flavour is the result of the engine being in the same room as the separator or releaser, more especially where a kerosene-engine

with a blow-lamp attached is in use. Occasionally a shed is met with where the engine exhausts into the separator-room, and frequently the piston-rings have worn to such an extent that the fumes escape into the room at each explosion. Such a room soon becomes saturated with the smell, which is very penetrating and can be detected several paces from the shed. Naturally cream held for two days in such an atmosphere absorbs the taint, but even the fresh morning's cream or milk will be affected. Instances are on record where a wind blowing from the engine to the separator gave this flavour to the cream, and with a change of wind the flavour disappeared. The same flavour will be imparted to the milk if the releaser is delivering it into open chutes which pass through the engine-room on the way to the milk-stand.

In some cases the circumstances may be such that the separator and engine-rooms have to be put at the opposite end of the shed to that shown. If so, the holding-yard and race must also be reversed. The object of this arrangement is to secure a clean atmosphere, free from dust, round the separator-room. If the cows are handled at that end this is impossible, as the large holding-yard, nominally of grass, is more frequently mud in wet weather and dust in dry weather. For the same reason the rest of the farm-animals should be prevented from wandering round the dairy, as it frequently results in buckets of milk being upset and the whole surrounding atmosphere polluted.

For this same reason the passage between the shed and rooms is made 6 ft. wide. In many otherwise well-conducted dairies there is no provision made for handling the skim-milk, and the whole surroundings are contaminated by skim-milk froth being spilt about. If the plan given is followed a tank can be provided with a tap to draw off the skim-milk for calf-feeding. The froth can then be dealt with and the tank washed out with very little labour, thus doing away with one of the common sources of smell round a separator-room. There is also room for wash-up tubs, discharging into a proper drain—another point which is frequently neglected.

The object of the spreading race is to prevent a "boss" cow cornering a timid one, which she has more chance of doing in an ordinary straight race. By fencing the race and discharging the cows at the end there is not the same difficulty in keeping the step-off in order, as the length of front is reduced.

Dwarf walls are provided under all wall-plates. Not only will the life of the plates be lengthened by this means, but the drainage cannot run over and leak through the bottom weatherboard. In the same way concrete is drawn up round each shed-post.

Quite a number of sheds are spoiled by having the gutters made too deep and narrow, with square edges. Wide, shallow gutters with rounded edges are much better, as they are much more easily kept cleaned, and the cows are not liable to slip off the edges and cause a splash. A gutter with sloping sides and level bottom may be preferred, and it is as good as the one shown.

Coming to optional points, the drainage may be carried off at either side of the yard or to the back of the shed if the slope of the ground makes it necessary. It is not advisable, however, to carry it through the passage between the separator room and shed. If placed

where shown 4 in. pipes are required at the gateways. The liquid-manure tank should be placed 30 ft. from the shed.

Pivoted doors are provided, as they have the advantage of being better balanced, and when left open between milkings the whole of the back of the shed is open to the sun and wind. Some users place the opening-lever on the opposite end of the door to that shown, but there is sometimes a difficulty in getting enough leverage to open or shut them if there is a strong wind blowing. Others prefer the 2 ft. 3 in. doors all opening either to right or left.

Some erectors may prefer to place the engine in the far corner of the separator-room in a line with the pump, and drive from the engine to the pump and thence to the shaft. This will require less shafting, but, on the other hand, there are three belts instead of two to transmit the power from the engine to the separator, and consequently more likelihood of a loss in speed through the belts slipping. The direct drive from the engine to the shaft is better where a saw is to be driven. No objection can be taken to a saw being driven off a pulley placed on the shaft in the air-space between the two rooms, but the practice of driving the chaffcutter, shearing-machine, &c., with the same engine usually results in each job being done badly.

Where the milk is to be separated it is advisable to wrap a piece of hair-felt round the milk-pipe in the passage, to keep in the heat. This can be easily removed when the pipe is taken down for washing.

The exhaust-pipe of the engine should discharge into the atmosphere near the top of the wall on the side farthest from where the milk is being handled. If the water from the roof is being used for washing the utensils it should not discharge over the iron. Exhaust flavour has been frequently traced to this cause.

Storm-doors are provided at the end of the passage, one or both of which can be shut if rough cold weather is experienced from that quarter. For the same reason the ventilating-board at the floor-level in the separator-room is hinged. This should always be kept open between milkings. By leaving out a board or two over the window and inserting bird-netting plenty of ventilation will be secured, and the current of air entering at the bottom opening will dry the floor and prevent the development of a damp smell.

The most important part of a milking-shed is the floor, and for this purpose concrete is easily the best material which has so far been found. Wooden floors are not nearly so satisfactory, and in many districts they cost more to put down and do not last so long as concrete. Even a well-laid floor of sawn timber cannot be kept thoroughly sanitary, as the wood absorbs and subsequently gives off many odours. Such floors are also more difficult to wash down, and when wet they are very slippery.

Slab floors are an abomination, as it is almost impossible to put them down in such a manner as to prevent them leaking, the result being an accumulation of filth underneath, which is a source of smell and a breeding-ground for flies. Moreover, the uneven surface makes it impossible to keep them clean. Gravel or metal floors are not satisfactory, and should be looked upon only as temporary substitutes for something better. They soon become foul, and are constantly breaking up and needing repairs.

Some details regarding concrete-work for the floor are given farther on.

In the construction of the building the lean-to roof has been adopted on account of cheapness. A ridge roof may be preferred, but it will be more expensive if the shed is to be used for home separation, on account of the extra width at the engine-room end. Boards and battens may be used instead of weatherboards, in which case the framing will have to be altered to suit. In one respect this is an improvement, as it presents a plain surface for lime-washing, and the lime does not run through and show on the outside of the wall.

If vertical boarding is decided upon a very nice finish can be given to the separator-room by using flooring-boards instead of boards and battens. By putting the dressed side to the inside of the room a smooth surface is obtained which is easily kept clean. If an old-style separator with high stand is to be put in it may be necessary to have the separator and engine-room about 1 ft. lower than the shed, to get the necessary fall from the releaser. An alternative is to have a rise in the milk-pipe from the bails up to the releaser, but this is bad practice. Owing to the surging of the milk in the pipes a quantity of butterfat is churned and collects in the releaser. This is a source of loss and makes the releaser very hard to wash.

Another plan was to sink the frame of the separator into the concrete, which caused trouble with the running, on account of it being too rigid. With the new style of stand, which is made in two pieces, this may be done, as the vibration can be taken up at the joint by putting in a piece of rubber packing. Where a low-stand separator is used a glazed earthenware pipe set into the floor and filled with concrete makes the best separator-block, being easily kept clean. A wooden or concrete block soon gets saturated with oil, gives an oily smell to the whole room, and looks unsightly.

For the milk-tank a bracket nailed to the wall is better than a stand, as there are no legs in the way when scrubbing down the floor. A very simple bracket can be made by nailing a couple of battens to the wall under the milk-tank and hanging them to the roof with iron rods. The fewer the wooden fittings round a separator the better. To this bracket a chute can be hung to carry the skim-milk to the tank in the passage outside. A tank 54 in. long, 30 in. wide, and 18 in. deep will hold approximately 100 gallons of skim-milk.

Where milk is delivered direct to the factory the releaser should be placed in the passage between the engine-room and the shed. From the releaser it can be carried by a covered chute to the milk-stand and then passed over a cooler into the cans. Copper chutes with a water-jacket are now largely used, but are not so efficient as the corrugated vertical cooler. If there is sufficient fall in the ground the floor of the stand can be kept up to wagon-height, but on a flat site the cans will be on the ground-level. It is a simple matter, however, to arrange a post and lever to hoist the cans into the wagon. Assuming that the prevailing wind is from the back of the shed the milk-stand should be placed about 30 ft. away in that direction. If a chute is used to convey the milk it will then be well out of the way and have no doorways to cross. A plank to stand on when washing this chute is necessary.

CONCRETE-WORK FOR THE FLOOR.

If well laid in the first instance concrete can be looked upon as a permanent floor, but it must be remembered that it is only as strong as the material from which it is made. For instance, floors made of burnt clay, scoria, shells, or pumice will not have the wearing-qualities of hard metal and sharp sand. It will also require a greater proportion of cement in mixing. For these reasons it may be actually cheaper to spend a little more money in procuring suitable gravel in the first instance, besides getting a floor which will last a good deal longer after it is put down.

The depth of concrete necessary to make a satisfactory floor will depend upon the material from which it is made and the nature of the foundation. On a good hard bottom 3 in. to 4 in. of good concrete may be quite sufficient, but if the ground is soft or has been filled in, 6 in., as shown in the plan, will be required. The depth of concrete and the proportion of cement used will, of course, make a difference in the cost of the shed. In allowing for the quantities given in the specifications the worst conditions likely to be met with have been kept in mind.

A mixture of four of gravel to one of cement by measurement is allowed for, but that again will depend on the nature of the materials used. Where good, clean, water-washed river-gravel or hand-broken metal and sharp sand is used a poorer mixture will give good results. The best concrete is made from gravel which is evenly graded from coarse sand up to stones 1½ in. square, or from broken stone and sand similarly graded.

To test for dirt rub the wet gravel between the hands, which will be soiled if earth is present. If so, it will be necessary to wash the gravel before it is used until the water runs clear. If there is any doubt about the materials it is a good plan to mix a small quantity of concrete in the correct proportions and place it in a mould to set, which will show whether it is suitable.

In mixing the object to be arrived at is to give each particle of sand or stone a coating of cement, and unless this is properly done the result will be a poor floor which will break up in patches. More depends on the way in which the turning is done than on the number of times it is done. To take a shovelful and turn it over is no use. It must be given a sweeping motion, from left to right, or *vice versa*, as though the gravel was being spread. Two men with shovels and one man with a coarse rake form a combination which gives good results. When thoroughly done the mixture should have an even, or what a buttermaker would call a straight, colour all through. A watering-can or a hose with rose attached is the best means of adding the water, turning to be then continued until the colour is straight. When finished the concrete should be so wet that, to use a successful concrete worker's expression, "you can find water in it"—that is to say, that if it is left to stand in a bucket water will collect on the surface. A great many more floors are spoiled by the concrete being mixed too dry than by it being mixed too wet.

When laying the floor, put the wet concrete down and ram it until the water and finer parts of the mixture are worked up to the surface, then trowel it off to a fairly smooth face. A plaster finish for either

factory or shed floors has proved a failure, as more often than not the plaster cracks and lifts off. Wire netting laid in the concrete will considerably add to the strength of the floor.

It must be remembered that a yard of gravel and sand and a quarter of a yard of cement mixed will not make a yard of concrete. For this reason considerably more gravel is allowed for in the specifications than the amount of concrete required.

Any one who has not previously done concrete-work would be well advised to engage the services of an experienced man if such is to be had. Nothing is more annoying than to go to the expense of putting down what was expected to be a permanent job and then find that it will not stand. A fault in any other part of the building can usually be rectified at almost any time, but a bad floor cannot be repaired until the following off season, and even then it is difficult to get a thoroughly satisfactory result. When competent assistance is not obtainable the foregoing hints may be of some value.

A BUSINESS PROPOSITION.

A properly equipped shed on a dairy farm is a sound business proposition, as the cost of milking is a question which must be taken more and more into consideration with the rise in wages. Take one item alone—washing-up and the cleaning of the shed. If through want of proper appliances, poor water-supply, or a bad floor it takes one man half an hour longer daily to do the work, the cost per year at 1s. an hour is £9 2s. 6d. This would pay interest on £150 worth of improvements. With improved conditions obtaining in other avenues the amount of labour offering for the farm must decrease in proportion unless the work is made more attractive. Even where no outside labour is employed the expenditure on a good shed is well repaid in comfort to the milkers. Then there is the question of quality of the milk or cream, which must not be lost sight of, and which is so much more easily maintained in a well-equipped shed than in an inferior one.

(To be continued.)

NOTE.—Larger copies of the plans reproduced on pages 148 and 149 may be obtained on application to the Director of the Dairy Division, Wellington, or to any officer of the Division. Where possible Instructors will also advise on the laying-out of dairies if application is made for assistance.

ADVICE TO FARMERS ON LIME-DEVELOPMENT.

A COMMITTEE of Government experts, consisting of the Chemist to the Department of Agriculture, the Director of the Geological Survey, and the Assistant Engineer-in-Chief of the Public Works Department, has been formed to advise groups of farmers requiring information concerning the erection of limeworks, limestone-crushing machinery, and related matter. Inquiries may be addressed to the Chemist, Department of Agriculture, P.O. Box 40, Wellington.

FIRE-BLIGHT.

A SERIOUS DISEASE OF FRUIT-TREES.

A. H. COCKAYNE, Biologist.

In December last alarming reports were published in various newspapers in the Dominion concerning a new fruit-tree disease that had appeared in the Auckland Province. Officers of the Horticulture Division and Biology Section have made a complete investigation into this outbreak, and the disease has been fully proved to be the dreaded American fire-blight, a bacterial disease caused by an organism known as *Bacillus amylovorus* Burr. In North America fire-blight has caused probably more loss than any other single fruit-tree disease. Unless adequately controlled in the Dominion it is liable to prove disastrous to our fruitgrowing interests, especially as it is particularly prone to attack apples and pears. To a limited extent it is also known to infect certain stone-fruits, more particularly apricots and cherries, but it is on pip-fruit that its ravages are rightly dreaded, and it is just on this class of fruit that the future of our orchard development depends.

Fortunately, at the present time fire-blight appears to be confined to the Waikato, with outlying areas of infection in the Tauranga district and the outskirts of Auckland south of that city. It is essential that every effort should be made to eradicate the disease, so as to avoid its distribution into the main fruitgrowing sections of the Dominion. Once well established in the main pip-fruit districts it might well be only the matter of a year or two before the whole of our fruitgrowing industry would be seriously menaced.

The control of fire-blight is difficult insomuch as spraying is of no avail, and the only method to adopt lies along the line of complete removal of all diseased portions of the affected tree. The main period of infection is in the late spring and early summer, when flower and shoot infection occurs. This is followed by a period of comparative quiescence of the organism, which winters over in cankered areas on the branches of the trees, followed again by rapid growth and fresh infection in the following year. Flower-infection is extremely serious, as it causes complete destruction of the crop.

Both flower and shoot infection can be prevented by systematic removal of all infected wood prior to the blossoming-period. All infected shoots, and laterals, &c., carrying infected flower-buds, should be cut away at least 1 ft. below the apparent infection. Where the grower is desirous of saving any large limbs bearing cankers he should remove the cankered areas with a sharp knife, cutting well outside the affected area. All knives, seccateurs, &c., used should be sterilized at each cut, which will prevent the further spread of the disease by such tools. The wounds left after cutting out should be sterilized with a 5-per-cent. solution of formalin, lysol, or similar disinfectant, and then coated with a dressing of coal-tar.

An extremely important point to remember is that the disease can winter over in branches that have been cut from the tree, so that the immediate burning of all prunings and cut-out cankers is essential. The systematic removal of all affected wood is a slow and tedious process, but the orchardist has the whole of the late autumn and winter (the quiescent period of the organism) in which to carry out the work.

A full account of the life-history and control of fire-blight is under preparation, and will be published in the *Journal* in the near future.

NOTE.—The subject of fire-blight is also dealt with in "The Orchard" monthly notes later in this issue.—EDITOR.

LIMESTONE AND LIME.

MINERALOGY, TESTING, AND SAMPLING.

Extracts from "THE LIMESTONE AND PHOSPHATE RESOURCES OF NEW ZEALAND": Geological Survey Bulletin No. 22, Part I, 1919, by P. G. MORGAN, Director, assisted by officers of the Survey.

LIME-BEARING MINERALS.

CARBONATE of lime occurs in two distinct mineral forms, alike in chemical composition but physically different. These two forms are known to the mineralogist as calcite and aragonite. There may also be other forms of calcium carbonate.

Aragonite forms hard parts of reef-building corals, the shells of gasteropods, and the inner pearly layers of bivalve shells, but is otherwise a somewhat uncommon mineral of little importance as a source of lime. Authoritative information concerning aragonite in organic structures is difficult to obtain, and it is somewhat doubtful how far it does or does not enter into the composition of shells, corals, &c.

Calcite, on the other hand, is a very abundant mineral, widely distributed through the earth's crust. There are numerous varieties, differing considerably in general appearance. All the varieties are characteristically of a light colour, but the presence of impurities may cause variations in tint from white or transparent to black. For the purposes of the present publication the chief forms in which carbonate of lime occurs may be enumerated and described as follows:—

(1.) Pure or nearly pure *calcite*, occurring in more or less perfect crystals, and then known as dog-tooth spar, nailhead spar, &c. Iceland spar is a perfectly transparent form.

(2.) Carbonate of lime, occurring in the form of *calcareous concretions*, which are usually very fine-grained and tough, but as a rule are not of great purity. Concretions are small masses of mineral substances which have collected round a nucleus. The nucleus may be a grain of some mineral other than that forming the mass of the concretion, a piece of vegetable matter, or it may be merely the point at which the concretion has begun to form. The late Alexander McKay's felicitous definition of a concretion may here be quoted: "A concretion is some-

thing that has gathered itself round about something else; sometimes there is nothing for it to gather about, but that does not prevent its being a concretion all the same, only there is no foreign substance in its heart."* Calcareous concretions occur in many forms—globular, ovoid, kidney-shaped, cylindrical, disk-like, dumb-bell shaped, or wholly irregular. They are common in claystone and the allied rocks, which in New Zealand are often called "papa." Calcareous concretionary bands or layers, usually very tough and impure, are not uncommon also in the calcareous claystones of this country.

(3.) *Massive limestone*, occurring in beds or layers. Such material forms the principal subject of this bulletin. Argillaceous or hydraulic limestone is an impure sub-variety, containing a considerable amount of clayey matter. As the clay increases, the rock grades into calcareous claystone. Arenaceous limestone is a limestone containing a considerable proportion of sandy matter. With an increase of the sand to, say, 50 per cent. arenaceous limestones become calcareous sandstones. Shelly limestone is a limestone composed very largely of visible fragments of shells. Some of the so-called shelly limestones of this country contain numerous pebbles, and are rather to be called shelly or calcareous conglomerates.

(4.) *Marble* is a highly crystallized altered limestone, suitable for ornamental use. The coarser-grained marbles are sometimes called crystalline limestones.

(5.) *Chalk* is a soft easily disintegrated variety of limestone, formed chiefly from the remains of the minute organisms known as Foraminifera.

(6.) *Coral-rock* is formed principally of the remains of corals.

(7.) *Calcareous marl* is a soft earthy deposit, formed chiefly in fresh-water lakes by the accumulation of the remains of calcareous algæ, fresh-water shells, &c. It grades into ordinary marl, which is simply a notably calcareous claystone.

(8.) *Stalactite* and *stalagmite* are materials formed in caves or under overhanging rocks by the deposition of carbonate of lime from water that has percolated through limestone or other calcareous rock. Moisture excluded, they are usually practically pure carbonate of lime.

(9.) *Calc-sinter*, *calcareous tufa* or *tuff*, and *travertine* are names applied to one and the same thing—namely, carbonate of lime deposited by springs or, more rarely, by streams.

(10.) In New Zealand *shells* form a somewhat important source of carbonate of lime. As a rule, they consist of almost pure calcium carbonate, either in the form of calcite or of aragonite. A few shells are highly phosphatic. The shells of crustacea are more phosphatic than those of ordinary shell-fish. As already indicated, corals, Bryozoa, Foraminifera, and some algæ are also important sources of carbonate of lime; and their remains, together with those of Mollusca (shell-fish), form the great bulk of the world's limestones.

Immense amounts of carbonate of lime exist in less pure forms than those enumerated above. If the percentage of carbonate of lime falls below 85 the limestone, as already explained, may be called "arenaceous" or "argillaceous," according to whether sand or clay is the

* "On the Prospects of finding Coal on Rowley's Farm, near Shag Point Railway-station." Rep. of Geol. Explor. during 1890–91, No. 21, 1892, p. 48.

chief impurity. Calcareous claystones, sandstones, and conglomerates are very common in New Zealand. The rock, or rather group of rocks, popularly called "papa" has a widespread distribution in both North and South Islands. Though in general only slightly or moderately calcareous, "papa" in places approaches or becomes argillaceous limestone. There are many rocks which, as first formed, contain lime only in the form of silicate, but by alteration come to contain several per cent. of carbonate of lime. In rare cases carbonate of lime in the form of calcite is an original constituent of igneous rocks.

Dolomite is a mineral composed of carbonate of lime and carbonate of magnesia, with possibly other carbonates. Typical dolomite, if pure, contains 54·35 per cent. of carbonate of lime and 45·65 per cent. of carbonate of magnesia. The union of the two substances is probably analogous to that of two metals in an alloy (especially such an alloy as Muntz metal) rather than to a strict chemical combination, such as that of calcium, carbon, and oxygen in carbonate of lime. It is not analogous to an ordinary mixture, because dolomite has a definite crystalline form and definite physical properties of its own. Dolomite forms the main constituent of extensive rock-masses in various parts of the world. Limestones with a moderate percentage of magnesia are not uncommon, and are termed dolomitic or magnesian limestones. Such rocks on microscopic examination are found to be mixtures of dolomite, calcite, and other minerals.

Various other minerals containing more or less carbonate of lime need not be mentioned here. There are, however, many minerals which contain a proportion of lime in the form not of carbonate, but of silicate. The chief of these are various varieties of feldspar, augite, and garnet. In addition there are two important mineral substances of which lime is one of the principal constituents. These are gypsum and phosphate of lime.

Gypsum is hydrated sulphate of lime, and is represented by the symbol $CaSO_4.2H_2O$. Varieties of it are known as satin-spar, alabaster, and selenite.

Several phosphates of lime, differing somewhat in chemical composition, and each having its own name, are known to the chemist. In ordinary usage the name "phosphate of lime" is applied to tricalcic calcium phosphate, with the symbol $Ca_3P_2O_8$. This substance does not occur pure in nature, but forms the essential constituent of the minerals apatite, phosphorite or collophane, and ordinary phosphate rock. It is also the most important constituent of green bones, and may be considered to form the whole of bone-ash, impurities excepted.

There are two varieties of apatite—*fluor-apatite*, with the composition represented by the compound symbol $3Ca_3P_2O_8 \cdot CaF_2$; and *chlor-apatite*, represented symbolically by $3Ca_3P_2O_8 \cdot CaCl_2$. "Phosphorite" and various other names have been applied to the form of phosphate of lime that forms the bulk of ordinary phosphate rock. Undoubtedly the mineral here present is an amorphous substance which has combined with it a small amount of carbonate of lime. Austin F. Rogers* proposes that the old name of "collophane" should be applied and restricted to this mineral.

* "A Review of the Amorphous Minerals" *Journal of Geology*, Vol. 25, No. 6, Sept.-Oct., 1917, pp. 530 *et seq.*

TESTS FOR LIME AND LIMESTONE.

The simplest test for limestone or any other form of carbonate of lime consists in the application of any of the ordinary acids (in liquid form). If carbonate of lime is present numerous bubbles of gas will form. This gas is no other than the carbon dioxide (CO_2) already mentioned as the substance driven off from limestone by heating strongly.

The most satisfactory acids for general use are nitric acid (spirits of hartshorn) or hydrochloric acid (spirits of salt) diluted with one or two parts of water. Good vinegar will answer quite well. It is not generally known that various solid acids, such as tartaric and citric, can be used by placing a tiny pinch of the powdered material upon the stone together with a drop or two of water.

Ordinary limestone gives off gas quite freely when cold acid is applied, but fine-grained hard calcareous concretions, especially if magnesian, may effervesce very slowly unless powdered and gently heated. Dolomite is hardly affected by cold acids, but if it is powdered and gently heated brisk effervescence soon begins.

It will be observed that the acid test is for carbon dioxide rather than lime, but in practice this test, combined with the general appearance of the stone being tried, is quite sufficient. For full information regarding tests for lime and its various compounds the reader must be referred to works on chemistry and mineralogy, or to teachers of those subjects.

If a small piece of fairly pure limestone is placed in a glass or porcelain dish (say, an ordinary saucer) and covered with some acid in liquid form (preferably dilute nitric or hydrochloric) it will be seen that the fragment of stone as it effervesces diminishes in size, and after a short time breaks up and practically disappears, except that a little sand will be left in the dish or other vessel used. The effervescence ceases, the carbon dioxide of the limestone having now escaped, while the calcium oxide or lime formerly combined with it has united with the acid to form a new substance (calcium nitrate or chloride, according to the acid used), into the exact nature of which it is not necessary here to enter. A stone which, though it effervesces freely, does not break up when treated with acid is of poor quality, and is useless for the manufacture of quicklime.

The object of describing the above experiment is to show the reader how he may roughly ascertain the quality of a sample of limestone—namely, by comparing the residue after acid treatment with the origina material. For this purpose the following directions may be given :—

Reduce what is considered an average sample of the limestone to a fine powder in any convenient way. The lumps may be broken into small pieces with a hammer on an anvil or on a hard flat stone, and then crushed to powder by placing them between two folds of brown paper and striking with the hammer. An iron pestle and mortar, if available, will, of course, be found much better than the brown paper and hammer. A very small sample may be powdered by pressure between two large coins. Take as much of the powdered limestone as will lie on a sixpence, place it in a saucer, dampen it with water, and then add a few drops of semi-dilute nitric or hydrochloric acid (one part of water by measure to one part of acid as bought from the

chemist or drug-manufacturer). When effervescence ceases add two or three more drops of acid to make sure that all the carbonate of lime has dissolved, then gently pour off the acid or most of it, and compare the bulk of the sandy residue with that of the powdered limestone that may be conveniently placed on a sixpence. If there is clayey matter in the limestone the comparison will not be very satisfactory, because it will be impossible to decant the acid off the residue left after treatment without some loss. Should the residue, however, be sandy, and clearly less than one-tenth the bulk of the limestone taken for the test, then the limestone is of good quality.

If the powdered limestone taken for the test is weighed on a chemical balance, and the residue after acid treatment with aid of heat is transferred to a filter-paper, washed with pure water, dried, collected (preferably after igniting—that is, strongly heating the material and burning the filter-paper to an ash), and weighed, the difference of the two weights, due allowance being made for the ash of the filter-paper when this has been ignited, represents with a moderate degree of accuracy the amount of carbonate of lime in the stone, plus any other carbonate, such as that of magnesia or iron, that may be present. The result thus obtained, however, is usually too high, because some of the silicates present will almost certainly have gone partly into solution. The weight of the residue left after acid treatment, reduced to a percentage of the weight of limestone taken, is the "insoluble" of some analyses.

SAMPLING LIMESTONE.

The operation of sampling a substance with a view to making an analysis is most important, for if the sample is not properly taken the analyst's skill and time will be wholly or largely wasted. The complete analysis of a rock takes days of the chemist's time; it is therefore irrational, in most cases at least, to spend only minutes in taking the sample. The sampling of an agricultural limestone need not be so elaborate as when the stone is to be used in the manufacture of glass or in certain other chemical industries, but it will be admitted that the more carefully the work is done the better. Hitherto in New Zealand the samples of limestone and of many other substances collected in the field have consisted of single lumps (which may be called fortuitous or "grab" samples), or of a few pieces of stone broken here and there from the deposit, so as to form as representative a sample as the collector knew how to obtain under the particular circumstances. Such samples may be termed "empirical" samples, and represent most of the samples collected by the Geological Survey in the course of its ordinary work.

Concerning the types of samples termed above "grab" and "empirical," Orton and Peppel write: "Experiment has shown that it is difficult, if not impossible, for any person to select a sample without bias, even where not interested in the result, if he is acquainted with the effect of his actions in putting in or rejecting portions."* This statement is somewhat unhappily worded, for it may be construed to imply that the less a person knows the more likely he is to select a

* Orton, Edward, and Peppel, S. V.: "The Limestone Resources and the Lime Industry in Ohio." Geol. Surv. of Ohio, 4th Series, Bull. No. 4, 1906, p. 26.

true sample, nor does it differentiate between the grab sample and the empirical. The meaning, however, is this: An interested person —for example, a prospector—is hardly able to resist the temptation of putting a large proportion of the best-looking material in his sample, instead of selecting average-looking material. Some men, perhaps with the best intentions, select nothing but the best material, and then persuade themselves that they have collected average samples. On the other hand, a person with a judicial temperament, if possessed of the requisite technical knowledge, and keenly interested in obtaining a true average sample—for example, a mine-manager or a battery-superintendent—may be trusted to select samples that on the whole will yield an average result, with possibly a slight error one way or the other, due to the personal equation.

The sampling of limestone and other nearly homogeneous substances does not present the same difficulty as the sampling of variable material such as auriferous quartz. In the case of limestone to be used for agricultural purposes only, the method of collecting empirical samples by chipping off average-looking fragments with hammer and chisel will give good results in the hands of an experienced person; and even an inexperienced person, by taking pains, employing common-sense, and resisting the temptation to select the best material, ought to obtain fairly representative samples. In this method of sampling the following points have to be observed:—

(1.) In the case of an unworked limestone deposit the places to be sampled ought to be selected with a view to access and convenience of working.

(2.) The limestone outcrop ought to be carefully observed, with a view to determining whether it is fairly uniform in quality from top to bottom.

(3.) If the limestone stratum is thick, and especially if the different layers show want of uniformity, it must be divided into sections of measured thickness.

(4.) The material to form the sample ought to be selected along lines at right angles to the plane of the deposit—that is, along lines that measure the thickness. Such lines will be at right angles both to strike and dip.* It is true the latter condition need not be exactly fulfilled, but the nearer one can approach to it the better.

* Sedimentary rocks generally show distinctly that they are formed of a number of layers, one superimposed on another, like the leaves of a book. Each distinct layer forms a bed or stratum (plural, "strata"). The terms "bed" and "stratum" are very often extended in meaning to include the whole mass of one kind of rock, particularly when the parting-planes between the various layers are not very distinct. "Stratification" and "bedding" are abstract nouns referring to the arrangement of rocks in strata. We speak of "horizontal stratification" when the beds lie level, "inclined stratification" when the beds are tilted or folded, and so on. "Strike" is a horizontal line drawn in an inclined bed or on a fault-plane, or it may be defined as the line of outcrop on a perfectly level surface. In practice the word "strike" generally means the direction of the horizontal line as defined above, as measured at some particular point, but it is no doubt more exact to speak of the direction of the strike. "Dip" is the inclination of a bed or fault-surface, &c., from the horizontal. The term is generally used so as to mean direction of inclination from the horizontal. The direction of dip of a stratum is always at right angles to the strike-direction.

(5.) In sampling the various sections care must be taken to select a proper proportion of each kind of material, as nearly as can be judged by the eye. Thus if the stone is partly hard and partly soft a due proportion of hard rock must be selected. If there are argillaceous, arenaceous, or greensandy layers present, a fair amount of the impure material must be taken. The inexperienced or non-judicial sampler is very apt to neglect this point.

(6.) If the outcrop is large, samples should be selected along several lines, duly divided into such sections as necessary, and spaced at equal distances from one another.

(7.) Careful notes concerning the locality of each sample, and the thickness and class of stone it represents, should be taken.

(8.) Each sample should be carefully labelled and placed with its label in a stout canvas bag, which also should be labelled or numbered.

(9.) The analyst should be given full particulars concerning the locality of the deposit, and such other information as may seem desirable or be asked for. Do not send him single lumps of stone or carelessly selected samples. Do not be so foolish as to attempt to mislead him as to the locality or nature of the deposit. Those who misinform or deceive the analyst are bound to be the losers in the long-run.

Quartering down.—In general a sample of limestone if properly taken will be too large to send by parcel-post to the analyst. It can safely be reduced in size by the method of quartering down. This consists in breaking all large pieces of stone to a small size—say, that of hazel-nuts or smaller—mixing the sample well, and piling it on a flat smooth surface in a somewhat low conical heap, which is then carefully spread out in a circle. The material is then divided into four quarters by drawing two narrow channels at right angles through the centre of the material. Two opposite quarters are then removed, and the operations of mixing, piling, spreading out, and quartering repeated. If a small sample is desired the lumps must be broken still smaller before quartering is repeated. The best procedure of all is to reduce the whole sample to a coarse powder before quartering down, but in the field this is not practicable.

Quartering down may also be employed where duplicate samples are required. The method of obtaining supposed duplicates by breaking a single lump in half, or of dividing a rough sample in two by picking out a few lumps, need only be mentioned to be condemned; yet there are frequent cases where persons have used this method, and have been surprised when the analyses of the two samples did not agree. Quite commonly the analyst is blamed for his lack of skill. If two analysts have been employed, the one who gets the lower results will get the credit of being unskilful or ignorant. As a matter of fact, an inexperienced sampler will obtain concordant duplicate samples only by accident.

Quarry sampling.—Where a quarry has been opened the facilities for sampling are generally better than in the case of ordinary outcrops. If only one or two general samples are desired the broken rock may be sampled, but usually it is better to sample the rock-faces in sections, as described above. When a rock-breaker is at work it is feasible to obtain a good average sample from the material passing through the

machine, care being taken to select proper proportions of coarse and fine. The sample, which should be large and selected at intervals, may then be broken and quartered down as described. If a fine-grinding machine forms part of the equipment, as in a limestone-pulverizing plant or cement-mill, no difficulty need be experienced in getting good average samples.

Systematic sampling.—The ideal method of securing true samples of a hard deposit is to bore it from top to bottom with a diamond drill, and save all the core. If the deposit is soft it may be bored in some other way, and all the drillings saved for analysis. Alternating hard and soft layers will prevent thoroughly representative samples of the whole being obtained by drilling methods. The usual method of sampling an exposed face of rock or mineral is to cut a uniform groove from top to bottom, and save all the cuttings. The face, if high, and especially if heterogeneous in composition, is divided into sections. An experienced sampler will alter his methods according to circumstances; but the following details, mainly quoted or paraphrased from Orton and Peppel,* illustrate the general methods of systematically sampling an outcrop or quarry-face:—

(1.) The sample should be cut from the strata in place rather than taken from the stock pile of the quarry. The latter is liable to fluctuate from hour to hour, as the product of one stratum or horizon happens to form its surface layer, as may be the case after a large shot is fired. Very often it is not possible to tell whether the pile of debris at the foot of the face is representative of the whole face or not.

(2.) The part to be cut should be first well cleaned from top to bottom by sweeping with a broom or brush.

(3.) A large canvas sheet (one 9 ft. square was used by Orton and Peppel) should be spread close under the place selected, so that the cuttings will fall and be collected on the sheet.

(4.) A groove, uniform in width (2 in. or 3 in.) and in depth (1 in., 2 in., or 3 in.), should be cut from top to bottom of the face to be sampled. The tools used may consist of a blacksmith's hammer of about 4 lb. weight, one or two cold-chisels mounted on handles, and a few heavy stone-cutters, gads, &c. It is desirable that the groove should be cut in a straight line from top to bottom of the section sampled; but if this is impracticable, then by following the edges of bedding-planes, and collecting from different strata in one small area, a full cross-section of the limestone may be obtained. When on account of the nature of the rock being sampled, or its location at great height requiring climbing and working with scant footing, a groove cannot be cut, the canvas may be removed from the foot of the face and large lumps of rock broken out of the various layers. From each of these a section of the proper size may be dressed.

Where narrow strips of shale, greensand, or other impurity occur, these should be carefully cut to the proper section, and all the cut material allowed to drop on the sampling-sheet. If the impure bands are wide it is better in some cases to sample them separately. The width, of course, must be carefully measured.

* Orton, Edward, and Peppel, S. V.: *loc. cit.*, pp. 27, 28.

(5.) All the cuttings should be saved on the sheet, but pieces of stone known to be accidentally dislodged from points adjacent to the groove should be rejected.

(6.) The total weight of the sample may range from 5 lb. to 150 lb. In special cases it may be greater. Apparently Orton and Peppel, as a rule, took only one sample of a high quarry-face. It would be better in many cases to divide the face into measured sections and take several samples.

(7.) Every sample should be labelled plainly and legibly with a number and other particulars inside and outside of the sack in which it is placed. The inside number may be written or cut on a piece of soft wood and then wrapped in cloth. Whatever the method, care should be taken that the marking cannot be obliterated or the label lost.

(8.) If the sample is taken from a stock pile, bins, rock-breaker, or any unusual source, all the circumstances should be noted.

(9.) Every detail of the sampling and every observation of the material sampled should be noted at the time the sample is taken. The entries in the notebook used should be clearly worded and legibly written. Abbreviations should be sparingly used.

Orton and Peppel give further details, which need not be quoted, of how the main sample, by crushing and quartering, is reduced to the small sample of about ½ lb. weight used by the analyst for his work.

As previously stated, for agricultural purposes limestone need not be sampled in quite so elaborate a manner as that just described, but for some industries sampling of that kind is very necessary. In reconnaissance work and in general geological survey it is usually impracticable to take samples by the method of cutting a continuous groove. Provided the geologist or other explorer has experience, skill, and a knowledge of the general principles of sampling, he can without much difficulty select empirical samples that are representative of the locality sampled; but during the preliminary examinations it is generally not feasible to take all the samples that may be required for a thorough knowledge of the deposit, the expense and time involved in such work being usually prohibitive. It may be added that where a deposit is being worked on a large scale, and small variations in quality do not matter, numerous empirical samples may safely take the place of a smaller number of systematic samples.

Sunshine for Young Pigs.—Sunlight is indispensable for the health and vigour of newly born pigs, except in extremely hot weather. The sooner they get the sunshine the better it is for them, and farrowing-houses fitted with windows and doors to let in the sunshine are decidedly advantageous. As soon as the little pigs are strong enough to run around and follow the sow they may be let outdoors into the sunshine, provided the weather is favourable. They should be able to do this within three days to a week. Sunlight and exercise make strong pigs in the early stages of their life.—*K. W. Gorringe, Instructor in Swine Husbandry.*

NATURAL COOL-AIR FRUIT-STORAGE.

SOME AMERICAN SYSTEMS.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

NATURAL cool-air storage (as distinguished from mechanical refrigeration) is very largely utilized in many parts of the United States of America, and although the systems vary somewhat the difference is not very great in the more recently constructed houses. The object sought in each case is, of course, to reduce the temperature of the house by admitting air when the atmosphere outside the house is colder than the air within, and to maintain for a maximum length of time the low temperature thereby secured.

To attain these results satisfactorily an ample free air-circulation must be available, and the walls, ceiling, and roof of the building must be specially constructed. In southern California the earlier citrus storage was built on the partial basement plan—that is, the floor of the house was some 4 ft. or 5 ft. below the ground-level. The building itself was practically a house within a house, some 6 in. to 12 in. space being left between the two walls, and similarly with the roof. A number of fairly wide doors set opposite each other in each set of walls provided the bottom ventilation, while the top ventilation was through an opening along the ridge of the roof. Such houses were and are still giving great satisfaction in the curing of lemons and the storage of citrus fruits.

The more recently constructed houses, however, are on a somewhat different plan. Underground ventilation by means of concrete tunnels is provided. In this case top ventilation is provided, but it is not so important, as the object of the tunnels is to provide a means whereby the whole of the air in a room may be drawn off by fans and replaced with fresh cold air in a comparatively short time.

The general plan adopted, however, for the storage of deciduous fruits is either the hollow or the insulated wall, with or without a basement. In the Yakima and Wenatchee districts the hollow wall with basement is the common method, while in Spokane the basement has been dispensed with, and the walls are insulated. The objection made to the basement lies in the added difficulties of ventilation, while it is claimed that any advantage gained by having the building partially underground is covered by insulating the walls.

The following description covers a two-story building with insulated walls and without basement :—

Foundation : Outer foundation solid concrete, 2 ft. to 2 ft. 5 in. high. Inner foundation concrete blocks 6 in. high and 1 ft. square, set in every 10 ft. with wooden blocks sufficient to bring the inner foundations on a level with the outer.

Floor : 10 in. by 2 in. floor-joists are set on the foundation, and the floor, which is 3 ft. to 3 ft. 6 in. above the ground, is made of 4 in. by 2 in. timber with a ½ in. space between each board. The joists are set in across the building. It is held that the floor would be better if it were made the height of the bottom of a fruit-wagon.

Bottom ventilation: The ventilators are 1 ft. 6 in. by 3 ft., and are constructed on the plan of a cold-storage door. They are set in lengthwise in the outer foundations, 14 ft. 6 in. from centre to centre.

Walls: Studs 8 in. by 2 in. These are boarded on the inside with what is in America termed "shiplap"; ordinary lining-boards would do. The same material is put on the outside, and the space between rammed firmly with shavings and sawdust. Next comes a covering of building-paper, and then the weatherboarding.

Roof: 4 in. by 2 in. rafters are used for the roof. These are lined above and below with the shiplap and covered with ruberoid or similar material. The space between is filled with shavings and sawdust. If it is desired to make two separate storerooms the ceiling should be insulated in the same manner as the roof. In the house being described, however, the upper floor did not come within 8 ft. of either wall, owing to the slope of the roof, and the whole of the building was held at the same temperature.

Upper ventilation: If the upper and lower rooms are not held for separate storage, louvre ventilators set in the apex of the roof are sufficient. These are about 3 ft. wide, and are so arranged as to provide approximately the same outlet as the intake provided by the bottom ventilators; but in arranging it is necessary that one should be set in at either end of the chamber and one in the centre. The upper ventilators are fitted with trap-doors that can be readily let down when required.

In the case of two separate chambers being run, two sets of bottom ventilators must be provided. The second set is in the outer walls immediately above the second floor. Separate upper ventilation must also be provided, so that the hot air from the chamber below may be carried off without contaminating that of the upper one. This is done by cutting a 1 ft. 6 in. by 3 ft. (or larger) hole in the ceiling at either end of the building, and boxing it in with timber, making a kind of flue up to an opening in the apex of the roof. This is also done in the centre as frequently as circumstances make it necessary, according to the size of the building.

Two separate chambers are rarely run other than in basement buildings. In this case bottom ventilation must be dealt with in much the same way, boxing being provided inside the chamber to carry the cold air, coming through the ventilator, down under the floor. Each ventilator must be treated in the same way. All other matters pertaining to a basement store are the same as those already described. Ventilators in the foundation must be set in opposite each other.

The hollow walls referred to are mainly constructed of hollow tiles, but some are on the system described minus the insulation. In this case, however, a further dead-air space is recommended, and is provided by putting 3 in. by 2 in. timber outside the building-paper, covering the wall again with lining and a further coat of building-paper, then finishing off with weatherboarding.

Although natural cool-air storage is, as previously stated, very popular in the United States, it is doubtful whether the same success would obtain under the milder climatic conditions of New Zealand. In the north-west States particularly the summer is very hot, but the season is short, and well before the apple crop is harvested the nights become cold and more or less frosty, thus simplifying the question of reducing the temperature in the store by means of night ventilation.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

ESMOND ATKINSON, Biological Laboratory.

PERENNIAL SOW-THISTLE (*SONCHUS ARVENSIS*).

THERE are many plants among those naturalized in New Zealand which in their native countries are of little importance, but which have become aggressive here; while, on the other hand, several plants known elsewhere as most objectionable weeds, though they have been observed in the Dominion for a number of years, have not hitherto proved particularly dangerous in this country. Among these may be mentioned the subject of this article, perennial sow-thistle (*Sonchus arvensis*), which is also known by the names corn sow-thistle and creeping sow-thistle.

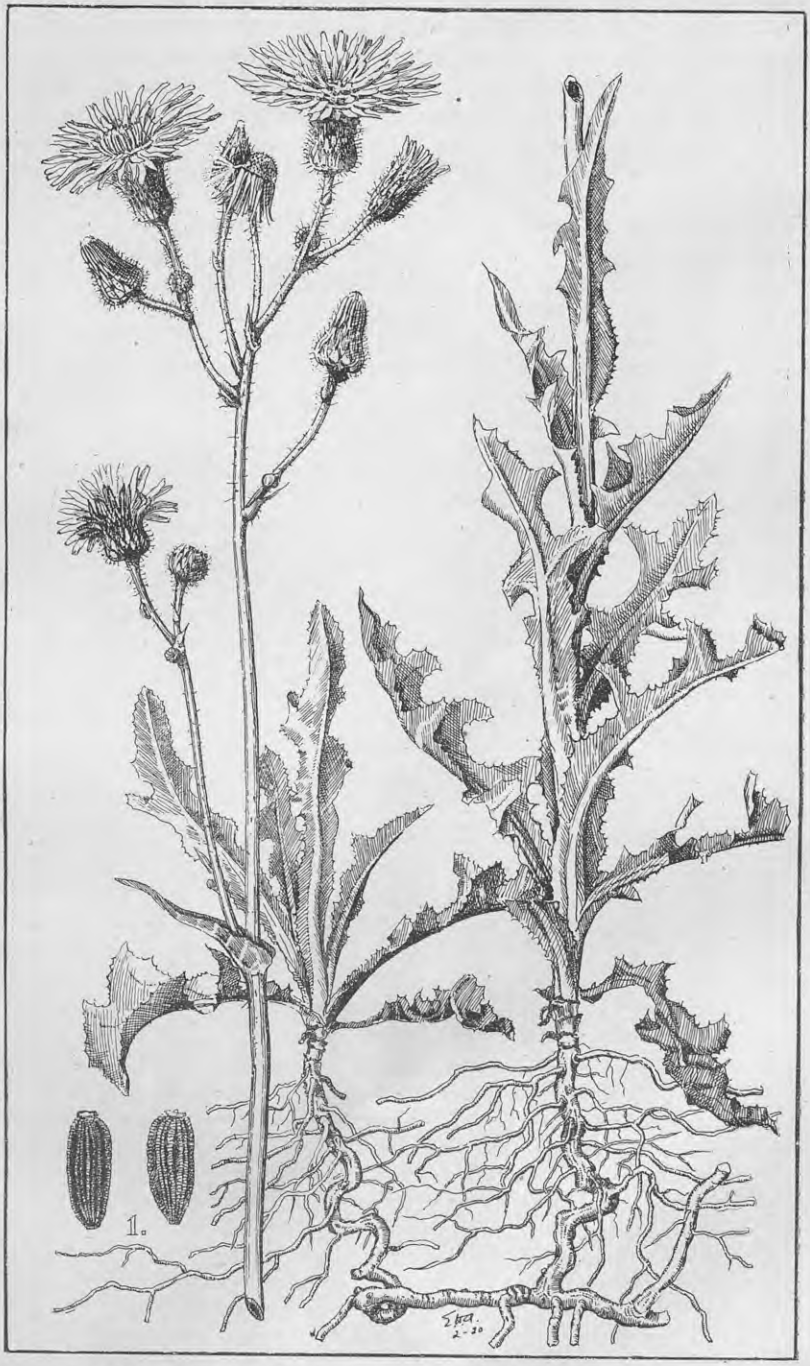
Perennial sow-thistle is a bad weed in England and in many parts of Europe (its native habitat), and in parts of Canada it is looked upon as the worst of all weed pests. While it does not follow from this that perennial sow-thistle may ever reach a position of first importance among weeds in New Zealand, it is already extremely troublesome under certain conditions.

As regards distribution in the Dominion, perennial sow-thistle was first recorded from Auckland many years ago, and has since been noted in several parts of the Manawatu district, and in Canterbury and Southland. Beyond these broad facts not much is known of its distribution, and further details on this point would be welcome.

DESCRIPTION.

Perennial sow-thistle is a tall plant, reaching the height of 3 ft. or 4 ft. It is, as a rule, much more slender than either of the two common sow-thistles (*Sonchus oleraceus* and *S. asper*), and the stem is only slightly branched; but it is in the root-system that the greatest difference is to be seen, for in the species now under consideration there is a thick wide-spreading horizontal rootstock which throws up leafy shoots at frequent intervals. In general appearance this root-system is not unlike that of Californian thistle, but it differs in being shallower, the horizontal rootstock often being not more than 4 in. or so below the surface of the soil. The whole plant is full of a bitter milky juice.

The leaves are crowded round the lower part of the stem, but become fewer towards its top, so that the part below the flower-heads is practically leafless. The root-leaves are the largest, being 6 in. or more in length; they are frequently less deeply lobed than the lower stem-leaves, but otherwise resemble them closely. The lobes of all the leaves are irregularly placed, often much twisted, and as a rule their tips tend to point towards the base of the leaf. The lower leaves,



PERENNIAL SOW-THISTLE (SONCHUS ARVENSIS), HALF NATURAL SIZE.

1. Achenes, or "seeds," magnified about 6 diameters.

in addition to the large indentations, have their margins toothed with small soft spines, but this character is absent from the upper leaves.

The flower-heads are borne in a loose spreading cluster at the top of the stem; in large specimens, or in those in which the top has been cut off, long stalks bearing smaller clusters of heads often arise from the axils of the upper leaves. The heads themselves are quite different in appearance from those of the common sow-thistles; they are far larger (up to 2 in. in diameter) and brighter yellow in colour, and have much the look of heads of dandelion or catsear.

The involucre (the ring of green bracts from which the yellow rays spring) varies in shape according to the age of the head; in the bud it is rounded with a flattened top, in the mature flower-head more or less cylindrical, and in the young fruiting-stage conical. As the fruit ripens and the feathery pappus spreads out the involucral bracts become reflexed and lie back against the stalk. All these stages are shown in the illustration. In the common New Zealand form of the plant the involucres and the stalks below them are covered with light-coloured glandular hairs—that is, hairs provided at their tips with minute knobs which secrete a sticky susbtance. There is, however, another form of the plant in which no hairs whatever are found.

The achenes, or "seeds," average about $\frac{1}{11}$ in. in length by $\frac{1}{32}$ in. in breadth, and are of a dull dark-reddish-brown colour. In shape they are roughly oblong and slightly flattened, and at one end bear a light-coloured crown, which marks the point of attachment of the pappus. The achenes are longitudinally marked with strong ridges, one on each edge and five on each side, the middle ridge and those at the sides being the most prominent, while in addition the whole surface is covered with deep transverse wrinkles.

SIGNIFICANCE AS A WEED, AND CONTROL METHODS.

In New Zealand perennial sow-thistle is harmful only as a weed of cultivated land, where its strongly developed root-system and its large production of seed render it very aggressive. The ordinary processes of cultivation, unless they are merely preliminaries to further control work, will only have the effect of breaking up the rootstocks into pieces and, since a small piece is capable of producing a new plant, of further distributing the weed.

I am indebted to Mr. J. Beverley, Plant-breeder, Central Development Farm, Weraroa, for an account of some experiments carried out by him with a smothering-crop of Weraroa vetchling, a species of *Lathyrus*, closely allied to the Tangier pea (*L. tingitanus*). Part of an area occupied by the sow-thistle was sown down on 7th May, 1919, with the vetchling, which came away well and made a fine growth, and when on 24th January last it was harvested for seed there was no sign of the weed on the surface. One small plant has since appeared, but there is no doubt that in the main the use of the smothering-crop has been effective. Another part of the same thistle-infested area was laid down in grass in 1917, and, except for a few scattered plants none of which are more than 1 ft. from the edge, all trace of the weed has disappeared. Sheep will eat perennial sow-thistle readily, and this fact, together with the results of the smothering-

crop and grassing experiments referred to, which indicate that a well-aerated soil is essential to the plant, shows that as a weed of pastures it is negligible, and that there is no danger of it spreading from cultivated land to land where there is a good sole of grass.

Perennial sow-thistle is thus an excellent example of a plant which under a certain set of agricultural conditions may be a most serious pest, while under different conditions, in places perhaps only a few yards away, it may disappear entirely from the ranks of weeds. An intelligent study of its behaviour under these different conditions should go far to disabuse those people who consider that the significance of any particular plant as a weed is one of its intrinsic characters instead of one which is supplied by environment. This is the fundamental fact on which all efforts at weed-control should be based (though this is far from being the case in practice), and if it were thoroughly realized no weed-control legislation would really be required.

The control methods against perennial sow-thistle where cultivated land has become badly infested may be summed up as follows, two courses being open: (1) The land should be laid down in grass; or, (2) where this is impracticable, some smothering-crop, such as that mentioned, or tares and oats, should be used, if necessary for two years in succession. The planting of potatoes, which are so often looked upon as a good cleaning-crop, is not to be recommended, as the aeration which they give the soil allows the underground stems of the thistle to last through the season.

The achenes of perennial sow-thistle are occasionally found as impurities in commercial lines of seeds, particularly in imported alsike and timothy, but they are of much rarer occurrence than those of the two annual sow-thistles.

Qualities of a Herd Boar.—The qualities and characteristics of a herd boar are matters of the greatest importance. Every pig-breeder should know and have fixed in his mind just what qualifications to require in the animal that is to head his herd. A sow directly affects only the pigs she farrows, while the boar affects every litter in the herd. The most important qualities required in a boar are: Good, big bone; well grown; a long, wide, deep body; a level back, with short neck and head; a wide, deep, roomy chest, low hams, short legs, and standing well on his feet; fairly large ears, wide between eyes, good colour, fine hair, good action, gentle disposition, yet showing strong masculine qualities and vigour; from a good family which is prepotent, prolific, and has quick feeding-qualities. If the sows are weak in certain qualities it is well that the boar be strong in those qualities. The breeder should always keep in mind an ideal of the best type of conformation, and try to improve his herd by mating such animals as will come nearest to bringing about that ideal. Remember that it is the best cuts and the highest quality of dressed pork or bacon that is the ultimate object, and not points of the show-ring.—*K. W. Gorringe, Instructor in Swine Husbandry.*

RADIO-ACTIVE FERTILIZERS AND PLANT-GROWTH.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE influence of radio-active ores applied as fertilizers is now attracting some attention in the northern part of the Dominion, owing to the claims of some fertilizer-vendors in attributing radio-active properties to their products. It may therefore be of interest to review investigations which have been conducted on this subject in England and other countries. In the December, 1915, issue of the *Agricultural Gazette of New South Wales* the following notes appeared :—

For some little time past the question of applying radio-active ores to the soil with a view to increasing plant-production has been receiving considerable attention in England. Among the experimenters in this direction is Mr. Martin H. F. Sutton, of Reading, who last year carried out a series of tests. These have been continued during the current year, and in September last a large party of scientists and others inspected the results of the second year's work. The visitors were impressed with the complete character of the investigation, and the provision made against error. The results examined were even more emphatic than those of 1914, in showing that "while in some cases plants dressed with radio-active ore had given better results than the control plants, the improvement had not been of such a nature as to warrant the assumption that so expensive a commodity as radium could be profitably applied to crops."

A series of field trials was also conducted at the University of Illinois during the seasons 1913–14, with the object of testing the effects of radio-active fertilizers as crop stimulants. The conclusion arrived at was that as long as the present prices prevail the use of radium fertilizers cannot prove an economic possibility.

Mr. Sutton's investigations are again referred to in the November, 1916, issue of the same publication, as follows :—

In 1914 the crops experimented on were radishes, lettuces, peas, and flowering annuals, and germination tests were made on seeds of rape, red clover, and smooth-stalked meadow-grass. The objects of the experiments were to ascertain—(1) Whether radio-activity has a harmful or beneficial effect upon plant-life ; (2) whether, if beneficial, strong or weak dressings of radio-active ore should be employed ; (3) whether radio-active material can be used with advantage to accelerate germination.

The general conclusion arrived at from these experiments was that they afforded some evidence that radium possesses the property of developing and increasing growth, but the cost of the ore far outweighed the worth of the additional crop. The experiments indicate that a light dressing is likely to give as good results as a heavy one. The germinating tests were not always consistent, but tests made with radio-active ore did not generally prove superior to the controls in which no radio-active material was used.

The experiments were continued in 1915 on tomatoes, potatoes, radishes, lettuces, onions, carrots, vegetable marrows, spinach, and beets—crops selected because of the widely varying character of the produce—fruit, roots, foliage, and bulbs. Nine different radio-active materials were tested, including pure radium bromide, pitch-blende concentrates, ores, mine residues, radio-active sands, and proprietary fertilizers said to be radio-active.

Experiments were also carried out to test the effect of radio-active material on the germination of seeds.

The general conclusions arrived at by Mr. Sutton are that the experiments indicate no more hope of the successful employment of radium as an aid to either horticulture or agriculture than did the trials carried out in 1914.

A great number of experiments have been conducted in different countries on various crops, and, so far as is ascertainable, wherever the experiments have been carried out under strict and comparable conditions the use of radio-active material has produced only negative results. Of local interest are the results of Victorian experiments. Dr. Ewart, of Melbourne University, as the result of experiments carried out on wheat (Journal Dept. Agric., Victoria, Vol. x, p. 417, 1912), concludes that "there is nothing in these results to show that radio-active mineral is of the least benefit to wheat when applied in the same manner as manure."

The Bureau of Soils, Washington (Bulletin of the U.S. Department of Agriculture, No. 149, by W. H. Ross), summarizes a number of such experiments from the United States, England, France, and Victoria on a variety of crops, all pointing to the same conclusion. Mr. Ross comes to the conclusion, among others, that it seems incredible that radium or any of its products can have any economical application as a fertilizer in general farming. He also points out that the average radium-content in an acre-foot of soil is about 3·6 milligrammes. The radium present in 1 ton of radio-active mineral containing 2 per cent. uranium oxide amounts to 5 milligrammes. So that in order to double the amount of radium in an acre-foot of soil there would be required about three-quarters of a ton of such ore, costing about £16 per ton.

In England, Mr. Sutton's investigations were followed up by trials at the Woburn Experimental Station. The following table is extracted from page 19 of the "Report of Pot Culture Experiments, Woburn Experimental Station," 1917 :—

Table XIII.—Radio-active Ore on Wheat, 1916.

—	Average Length of Ear.	Average Length of Straw.	Percentage Weight.	
			Corn.	Straw.
	In.	In.		
No treatment	2·77	25·11	100	100
Radio-active ore 5 cwt. per acre ..	2·55	24·76	92·5	93·1
Radio-active ore 10 cwt. per acre..	2·45	22·17	94·6	91·3
Radio-active ore 1 ton per acre ..	2·45	22·61	93·2	92·4

It would not appear, therefore, from this experiment that there was any advantage whatever accruing in the yield of wheat from the application of the ore.

Montane Tussock-grassland Investigation: A Correction.—On page 90 of last month's *Journal* barley-grass (*Hordeum murinum*) was included in a list of species noted in the experimental tree-planting area on the Sugarloaf, near Lowburn. This was a slip for soft brome-grass (*Bromus hordeaceus*).

Hemp-grading.—A grading-store for the examination of hemp, tow, and stripper-slips has been established at Wairoa, Hawke's Bay, in the premises occupied by the New Zealand Shipping Company.

HERD-TESTING ASSOCIATIONS.

THE PART OF THE DAIRY DIVISION.

W. M. SINGLETON, Assistant Director, Dairy Division.

THE testing of dairy herds for production is increasing in popularity, and as a result more of this work has been undertaken by the Dairy Division during the present season than hitherto has been the case. The work is additional to that done by dairy companies who employ private testing officers either at a wage or at a definite rate per cow. When associations are large enough to afford sufficient employment for a testing officer to devote his full time to this work, or where a testing officer can test for two or more smaller associations, the work in the majority of cases is being carried on satisfactorily. Unfortunately, not all companies have sufficient cow-testing offering to keep a testing officer fully occupied; neither is it always convenient, because of the distance between dairying centres, to increase the number of associations under such officer's control. Doubtless, however, there are districts where proper organization would remove the difficulty.

Some of the dairy companies have asked the Dairy Division to appoint testing officers at the company's expense. In a few instances this was done, although later developments modified the financial arrangements and also the status of the officer, whereby he was asked to do some instruction work amongst the milk-suppliers as well as to take control of the cow-testing association. By providing less experienced assistance for some of the detail work connected with the testing the official is given an opportunity for more outside work. This method appears to be working very satisfactorily indeed. Moreover, it enables the dairy company to get most value from the official's time.

In other instances the organization of cow-testing associations has been accomplished by energetic and enthusiastic factory-managers. They, in various companies, have secured sufficient support for a moderate-sized association and undertaken the testing and figuring. Such work, however, usually takes up too much of a manager's time, so that in some instances it has been found difficult, and even impossible, to continue this praiseworthy enterprise.

The extension of the testing of purebred dairy cows by the Dairy Division has each year necessitated the appointment of additional testing officers. There are now some seventeen officers engaged in this work, and the increased demand for the testing has brought them into districts which previously were not regularly visited. This being so, the Division has had an opportunity of coming to the rescue of a number of cow-testing associations that would otherwise have become defunct. A number of these are included in the list of twenty-seven associations for which Dairy Division officers are this season testing and figuring returns. In addition to sustaining associations which could not have otherwise survived, new ground has been broken and the testing carried into other districts. Having received departmental approval for the extension of the testing work on this system—under which the dairy company guarantees the Department the testing-fee of two shillings per

cow and grants the free use of its testing room and appliances—many testing officers of the Division have evidenced a praiseworthy keenness in getting new associations under way.

The association testing of grade and crossbred cows as found in our dairy herds, and the C.O.R. testing of purebred dairy cows, are mutually complementary. The association testing awakens an interest in better breeding on the part of the dairyman, while the testing of purebreds indicates the producing-strains and affords information to the dairyman regarding the producing factors behind purebred bulls which may be available for purchase. In addition to this, the testing of purebreds assists breeders materially in formulating their breeding plans.

We hope to see the association testing become a stronger factor each year in the improvement of our dairy herds. This work is in direct line with an increase in the production of primary products which economists assure us is the key to relieving the present stringency. By producing more milk and butterfat we shall, after providing for the local population, have an increased surplus available for export. At present prices this increase will be more effective in bringing financial credit to New Zealand than would have been the case from an equal surplus in the past.

An example of summarized figures for the testing associations now operated by Dairy Division officers may be interesting to *Journal* readers. The results of the tests for the thirty-day period ending in December, 1919, were as follows :—

Associa.ion.	Association Average.			Highest Herd-average.			Lowest Herd-average.		
	Milk.	Test.	Fat.	Milk.	Test.	Fat.	Milk.	Test.	Fat.
	lb.	%	lb.	lb.	%	lb.	lb.	%	lb.
1	1,099	3·7	40·76	1,168	5·0	58·23	944	3·5	33·29
2	974	3·6	35·07	1,175	3·8	45·23	744	3·5	26·34
3	880	3·5	31·58	1,115	4·2	47·77	595	3·4	20·51
4	920	3·4	31·69	1,240	3·4	42·38	626	3·4	21·52
5	890	4·0	36·68	1,123	4·2	47·55	679	3·8	25·80
6	874	4·3	36·69	893	4·7	41·53	747	4·3	31·87
7	797	3·9	31·77	923	5·1	47·46	645	3·5	22·59
8	828	4·3	35·70	885	6·1	54·19	492	3·8	18·60
9	816	4·3	35·26	905	5·3	48·26	662	4·2	28·09
10	908	4·0	37·10	961	4·2	40·49	824	4·2	34·26
11	874	3·9	34·44	900	4·7	42·68	606	4·3	26·12
12	986	4·1	40·85	1,290	3·8	49·19	866	3·9	33·37
13	621	4·0	25·19	651	4·9	32·17	498	3·5	17·45
14	862	4·3	37·08	1,062	4·3	45·56	836	3·7	30·70
15	924	4·2	38·80	980	4·7	46·50	836	3·8	31·46
16	823	4·1	34·01	1,023	4·0	41·37	711	3·5	24·81
17	860	3·9	34·14	916	4·5	41·79	635	3·9	25·24
18	906	4·3	38·99	1,340	3·6	47·71	730	3·7	27·15
19	904	4·0	36·99	1,038	4·5	46·27	715	4·0	28·95
20	973	4·0	39·34	1,187	4·2	50·13	925	3·5	32·34
21	929	4·3	39·94	970	5·0	48·91	860	3·7	32·13
22	964	4·2	40·63	1,237	4·5	56·02	941	3·6	34·18
23	874	4·2	36·53	1,170	4·6	53·98	612	4·1	25·52
24	890	3·9	34·72	1,070	4·2	44·07	643	3·7	23·62
25	612	3·8	23·58	1,155	3·9	45·29	362	3·6	13·36
26	771	4·4	33·89	901	4·9	44·17	624	3·5	21·82
27	842	4·2	35·26	1,157	4·9	57·24	655	3·7	24·20

Average of all associations : 874 lb. milk, 4·1 test, 35·43 lb. fat.

CONTROL OF RED MITE ON APPLE-TREES.

TESTS AT PAPANUI EXPERIMENTAL ORCHARD.

G. STRATFORD, Orchard Instructor, Christchurch.

A SERIES of experiments for the control of red mite was initiated at the Papanui Experimental Orchard early this season, using various brands of red oil and lime-sulphur. The orchard is an old one, with trees ranging from twelve to twenty-five years, and suitable in every way for the experiments. The trees were excellent subjects to work on, being badly infected with red mite, and it could hardly be expected to entirely eliminate the pest in one season. On the whole the experiments have been very successful, and the mite has been reduced to a minimum. A power sprayer was used throughout, a constant pressure of from 200 lb. to 250 lb. being maintained. Careful observations were made before and after the sprayings, and the data collected afford much useful information to the fruitgrowers of the district.

OIL-SPRAYING.

The brands of red oil used for the tests were "Orchard," "Dial," "Gargoyle," and "Federation." All brands were applied at a strength of 1–8, on 20th August, 1919. The varieties sprayed were Sturmer, Ribston Pippin, Adams Pearmain, Jonathan, and Rokewood. The mite was very prevalent on all these trees when spraying was done. Live mite was first noticed on the unsprayed trees on 16th October. The following are notes of the operations and results with each brand of oil used:—

Orchard Brand: One row of eighteen Sturmers and one row of mixed apples. Mite very bad. Examined on 10th October and 20th November. Spraying had apparently destroyed the great majority of the eggs; very few hatched out. Examined again on 12th December, and finally on 12th January. Trees practically free from mite. This brand of oil does not show on trees so well as other brands, but appears effective.

Dial: One row of eighteen Sturmers and one row of mixed apples and plums. Mite very prevalent, especially on Sturmers. Spray did its work well, and appeared to have destroyed the majority of eggs when examined on 20th November. Trees examined again in December, and finally on 12th January. Results very good, practically no mite being visible.

Gargoyle: One row of Sturmer and Ribston Pippin. Mite bad. When examined on 20th November there appeared to be quite a number of mites not destroyed. Examined again in December and January. Results very satisfactory, but not quite so good as with other brands.

Federation: One row of Sturmer. Trees very bad with mite when spraying was done. Examined on 10th October and 12th December, and finally 12th January. Results very good, trees being practically

free from mite. This oil did not emulsify as readily as other oils, but showed up well on the trees and appeared to last for a long time.

LIME-SULPHUR SOLUTION.

Further experiments were carried out, using lime-sulphur at different strengths at different periods. The following notes indicate the practice followed and the results :—

(1.) One row of Lord Wolseley sprayed on 18th September at strength of 1–6, at bud-movement. Trees about the worst in the orchard for mite. Examined 10th October. Much evidence of mite on trees apparently not affected by spray. Sprayed again on 14th October, 1–25, at open cluster-bud. Slight burning of tips of foliage, but not sufficient to do any damage. Mite still noticeable. Sprayed again on 15th November, with 1–80, at formation of fruit. No injury to fruit or foliage. Examined 21st November. Practically no mite visible. Further examinations in December and January. Results excellent considering state of trees when first sprayed.

(2.) One row of Lord Wolseley sprayed on 18th September, 1–6, at bud-movement. Sprayed again 14th October, 1–25, at cluster-bud. Results from these trees were practically the same as No. 1. On 15th November trees were sprayed, 1–100, at formation of fruit, as against 1–80 in No. 1. This strength appeared to give as good results as 1–80, and the trees were practically free from mite when examined on 21st November. Further examinations in December and January confirmed this.

(3.) One row of Rokewood sprayed on 23rd September, 1–25, at cluster-bud, the bud-movement spraying being omitted. No dormant dressing was given. This spray burnt the tips of the foliage slightly, and when examined on 9th October the eggs of the mite appeared sound. Live mite was noticed on 16th October, and on 29th October mite was bad. Sprayed, 1–100, 8th November, mite being prevalent at time of spraying. Mite checked considerably, and trees appeared as good as others when examined on 21st November. Examined again in December and January, when trees were found practically clean.

(4.) One row of Sturmer sprayed 6th August, 1–6, at bud-movement, and again 1–25 on 10th October, at cluster-bud. The fruit-formation spray was omitted so that comparisons could be made with other trees. When examined on 21st November red mite was bad. These trees were left as long as possible in order to watch results, but as the mite was on the increase a spraying at 1–80 was given early in December. On examination in January live mite was found, although not bad.

CONCLUSIONS.

As previously stated, the trees experimented with were very bad with mite. Considering this, all the brands of red oil used were very successful in the destruction of the winter eggs, reducing them to a minimum, so that very few hatched out. There was very little distinction between the different brands used, and no damage was done by any of the oils. From these experiments it appears that a delayed spraying, using the oil at strength 1–8, as late as possible, will do much to control red mite when in the egg stage.

Where lime-sulphur was used the 1–6 and 1–25 sprays appeared to have very little effect on the eggs, which presented a healthy appearance some days afterwards—in fact, these sprays did not prevent the hatching of the eggs. The lime-sulphur sprays at 1–80 and 1–100, at fruit-formation period, were most successful, clearing up the newly hatched mite to a remarkable degree. This was very noticeable on the row of trees sprayed at 1–6 and 1–25 only, the fruit-formation spray of 1–80 being omitted. Spraying at 1–80 was delayed as long as possible on these trees, but on examination it was found necessary to apply it early in December. At the final examination in January mite was found on these trees, as well as many summer eggs. From the experiments it appears that lime-sulphur at strength 1–80 to 1–100, used at the fruit-formation period, when the mite is on the move, is a most valuable spray.

CO-OPERATIVE FRUIT-VARIETY TESTING.

TASMAN AND LOWER MOUTERE AREAS.

W. T. GOODWIN and W. C. HYDE, Orchard Instructors.

TASMAN AREA.

THE purpose for which co-operative fruit-testing plots were initiated was indicated in an interim report concerning the area established on Mr. A. McKee's property, at Tasman, Moutere Hills, Nelson, published in the *Journal* for May, 1917. The term of seven years for which this experiment was undertaken has now expired, and the full management of the area has been taken over by the owner. In publishing a summary of the results of the trials it must be clearly understood that the conclusions are based on a seven-years test.

Apples.

The varieties that have made good growth and are cropping well are as follows: American Golden Pippin, American Summer Pearmain, Ballarat, Buncombe, Cox's Orange Pippin, Crisp's Russet, Delicious, Duke of Clarence, Dunn's Favourite, Early Joe, Golden Pearmain, Gravenstein, Gravenstein Rouge, Jonathan, King David, Lady Carrington, Liveland Raspberry, Parlin's Beauty, Pomme de Neige, Reinette du Canada, Rhodes Orange, Ruby Gem, Rymer, Salome, Scarlet Pearmain, Senator, Shiawassee Beauty, Shorland Queen, Statesman, Stayman's Winesap, Sturmer, Wagner, White Winter Pearmain, Willie Sharp.

While all these varieties grow well in the locality, it is not to be assumed that they are all recommended for planting for commercial purposes. Many considerations have to be taken into account before undertaking extensive planting on commercial lines, such as the quality of the variety, its marketable value, and keeping and carrying qualities. Most of the well-known popular standard varieties do well in the locality, and in the test area there were no other varieties with outstanding merits that are likely to displace them.

The following varieties, which also did well on the plot (good growth of trees with very fair crops), proved to be of inferior quality, and for that reason cannot be recommended for planting in the locality: Ben Davis, Coldstream Guard, Dillington Beauty, Dumelow's Seedling, Edward Lippiatt, England's Glory, Gascoigne's Scarlet, Loy, Mona Hay, The Queen, Thomas Rivers, Welcome, William Anderson.

Calville Blanche D'Hiver, Surecrop, and Wright's Perfection did not do well on the plot and may be classed as poor doers for the locality.

The following, up to the present, have proved exceedingly light croppers: Allsopp's Beauty, Barry, Champion, Cliff's Seedling, Climax, Cornish Aromatic, D'Arcy's Spice, Lane's Prince Albert, Late Gravenstein, Marshall's Red, Wealthy, Winterstein.

Cleopatra, a well-known variety, does not do well in this locality, owing to its excessive susceptibility to powdery mildew and black-spot. Golden Reinette and King of Tompkins County failed to prove suitable owing to the attacks of woolly aphis, to which they were extremely susceptible. King Edward VII and Taupaki failed for a similar reason in regard to bitter-pit.

The following varieties were grown on the area with inconclusive results, and are recommended for further testing: Alfriston, London Pippin, Lord Wolseley, Yates, Esopus Spitzenberg, Foster, Newtown Pippin.

Pears.

The following varieties proved good croppers, and have done well in the locality: Beurre Bosc, Beurre Clairgeau, Beurre Capiaumont, Doyenne du Comice, Durondeau, Glou Morceau, Harrington's Victoria, Howell, Huyshe's Victoria, Keiffer, Koonce, Madame Cole, Madame Lang, Marie Louise, Triomphe de Vienne, Vicar of Winkfield, Wilder, Winter Bartlett.

Other varieties that cannot be recommended for planting on this class of land are: Bazi Mai, Josephine de Malines, and Jargonelle. The latter, although a vigorous tree and doing well, has no commercial value.

L'Inconnue, Flemish Beauty, and Le Lectier are recommended for further testing.

Stone-fruits.

Stone-fruits were also tested on the area, but owing to several causes the results are somewhat indifferent.

Apricots that promise fairly well are: Campbellfield Seedling, Heemskirk, Pineapple, Shipley, and Warwick. Heemskirk and Shipley made the best record both in the way of growth and bearing-capacity.

Varieties of plums that have done exceedingly well are: Denyer's Victoria, Evans's Early, Golden Gage, Green Gage, and Pond's Seedling.

Cherries that have done well are: Bedford, Prolific, Black Eagle, Black Tartarian, Centennial, Florence, May Duke, St. Marguerite, and Werder's Early Black. Of these Centennial and May Duke are outstanding.

LOWER MOUTERE AREA.

This area is in the orchard property of Mr. C. H. Mackay, and the seven-years term of the test has also expired. An interim report was published in the *Journal* for September, 1917.

The test has demonstrated that practically all varieties worth growing will do well in this locality. The test was mostly confined to varieties that are not generally grown in the district. Those varieties which have proved their adaptability to the locality, including such standard varieties as Sturmer, Jonathan, and Dunn's Favourite, were grown in neighbouring orchards, and were not included in the area under trial.

Apples.

The undernoted varieties did particularly well, both in growing and bearing capabilities: Alfriston, Beauty of Bath, Ballarat, Claygate Pearmain, Delicious, Dillington Beauty, Dougherty, Duke of Clarence, Granny Smith, Gravenstein, Ribston Pippin, Scarlet Pearmain, Senator, Stark, Worcester Pearmain, Yates.

The remarks made regarding the varieties tested at Tasman also apply to the foregoing list when the matter of considering extensive planting is under consideration. The main object of the experiment was to ascertain the adaptability of the varieties to the district.

The following varieties proved unsuitable, chiefly for the reasons stated: Baldwin—vigorous growth, but too light in bearing-quality; Dumelow—good doer, but fruit of very poor quality; French Crab—very susceptible to powdery mildew and woolly aphis; Loy—poor doer and light bearer, fruit of very inferior quality; Welcome—tree a good doer, fruit very small and grows in clusters, no commercial possibilities; William Anderson—good doer, but fruit of inferior quality.

Pears.

The following well-known commercial varieties of pears did very well and maintained their reputation: Beurre de Capiaumont, Conference, Doyenne du Comice, Fertility, Marie Louise, Louise Bonne de Jersey, Winter Cole.

RETURNED SOLDIERS' QUARTERS AND SOME OF THE MILKING SHORTHORN HERD AT RUAKURA FARM OF INSTRUCTION.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE OUTBREAK OF FIRE-BLIGHT.

ATTENTION was recently called to an attack of a new disease in the Tauranga, Waikato, and Auckland districts attacking apple, pear, and quince trees, and hawthorn hedges. It has now been identified by the Biology Section as the disease commonly known in America as fire-blight, and caused by the organism *Bacillus amylovorus* Burrill.

The disease has been definitely identified on all the foregoing plants. It is also suspected to exist on one or two other kinds, which are now the subject of investigation. As soon as this is completed it is proposed to publish a full account of the disease. In the meantime the following brief particulars will be sufficient to acquaint growers with the nature and seriousness of the disease.

In America fire-blight is responsible for an enormous amount of damage to pome-fruit trees, consequently its appearance in the Dominion has been dreaded by those interested in the fruit industry. It attacks and kills the blossoms and young shoots, and is readily recognized by the leaves withering and drying and remaining attached to the diseased parts. At the base of infected spurs and twigs cankers form, which rapidly spread, and frequently ring-bark the limb, thereby causing death. Where infection is severe the tree is killed outright.

As this is a bacterial disease, the only known remedy is to cut away and immediately burn all diseased parts. Cut diseased shoots and smaller branches about 1 ft. below the lowest point of visible infection. By cutting out the canker well outside the margin of infection large branches can often be saved. When this is done the wound should be immediately disinfected by swabbing with a 5-per-cent. solution of formalin, lysol, or some other germicide. After sterilizing, the wound should be painted over with coal-tar. All tools used should be sterilized in one of the foregoing disinfectants after each cut.

The Department realizes the seriousness of the outbreak, and, with a view to definitely determining the limits of infection, as many Orchard Instructors as possible have been assembled in the affected areas. At the same time the earnest co-operation and assistance of every owner of fruit-trees is solicited. Every grower who has trees showing conditions resembling the foregoing description is asked to notify the Director of the Horticulture Division, Wellington, or the Orchard Instructor for the district. At the same time he is urged not to await official identification of the disease, but to remove and destroy all dead wood. Specimens carefully and securely wrapped should be forwarded for identification to the local Orchard Instructor, who will further attend to the packing. This is advised with a view to eliminating all possibility

of further spreading the disease by means of indifferently packed specimens. For the same reason growers should entirely refrain from posting specimens to any one at all, other than the departmental officers referred to, even though requests to do so are based on the plea of education, &c. The Department will attend to this phase of the question, and will keep growers well informed from time to time.

—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

There appears to be an increasing inclination among growers to suspend their applications of arsenate of lead at too early a date. Codlin-moth is usually still active well into April, and it is therefore advisable to continue moth-sprayings right up to the end of harvesting. As woolly-aphis attack is invariably heavy in the autumn, nicotine sulphate, 1–800, should be used throughout in conjunction with the lead.

The stone-fruit season concluded, growers would do well to pick up and destroy all mummified fruits from the orchard, in order to minimize the source of infection of brown-rot for next season.

In cases where citrus trees have not been sprayed for the control of sucking-insects, such as scales, thrips, &c., red-oil emulsion should be applied at 1 to 40, care being taken to see that young growth is well hardened off.

By the beginning of April the main autumn crop of lemons will be set, and it is then time (as the blossom-petals fall) to spray thoroughly with bordeaux, 4–4–40, or lime-sulphur, 1–35. If it can be so arranged, oil should follow the fungicide, but an interval of four to five days should elapse between the two applications.

Pip-fruits which it is intended to store will mostly be gathered in April, and in this regard much care in picking and handling is necessary.

Orchardists who are intending to extend their plantings will find April the best month to get the plough in and commence the final operations for preparation for planting. —*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

At this period of the season sprayings for codlin-moth are usually discontinued, but it will be wise to spray at the usual strength varieties which have some time to hang on the trees, not only as a moth-control but to minimize the loss due to leaf-roller caterpillar, which continues very active until quite late in the season.

As there is a great possibility of a late infection of black-spot on such susceptible varieties as Dougherty and Rome Beauty, a sharp lookout should be kept, and bordeaux, 3–4–50, applied on the first appearance of activity. Red mite has been very active over a prolonged period this season, no doubt due to the favourableness of the dry weather Control measures will depend on the condition of the trees. Those carrying fruit, and susceptible to scorch, should be sprayed with Blackleaf 40, 1–800, and hardy varieties carrying fruit with the less expensive lime-sulphur, 1–100, while trees from which the fruit has been harvested may be sprayed with oil, 1–80. Further sprayings of Blackleaf 40 will be necessary to check as far as possible the autumn brood of woolly aphis.

March to April usually finds the orchards more or less run to weeds, cultivation having been suspended during picking-time. Where a weedy condition exists it will be a distinct advantage, both as a convenience and to prevent seeding, to use the mower, and let the weeds lie as cut, if the condition of the trees will allow this to be done.

In regard to extensions and new plantings, early ploughing should be done wherever possible so as to ensure full advantage of the autumn rains and permit the land to be worked well in advance of planting. Experienced growers will no doubt remember the shortness of supplies of certain varieties of fruit-trees last season and make provision for contemplated plantings by placing the order early with the nurseryman. —*W. M. Rice, Orchard Instructor, Hastings.*

NELSON.

The harvesting of late varieties of apples and pears is among the most important work in the orchard at this season. Grade out the poorer qualities

for immediate disposal, and store only clean, sound fruit; good stocks are too often contaminated by neglecting this precaution. Fruit to be stored in an orchard-shed for some time should be stacked with the same care as in a cool store—that is to say, the stack should be some 4 in. from the walls, and each pile of boxes 1 in. or so from the next. Such an arrangement allows for satisfactory ventilation. Where large stocks are to be held it is advisable to place them well up on a false floor, to allow an indraught of cold air to be admitted when necessary.

The orchard will require to have fungus-infected fruit well cleared up. The fungus does not die because it is on the ground; it is in exactly the right place to grow and flourish, and become a menace to the trees next season. Any autumn spraying required should be done without delay (see last month's notes). Stone-fruit trees which have been badly affected with brown-rot or other fungus should be given one or two good applications of bordeaux at summer strength.

In most orchards a cover-crop is required. It is now rather late to sow lupins, but horse-beans, vetches, and oats may be sown.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The principal work for the month will be harvesting and storing the main crops of the later varieties of apples. Fruit for storing should be carefully selected and graded; inferior fruit will not pay for storage charges. Care should be taken that badly bruised fruit or fruit with skin broken—either by rough usage or deep cracks—is not included among that intended for late keeping. Where properly constructed cool stores are not available, and the fruit is stored under ordinary conditions, see that the ventilation is good, especially at the top of the building, to allow foul air from the fruit to escape.

Grading and packing out to standards should be undertaken by every fruit-grower. Where grading-machines are not in use the sizing of the fruit by hand methods should be done by a competent set of sorters in the orchard. It will generally be found that two pickers can keep two sorters going. This orchard sizing is better carried out by having a portable table or bench with extended handles for transporting about the orchards. The bench can be made large enough to hold about half a dozen cases, this serving to accommodate the various sizes of any particular variety and allow a case for the obvious culls, which should be rejected at the first handling. Each table will accommodate two sorters, one on either side, working into the same cases. Where picking-bags are used one end of the table may be converted into a bin by suspending sacking, into which the pickers empty their bags of fruit for the sorters to operate upon. Colour and quality grading may subsequently be carried out in the shed according to standards. I would strongly recommend that this grading be done before the fruit is stored. By doing this the fruit is well sorted, and those grades may be selected for packing out which will not keep as long as others, thus doing away with a lot of picking-over when taking out of storage.

—W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

The orchardist's chief occupation at the end of March and during April will be the picking, grading, packing, and marketing of his apples and pears. Growers should realize that this is one of the most important branches of the industry, and work accordingly. Take care when picking the fruit not to damage any fruit-spurs, and only pick well-coloured and matured fruit, leaving the balance for a further picking. Grade and pack carefully, and place the fruit on the market in the best condition possible. If cool storing, lose no time between the picking and the placing in the cool store, and only send in sound fruit. Bruised fruit will not store properly, and fruit with the skin broken or damaged in any way often causes decay in sound fruit. It is not worth paying storage charges on unsound fruit only to find at the end of the season that the fruit is much worse than when put in. The matter rests largely with the orchardist. Fruit from young trees is much better marketed as soon as picked, as it does not store well.

Those orchardists intending to put in green crops for turning under in the spring should attend to it early this month. The orchard should be well ploughed and harrowed down, making a good seed-bed. If artificial manure is to be applied it will be as well to drill it in with the seed.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

At this time of the year woolly aphis usually becomes very prevalent, and laterals and buds for next year's fruiting are often destroyed. Many growers make the mistake of waiting till the spring to fight this pest, by which time the damage is done. The better plan is to destroy the pest before it destroys the laterals. Cut away inside growths and surplus shoots, and spray well with Blackleaf 40, at 1–800. Good results can also be obtained by the use of red spraying-oil, 1–60, but it is not advisable to use this spray till the apples have been removed from the trees. The addition of a small quantity of Blackleaf, equal to 1–2,000, enhances the value of the oil spray.

Where leaf-roller caterpillar is prevalent a further application of arsenate of lead should be made, especially on apples which are to be stored, otherwise the grubs will hatch out on the fruit in the cases after storing.

Growers are again reminded to keep a lookout for late infection of black-spot after rainy and misty periods, and to spray with lime-sulphur, 1–120, where necessary. *J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CULLING AND SELECTION OF THE BREEDING-HENS.

THE culling of the hens that have passed their best period of production, and the selection of the most desirable specimens for next season's breeding-pens, are matters which should claim the first attention of the poultry-keeper at the present time. Indeed, if this important work be delayed now it is impossible for it to be carried out to the best advantage at a later date, chiefly for the reason that if left till the flock has fully moulted choosing between the good and bad layer is a matter of great difficulty.

All things being equal as to the time of hatching, and when the flock has received uniform treatment in regard to feeding and general management, it will usually be found a safe course to discard the birds that moult first and retain in the flock the late moulters for breeding and laying purposes. In this connection it is not to be inferred that all late moulters which give indications of being heavy layers are desirable breeding specimens, for the best layer is not necessarily the best breeding-bird. Breed and laying-type, the desired size, together with points indicative of constitutional vigour, must be combined if desirable progeny is to be produced. For instance, a freak type of bird may prove to be a late moulter and a heavy layer, but, if bred from, its progeny in all probability would prove disappointing.

The point cannot be emphasized too strongly that to maintain a flock of heavy egg-producers the breeder must have an ideal type in his mind's eye, and choose birds as near to this as it is possible to do. Breeding from hens of various types and sizes merely because they have a good egg-performance behind them is no doubt responsible to a considerable extent for much of the weak stock being bred at the present time. I have recently seen breeders who were pinning their faith on small weedy hens as future breeding specimens for the sole reason that they possessed a fair single-pen egg-record, whereas birds were to be

seen among the general flock and of the same strain that were of ten times the value from a breeding viewpoint. This is not said in any way as a condemnation of single pens, but rather to emphasize the importance of placing in the testing-pens in the first instance only pullets of uniform type and desired size, and which are at any rate likely to produce desirable progeny when bred from.

It is, however, not always feasible or convenient for every poultry-keeper to use single pens as a means of determining which are his best layers. He must therefore depend on picking out according to laying-type and points indicating constitutional vigour, and in this connection the time of moulting gives the best guide to a bird's productive capacity. For a bird to produce a high yearly egg-record, whether confined in a single pen or running with a flock, she must necessarily be a long-season layer and obviously a late moulter, for it would be an exception to the general rule for a bird to complete its moulting process and continue laying at the same time. In addition to being a late moulter the good layer at this season of the year will usually have weatherworn shabby-looking plumage, red healthy-looking comb and face (the latter being free from feathers), bright prominent eyes, well-bleached shanks (in the yellow-legged breeds), fullness of abdomen, and wide pelvic bones. She will also be a heavy feeder and still retain an active businesslike appearance. The poor layer, apart from being an early moulter, is usually very fat, has well-kept plumage, bright yellow legs, feathered face, overhanging eyebrows, spare abdomen, contracted pelvic bones, and generally an inactive appearance.

The selection of the late moulters for future breeding is not the only essential. Something more is required. They should be marked as breeders, and then, by lighter diet or a change of diet, or a change of quarters, be discouraged from laying and encouraged to moult. Changing the ration from wet mash to whole grain for a week, and then suddenly changing back to the mash, will usually have the desired effect. This will give the birds an opportunity to recuperate and build up their bodily vigour before being called upon to lay eggs for hatching purposes. This advice is based on hard experience. I have bred from high-scoring competition and forced birds, only to find that the progeny were weakened specimens, unprofitable as producers, and most undesirable as breeders.

TUBERCULOSIS.

This is the time of year to keep a watchful eye for birds showing signs of being affected with tuberculosis. One- and two-year-old hens that are finishing up an exhausting laying season and are not in a vigorous condition are most liable to become affected with this disease should they come in contact with the tuberculosis germ. The latter usually attacks the liver and spleen, which later become covered with tubercular nodules. These vary in size, sometimes being as small as a pin-head and in other cases as large as a pea. They can easily be seen on post-mortem examination and when the disease has reached a fair stage of development. As a rule the first outward symptom is a rapid wasting of flesh, particularly surrounding the breast-bone, the latter standing out as a sharp ridge. Later, the wings and tail droop, the plumage becomes ruffled, there is usually lameness in the right leg, and the bird will frequently be seen standing on one leg with its

head under its wing. At this stage the bird shows little desire for food, even when of a most appetizing nature. Later the evacuations become a greenish-white, and often adhere to the fluff feathers surrounding the abdomen. From this onward the bird appears to be in a dazed, listless condition. It gradually becomes more emaciated, and finally dies.

Tuberculosis is probably the most dreaded disease that the poultryman has to fear. Most other troubles which affect poultry can be easily checked if taken in time, but it is entirely different with this disease, and once it makes its appearance in a plant there is no telling when it is going to be effectively stamped out. The excreta of a diseased bird contain large numbers of the tuberculosis germ, and it will be easily understood that the food, &c., may get contaminated, and a healthy bird become affected. It is useless trying to doctor a bird affected with tuberculosis. All that show the slightest signs of being affected should be killed and burnt at once. Prevention is the one and only safe course. The first essential in this connection is to breed birds with the necessary constitutional vigour to resist the infection. Further, too much emphasis cannot be placed upon the value of cleanliness, good feeding, and well-ventilated houses. Above all, never allow the runs to get into what may be termed a "poultry-sick" condition.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

ROBBING.

By this time most of the season's honey will have been removed from the hives and extracted. Some beekeepers prefer to leave the honey in the hives until late autumn, but, while it is claimed by some that this method conserves the flavour and ensures ripeness, it is not usually adopted. The disadvantages of late extracting probably outweigh the advantages. Perhaps the greatest drawback is the liability to set up robbing when removing the honey so late in the season, and this is an important matter to consider.

Robbing, as understood by beekeepers, is the act by which bees steal from each other or from any source where sweet substances are left exposed. The cause of robbing is usually the sudden stoppage of the flow of nectar in the fields. Bees will not attempt to rob while a good yield of nectar is obtainable. In fact, at such times combs of honey may be exposed in the apiary without being molested by the bees. But as soon as the blossoms cease to yield, the leaving of even small portions of honey near the apiary would cause a commotion, and would in most cases start the bees robbing out any weak colonies. At such time the bees become very cross and seem to delight in looking for trouble. At the fall of the year the beekeeper should therefore take every precaution and refrain from dropping any pieces of honeycomb about. He should also open the hives as little as possible, any manipulations required being done late in the afternoon.

Robbing is easily detected when in full swing, but is very hard to stop. The first symptom noticeable is usually the uproar of excitement

around the particular hive being robbed, and this, when examined at the entrance, will be found to be a scene of turmoil. In such a case the hive should at once be closed down to one bee-way entrance, and if the trouble continues it may be found necessary to close it up altogether until dark.

Slight cases of robbing, however, are not so easily detected, and beginners are sometimes unnecessarily alarmed by the action of the young bees on a fine afternoon when flying about the entrance of the hive taking their bearings. If robbing is suspected the best way is to carefully watch the entrance to the hive. A bee leaving the hive for the fields comes out casually and leisurely, quietly taking flight from the alighting-board. A robber-bee when leaving the hive with its load of stolen sweets invariably hurries out, usually climbs up the front of the hive before taking flight, and then takes a downward curve until it has controlled its balance. Another suspicious sign is small particles of wax capping scattered around the entrance.

The best plan is to take precautions so that there is no excuse for its starting. See that all extra ventilation is closed as soon as the flow is over, giving the bees only a small entrance to their hive. Take care that no bees can gain access to the honey-house or any sweet substance such as honey, jam, or syrup. Do not open the hives more than is necessary, and then only for a short time. See that all covers of hives are secure, so that they cannot be blown or knocked off. Unite any weak or queenless colonies.

UNITING WEAK COLONIES.

Now that brood-rearing will be lessening it is advisable to unite any weak colonies. Perhaps the best method is to kill the queen of the weak colony; then in the evening take off the cover and mat of a fairly strong colony, and place a double sheet of newspaper over the top; next quietly lift the weak colony off its bottom-board and place it over the strong colony. This will result in the bees being confined until they have eaten their way through the paper, which will take a couple of days, and by that time they will unite without fighting. The hive should not be again disturbed for a few days. If the weak hive contains a good young queen which has not had time to build up, it can be united to a queenless colony by the same method.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

WINEMAKING OPERATIONS.

LAST months' notes dealt principally with the time of gathering and the condition the winemaking grapes should be in when commencing the vintage. It will be assumed that everything is now in readiness in the press-house and cellar for getting in the grapes. The making of dry red wine will first be dealt with, as in New Zealand it covers the principal work, the making of sweet wine being usually an after-manipulation by the addition of spirits and sugar to the dry wine.

Fermenting.

Where the grapes have been gathered at their maximum condition and all objectionable or green bunches thrown out, so that the resulting must comes up to the sample obtained from the tests made beforehand and obtained from an average of the crop selected for that purpose, it can be estimated what the probable alcoholic content of such a wine will be. Under usual conditions fermentation lasts from forty-eight to seventy-two hours. During this period, and where the grapes are fermented on their skins, the vigneron must give it close attention. The labour employed must be so divided that a reliable man is always on duty. As long as violent fermentation is proceeding the carbonic gas given off is a protection from the surrounding air and its contaminations. The fermentation brings to the top a thick layer of skins varying from 4 in. to 8 in. From time to time this has to be broken up and pushed down into the body of the vat. This is necessary to allow all the colouring-matter in the skins to be extracted by the process of fermentation. It is also a help in keeping the temperature down.

The temperature of the fermenting mass in the vats is an important matter, and should be under control. It may vary during the day from 75° to 95° F., and between these two points (say, 85° is as high as it should go. The fermentation is prolonged by the lower and hastened by a higher temperature. If maintained as near as possible to the mean of these points the wine will be the better for it. The weather during March and the early part of April is rarely too cold to seriously check fermentation. To prevent it going too high has generally been the concern of the New Zealand winemaker. One of the effects on the wine of allowing it to work at too high a temperature is the danger of its being affected by acetic, lactic, or other harmful bacteria; while at the lower temperature vinous fermentation soon sets in and holds its own, destroying the others. To maintain a right temperature, after breaking up and pushing down the cap of skins plunge the thermometer well into the body of the vat, note its reading, and if exceeding 85° draw off some of the must and pump it over the top, repeating this till the reading shows it is within the best limits.

It should be impressed on the mind of the winemaker that the grapes, fermenting-house, and all utensils teem with harmful bacteria. These can only be prevented from affecting the wine by keeping down the temperature of the vat-contents, and by the greatest cleanliness in conducting the work. The floor of the fermenting-house, the grape-boxes, and utensils should all be washed at least once in twenty-four hours. The warmer the weather the greater is the danger. It is within the period of the grapes being put into the vat, fermentation taking place, and its removal to the cellar that the wine is made good or bad.

As soon as filled the vats should be kept covered. Strong unbleached calico is the best for this purpose. The cover is removed from time to time to permit of the cap being pushed down and taking the temperature. The fermentation gradually slows down as the sugar is transformed into alcohol and carbonic gas, and the contents become cool. When completed, what was the must is now wine, and if tested with the saccharometer that instrument will float at zero

or water-level. This indicates that all the sugar has been transformed. When quite still and the wine cool it should be drawn off, provision having been made beforehand by a perforated shield or bunch of twigs placed over the outlet and fixed inside the vat to keep back the skins. The wine falls into a tub placed for that purpose, and is pumped direct from that into casks. The shorter the delay in carrying out this work and the contact of the wine with the air the better for the wine. It is unavoidable in doing this that some of the thick portion goes into the casks, apart from a turbid state of the wine at this period. Before this matter finally settles in the wine a second or silent fermentation occurs, caused probably by some unfermented portion asserting itself. To provide for the escape of the carbonic gas from this secondary fermentation place small bags of well-washed coarse sand, about 6 in. square, over the bung-holes. This permits the escape of the gas while preventing contact with the air. Some winemakers keep the wine in the vats on the skins for some days, with the object of obtaining a deeper colour. If the weather is very cool and the vat closely covered possibly no harm will result. The practice is not recommended, however. If the grapes passing through their fermentation receive regular breaking-up of the cap all the colouring-matter will be extracted by the violent ebullition they pass through.

Making White Wine.

It will be noted on reference to last month's notes that, with the exception of Pineau Gris, the white-wine grapes do not attain the natural sugar-content of the dark ones. Wine from the white grapes is more delicate and subject to outside influences. It is not generally fermented on the skins. The white grapes are the latest in ripening and can be left to the last. The must from these grapes should not go into the ordinary wooden vats or casks in which red grapes have been fermented, as more or less colour might be imparted. There would not be any objection in the case of concrete vats, provided they were well cleaned.

The white grapes pass through the stemmer and crusher, the must coming out on to the floor of the press and running from that into a tub. From that it is pumped into a large vat to be aerated. As the stems and skins soon collect in the press and pile up, pressure can be applied two or three times till the press will not hold any more, after which the final pressure is completed.

Aerating the must of the white grapes is an important stage in the making of a white wine, on account of the albuminous matter in the white grapes, which is a hindrance to its keeping-qualities and fine flavour. To successfully carry out this part of white-wine-making sufficient grapes should be gathered the evening before, so that an early start can be made to fill a vat the following day, regulating the work so that the vat will be three-quarters filled early in the day. Aeration of the must for the purpose of eliminating the harmful albuminoids is done by four or five hours thorough stirring. Drawing the must off into a tub, and pumping it back into the vat, and letting it fall from a height of 3 ft. or 4 ft. is the best way of doing this. If scum collects it should be skimmed off and put into a vessel by itself, to be made use of afterwards. At the completion of the aeration pump the must

into the casks to ferment, not quite filling them, so as to allow of some working over, and cover the bung-holes with the small sand-bags already mentioned. Each day's work should be complete in itself—stemming, crushing, filling of vat, aeration, and finally pumping into the casks to ferment.

As the fermentation gets strong the froth works over more or less, and vessels should be put to catch it. The sides of the casks should be wiped clean with a damp cloth several times during the day. This froth rapidly becomes sour, and would communicate with the wine if neglected, setting up acetic contamination.

Further notes on the treatment of the wines will be given next month.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

In the colder parts of the Dominion arrangements for the winter supply of vegetables will be completed by this time. In other places there is still time to put in a good breadth of turnips, though no time should be lost. In warm localities it is possible to get turnips from seed sown early in May, but the roots stand for such a short time that it is worth while only in exceptional cases of shortage. In warm places spinach may still be sown. Lettuces may be planted in all parts.

Cabbage-moth: It is possible to save small lots of affected cabbages if sufficient attention is paid to them, but the saving of large areas depends mainly on getting growing-weather. The worst infestations occur during very dry summers. Under such conditions it is practically impossible to save the crops, except where the soil naturally holds a good deal of moisture. When the season is cold and wet the moth is not troublesome. Between the two extremes there is the medium season, when the plants may grow fairly well, and yet there may be a fairly heavy infestation. Under such circumstances the crops can be saved. Spraying large areas in an effective manner is a practical impossibility. In addition to the habit the larvæ have of descending to the ground when disturbed and returning to the plant when danger is past, their work is mostly done on the under-side of the leaves, where it is difficult to reach them. I have found it best to concentrate attention on the saving of the young leaves forming in the centre of the plants. If these are injured by the insects growth must cease. A little hellebore powder dusted into the centres of the plants will save them from injury, and if some nitrate of soda is given to the roots there is every likelihood of the plants doing well. Cultivation between the plants should be frequent, and if the implement used brushes against the outer leaves it will cause many of the larvæ to drop to the ground, and a proportion of them is sure to be buried in the soil.

Brussels sprouts: About this time the plants are almost always attacked by a grey aphis, which, unless it is checked, speedily ruins

the plants. Spraying with Vistolene or XL All fluid will kill the insects and be the easiest method of control. Forcible syringing with boiling water is quite effective. The usable parts of these plants are the little rosettes that form in the axils of the leaves. The question is sometimes asked whether the leaves should be cut off to encourage the growth of the rosettes or sprouts. The answer is emphatically No. The sprouts will not develop properly without the leaves, which should not be cut off until they turn yellow. Seedsmen's catalogues show the plant without leaves, the leaves being removed to show the sprouts.

Onions: Most crops are harvested before now, but there are sure to be some backward crops. Rain following a dry spell may make available fertilizers that were inert for want of sufficient moisture, and this may lead to late growth and consequent delay in ripening-off. An overplus of fertilizer may have this effect without interference by the weather. If the bulbs are properly grown the necks should become thin and lose substance, and the tops fall over from their own weight. If this does not occur the bulbs have not finished properly, and they will not be good keepers. The cause may be too much manure, untimely rain, or an unsuitable variety; or, lastly, they may have been lifted too early. Giant varieties should be sown in autumn; if sown in spring they will not finish properly. Ripening occurs earlier in some places than in others, but in cases where the tops have not withered lifting should be left till March in order to give the bulbs a chance to finish ripening.

Turnips: Where the winter supply is of consequence it is a good plan to sow two varieties at this time—Snowball or a similar white variety for first use, and Golden Ball or Orange Jelly for later. The yellow varieties stand better through winter than the whites, and are at that season better in flavour. The yellow variety should be well thinned, as they are to stand. Thinning the white variety is mostly done when roots are pulled for use or market. This enables the taking of a large crop from the ground, and is the usual method of market-gardeners.

Celery: Late crops should be moulded up; they are better so than exposed to winter weather. The moulding-up protects them from heavy rain, the heads keep better, and are gaining crispness. Celery leaf-spot is causing losses as usual. Losses would be smaller if growers realized the early beginning of the disease. A very frequent cause is infected seed. When this is the case the disease attacks the seedling plants, but at this stage it may not be noticed unless it is looked for. Later on, when the disease has obtained a firm hold, it may be impossible to save the plants; certainly, badly affected leaves cannot be saved. Spraying with bordeaux mixture should begin with the seedlings and be continued as long as may be necessary. Growers are known to obtain complete control by this means. Some authorities state that the spores of the disease present on seeds die within two years, and advise that seeds less than two years old should not be used. The seeds retain vitality for eight years. The fungus may be killed by steeping the seed for a period of three hours in a dilute solution of 1 part formalin to 600 parts of water. The seeds should afterwards be quickly dried on sheets of blotting-paper.

Autumn sowing of cauliflower, cabbage, onion, and lettuce: These seeds should be sown during the last week of March or early in April. This sowing is one of the most important operations of the whole year, particularly so in reference to cauliflower, cabbage, and lettuce, because it provides for the spring crops, the most valuable of all both to the market-gardener and the private grower. Two kinds of cauliflower should be sown — Early Snowball or Early Paris for first cutting, and one of the Autumn Giant types for succession. In the warmer parts of the Dominion another lot may be sown about 1st May, and the combined sowings will carry the supply till the New Year. Heads from the first sowing should be ready during September, a month earlier than in other parts, rendering the growing of broccoli almost unnecessary. This is a great advantage, as broccoli has to be planted in summer, when the moth may make it impossible to grow it.

With onions autumn sowing applies most properly to the giant kinds. These cannot be brought to maturity if sown in spring. The young plants must be transplanted in spring; 1½ lb. of seed will provide plants for an acre. In some circumstances it is advisable to sow the smaller keeping kinds in autumn. In some districts mildew attacks the plants early in the year, and this prevents the bulbs maturing in a proper manner. By sowing in autumn the plants are so far advanced in growth when the disease attacks them that they suffer little or no injury. It is not absolutely necessary to transplant these kinds in spring—in fact, many growers do not. There is, however, greater risk of the plants bolting to seed when not transplanted, and in some cases the ground becomes so weedy during the winter months that transplanting to clean ground becomes imperative. The small kinds being planted closer than the large varieties, 2 lb. of seed should be sown to plant an acre. If not transplanted, 3 lb. will sow an acre.

SMALL FRUITS.

Cape Gooseberries.—For practical purposes these plants have a life of two years. Seeds should be sown in boxes early in April, pricked off in other boxes when large enough to handle, and kept till spring frosts are past. Planting should be in an open position, so that the plants may make sturdy, fruitful growth. Personally, I prefer to plant in clumps of three plants. The growths then intermingle and the plants are firmly anchored, and wind will not disturb them. The clumps should be 5 ft. apart every way. The crop obtained during the second season is the heaviest. Commercial growers should have two plantations, setting out a new one each year, so that after the first year there would be always one lot giving the second crop.

Strawberries.—In some districts autumn planting is necessary, April being the best month. Care should be taken to firm the soil thoroughly round the roots. Where the character of the soil admits it is a good plan to pass a roller over the whole area after planting is done. This makes the soil firm and does not injure the plants. When the land is to be replanted with strawberries it is doubtful policy to plough in the old plants. The rootstock is woody, and even the foliage is hard. Neither decays for a long time, and the soil could not become properly consolidated; also there is the risk of leaf-spot contaminating the new plants. It would be wiser to cut the plants off with an adze and burn them.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RINGWORM IN YOUNG CATTLE.

O. J. M., Paparata :—

What is the best treatment for some young cattle which are getting ringworm about the face and neck ?

The Live-stock Division :—

The affected parts should first be well washed with soft-soap and water. When dry a preparation of creosote, 1 oz., and olive-oil, 7 oz., should be applied with a stiff brush. Tincture of iodine will also answer the purpose. Whatever treatment is used the dressing should be extended beyond the affected parts. A second application may be necessary.

BEST STAND-UP WHEATS.

"INQUIRER," Frankton, Central Otago :—

We intend sowing about 100 acres of wheat this season. The soil is naturally very rich and has not been cropped for ten years, so we are afraid the crop will go down badly. We should be glad of advice regarding the best standing varieties.

The Fields Instruction Branch :—

Probably the variety which stands up best is Purple-straw Tuscan. Other varieties of Tuscan, such as White-straw and Solid-straw, also Hunter's wheat, are commonly grown on heavy land in Canterbury, where resistance to lodging is of considerable importance. Further, College Hunters can be counted on to stand drought conditions well, in addition to standing up well on heavy land.

EXPLOSIVES FOR HARD-PAN IN ORCHARD.

"POMUS," Waipukurau :—

The growth of a large number of trees in my orchard has been very much checked by the existence of a hard-pan of sandstone which runs through part of the orchard at a depth of from 1 ft. to 3 ft. below the surface. These trees are only about 5 ft. high in some instances, although they have been planted seven years. Would you kindly inform me of the best method of breaking the pan with explosives so as not to injure the roots of the trees, the best explosives to use, and the proper season to do it ?

The Horticulture Division :—

Some injury to the roots of the trees is sure to occur if sufficient explosive is used to do any real good. It would, however, do the trees no harm provided the work was done in autumn—April would be a good month. Holes should be made midway between the trees in each direction, and one in the centre of each square enclosed by four trees. The holes should go through the hard-pan if possible, or at least well into it. A 1½ in. auger is the best implement where it can be used, the shaft being lengthened for the purpose. If an auger cannot be used a light steel crow-bar is the next-best implement for making the holes. A plug of gelignite is required for each hole, or possibly two plugs ; detonating-caps and fuse are also necessary. A cap is firmly fixed to one end of the fuse ; a cut is

made in the plug of gelignite, and the cap partly enclosed in it. The cap and fuse must be firmly tied to the explosive, which is then dropped to the bottom of the hole. The pieces of fuse should be long enough to allow a few inches to project above ground. Put dry soil into the hole and tamp with a wooden rammer. Tamp the first 6 in. lightly, the rest of the hole as hard as possible. Light the fuse and stand clear.

BOILS ON HORSES' BACKS.

"UTUKAI," Mangonui :—

Can you recommend a cure for boils on the backs of horses? My riding-horses have been subject to them since spring, and two months' spell has not improved their condition. The horses are on good feed and in good condition, and although methylated spirits seems to absorb the boils, they reappear in other places along the back.

The Live-stock Division :—

This trouble is due to inflammation of the sebaceous glands and hair-follicles, with retention of their secretion, which not infrequently causes pus-formation. It is usually produced on horses' backs by badly fitting and dirty saddles. When the boils or pimples make their appearance the parts should be well fomented with hot water to which a disinfectant has been added. When the pimples begin to discharge they should be kept clean and touched up daily with a little undiluted carbolic acid. After recovery, care should be taken that the lining of the saddle is thoroughly disinfected and the saddle made to fit properly, otherwise reinfection may take place. Salines, such as hyposulphide of soda, given daily in 1 oz. doses will also have a beneficial effect. The animals will eat this freely if crushed fine and put in their feed.

PINUS INSIGNIS TIMBER FOR BUILDING.

G. TEBBS, Tauranga :—

Can you give me any information as to the suitability of *Pinus insignis* timber for building purposes. The general impression in this district is that the borer would soon get into it. Would it be of advantage to dress the timber with Solignum or creosote? Any information would be gladly received.

The Horticulture Division :—

The timber of *Pinus radiata* (*insignis*) is being quite extensively used for the construction of buildings, especially in the South Island. Some buildings have been erected for a number of years, and so far we have heard of no report of borer attack. A dressing of benzine, 5 parts, to creosote, 1 part, is recommended as being protective against borers. Care in selection of the timber, using no sap-wood, and felling the trees in winter, will have good deterrent effect.

COWS WITH FOOT TROUBLE.

A. W. B., Teddington :—

Three of my cows are suffering with some trouble in their feet. They first went extremely lame, their feet swelling up just above the hoof. After a time the swelling burst, and with the discharge the pain ceased, but the places are still open and raw. Could you give me any information as to this disease and its treatment?

The Live-stock Division :—

The trouble you describe as affecting your cows is, in all probability, the condition known as "foul-in-the-feet" of cattle. It is more common in wet, marshy places, and very often a change to dry ground causes it to disappear. As regards treatment, you should endeavour to get the feet into as clean a condition as possible. Bathe the parts you describe as "open and raw" above the horn with hot water containing a little antiseptic, such as Jeyes Fluid or Kerol. Afterwards a lotion made by dissolving 1 oz. of sulphate of zinc in a quart of water should be applied once daily.

BLACK BEES FROM THE BUSH.

R. H. CROZIER, Palmerston North :—

Can you recommend the small black bee we find in the bush as a good honey-bee ? I know of three strong colonies of them, and if they are worth taking I shall hive them.

The Horticulture Division :—

The black bees found in the bush are from the original bees imported from England, and are good honey-gatherers, but the Italian race has come into more general favour.

CONTROLLING TOP GROWTH OF APRICOT-TREES.

MRS. E. WRIGHT, Puriri :—

Can you advise me how to prevent apricot-trees from making too much top growth ? I have some eight-year-old trees which did not grow much at first, but have made from 8 ft. to 10 ft. of wood this year. The more they are pruned the more top growth they make. I wish to keep them down, as I find it impossible to pick the fruit from some of my trees, which are thirty-five years old and 30 ft. high.

The Horticulture Division :

Apricot-trees usually make strong growth after pruning. This habit is useful while a tree is young, but is likely to be troublesome when the trees attain to a height at which it is desirable they should remain. There are two ways of preventing strong growth and still keeping the tree in the desired form. One method is to prune toward the end of December, in which case the leaders should be pruned to a bud at about the desired height. The resulting growth will be weak, and will remain so thereafter. The other plan is to shorten in winter to a lateral instead of to a bud.

CRACKS BETWEEN COWS' TOES.

GEORGE IRVING, Henley, Otago :—

Kindly inform me what is the best treatment for cracks between the toes of cows. I have two cows very lame with this trouble. Their feet have a very bad smell.

The Live-stock Division :—

Good treatment for cracks between the toes of cows consists in cleansing the part thoroughly with warm water and disinfectant, then applying a mixture of powdered bluestone (1 part) and glycerine (7 parts). This should be repeated daily. The cows must be kept on dry, clean pasture. Wet boggy ground and mud is usually the cause of the trouble. Powdered fresh unslaked lime dusted between the claws is often used with beneficial effect, the interdigital space being first cleaned.

PROTECTING FRUIT-TREES FROM RABBITS.

"SUBSCRIBER," Puketiro :—

Kindly advise whether there is any simple home-made solution that one could paint on apple-trees to make the bark distasteful to rabbits ; also, in the case of the bark having been chewed off in places, what should one put on to help it to heal ?

The Horticulture Division :—

There are various mixtures that can be applied, and which are fairly effectual. The chief difficulty, however, is that as in this country trees are usually branched low, the rabbits (or hares) are able to reach up and eat the young shoots, which they will do if the trunk bark is made distasteful to them. There is really no effectual method of protection except to shut them out by the use of wire netting. The

following are useful mixtures: Cow-manure, lime, and water; cow-manure, sand, and water; sulphur, soot, and lime. In each case the mixtures should be made into a thick paint and applied with a brush. Stockholm tar is also useful (gas-tar must not be used). Where the bark has been gnawed off the bare wood may be covered with either Stockholm tar, grafting-wax, or white-lead and oil paint. Any of these will exclude weather and assist healing.

MAKING CANDIED LEMON-PEEL.

A. HUTCHINSON, Silverdale:—

Please state a simple way to make candied peel. We have the lemons, and commercial lemon-peel is unprocurable.

The Horticulture Division:—

The peel is first soaked in brine for ten to fourteen days, or longer if required. Strain and wash thoroughly, preferably in running water. Make a syrup at the rate of 10 lb. sugar to 1 gallon water, and boil until it will just form a thread. While boiling put in the peel, and continue boiling for two or three minutes. Let stand for several hours. Drain the peel, reboil the syrup, and again put in the peel, continuing to boil for two or three minutes. Repeat this five or six times. Then place the peel in dishes, pour a small quantity of syrup into each piece, and place in a warm place to dry, either in the sun or an artificially heated drying-room.

PIGS WITH PROTRUDING BACK PASSAGES.

J. W. L., Otaki:—

Of twenty weaner pigs, about three months old, I have had five with their back passages blown out and hanging down. I have washed, oiled, and carefully replaced the parts, leaving the pigs without food for a day, but as soon as the operation is over the parts again protrude. The pigs are fed twice a day on thick sour milk. Please advise me as to the cause of and remedy for this ailment.

The Live-stock Division:—

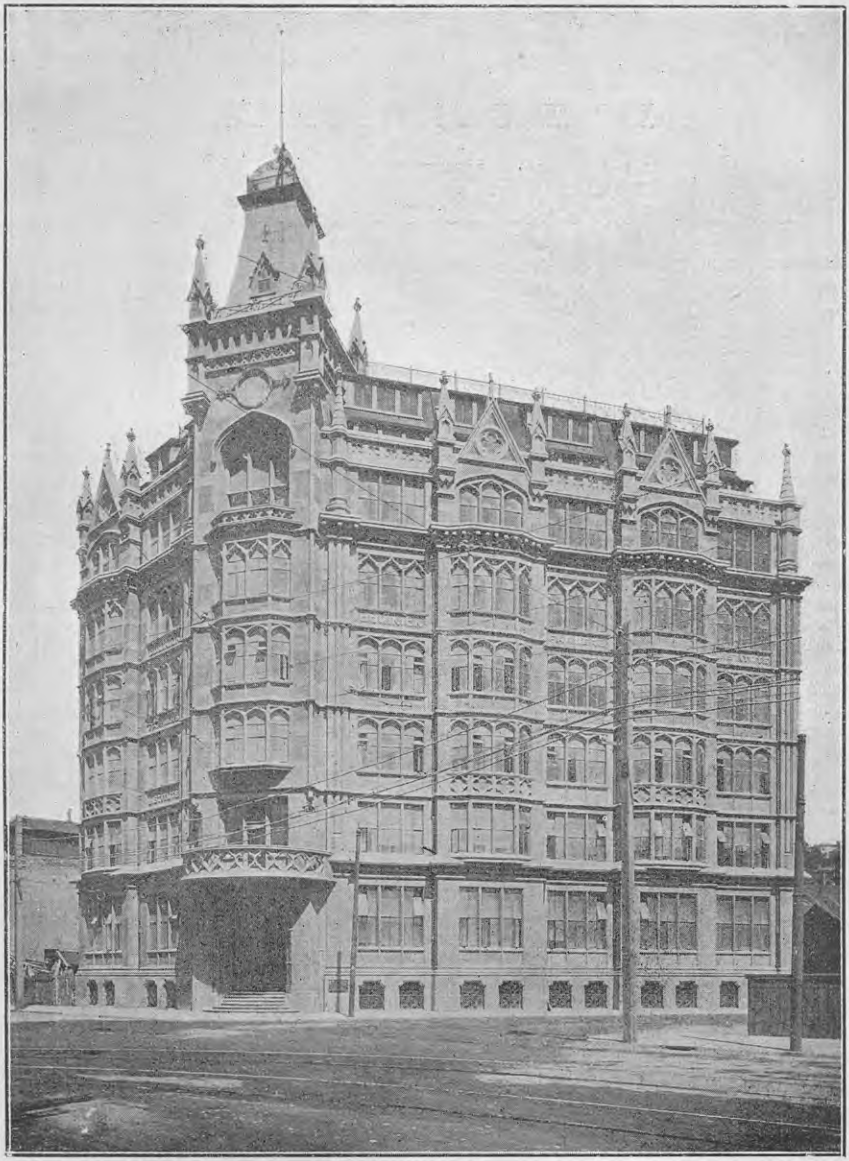
The condition you describe affecting your pigs is directly caused either by straining or intestinal irritation. Thick sour milk cannot be recommended under the conditions: fresh separated milk would be much more suitable. The back passages will require to be replaced until all excessive straining ceases, the procedure you adopt being quite correct. Strict attention should be given to the feeding-utensils as regards cleanliness, and the pigs should be kept warm, dry, and free from draughts.

NOTICE.—An inquiry from Taneatua, regarding Californian thistle, cannot be answered unless name of sender is supplied.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 23rd and 24th March (Autumn Show).
Oxford A. and P. Association: Oxford, 8th April.
Methven A. and P. Association: Methven, 15th April.
Malvern A. and P. Association: Sheffield, 15th April.
Clutha Valley A. and P. Society: Greenfield, 5th May (Winter Show).
Manawatu and West Coast A. and P. Association: Palmerston North, 22nd to 25th June (National Dairy Show).

Unidentified Subscription.—A postal note, No. 477943, dated Palmerston North, 29/1/20, has been received without further advice. The sender should communicate with the Publisher, Department of Agriculture, Wellington.



THE DOMINION FARMERS' INSTITUTE, WELLINGTON.

This fine building, recently completed, has become the headquarters of the Farmers' Union, the Council of Agriculture, the Farmers' Co-operative Wholesale Federation, the National Dairy Association, the Forestry League, &c. The Board of Agriculture, the Forestry Department, the Farmers' Co-operative Distributing Company, and several other agricultural concerns also have offices in the building. The conference hall is now used for practically all gatherings of the various Dominion agricultural organizations when meeting in Wellington.

REVIEWS AND NOTICES.

THE LIMESTONE RESOURCES OF NEW ZEALAND.

A RECENT publication issued by the Geological Survey Branch of the Mines Department is Part I of Bulletin No. 22 (New Series), entitled "The Limestone and Phosphate Resources of New Zealand," with the parenthetical subtitle "Considered principally in relation to Agriculture." The author is Mr. P. J. Morgan, Director of the Geological Survey, assisted by Dr. J. Henderson and Messrs. M. Ongley, J. E. Harris, and F. Fulton-Wood, officers of the Survey staff. The preparation of the bulletin was undertaken at the request of the Department of Agriculture, which, in the interests of the agricultural industry, desired a comprehensive report on the limestone deposits of the Dominion. Part I of the bulletin, now published, deals with limestone only, giving a full summary of all available information concerning the various known deposits in the Dominion, each county being dealt with separately. Preceding this matter is a chapter of general information on the subject of limestone and lime, some extracts from which are published elsewhere in this issue of the *Journal*. This part of the publication, dealing in a clear and simple manner with the agricultural, chemical, geological, and other branches of the subject, would in itself form an excellent bulletin or handbook of moderate compass. It is stated that Part II is to consist mainly of a general account of the plant and machinery used in the calcination and the crushing of limestone, followed by a description of the phosphate deposits of New Zealand. Part I, it may be mentioned, is a crown quarto volume of 316 pages of letterpress, together with fourteen plates, six text-figures, and two maps, bound in quarter-cloth boards. The publication is one eminently suitable for the libraries of bodies such as farmers' unions and agricultural associations. It may be procured from the Government Printer, Wellington, at a price of 5s. A limited edition only has been printed.

THE STATE FORESTRY REPORT, 1918-19.

DURING last parliamentary session appeared the first annual report of the newly constituted Department of Forestry—really the first yearly State forestry report for New Zealand. Previous to this forestry had been a branch of the Lands Department, and had concerned itself with little more than exotic timber plantations outside the boundaries of the indigenous forests. Forestry in New Zealand to-day may be defined as the building-up of national forest estates out of the rough-and-tumble forestal chaos of the past. One of the first steps in serious forestry taken by Sir Francis Bell, Commissioner of State Forests, was to ascertain what were the forests still left to the State. The report under review gives what is perhaps the first reliable information yet published on that very important point. The total area of forest now owned by the State is stated at about 10,478,247 acres. This is actually 15·9 per cent. of the total area of the Dominion, as against the 25 per cent. considered necessary in other well-populated civilized countries; against 35 per cent. achieved in that highly industrialized area, the Rhine Valley; and against 65 per cent. aimed at in the forest policy of Japan.

This area of 10,500,000 acres owned by the State requires the early attention of the people and Parliament in two particulars. Firstly, only 1⅛ million acres of the total is now considered millable, and thus able, when in charge of foresters, to pay profits on its working and rejuvenation. The rest, to be put in order as a productive property, will require expenditure on roads, nurseries, and buildings, together with the settlement of population. For this we must be prepared to find funds or to suffer the reproach and loss attendant on unproductive or poorly productive areas

in our midst. Secondly, of the area of 10,500,000 acres, only 1,654,214 acres when the report was published were under the Commissioner of Forests and the Forestry Department [some additions have since been made]. The fate of the national forest area will be watched with interest in future departmental reports. There will be additions to it in Maori lands bought up (mostly from the Urewera country); there will also be subtractions as areas suitable for agriculture are cut off in the process of forest demarcation. Details of the forest areas in scenic reserves, national parks, national-endowment lands, and milling-areas are given. Actually these are parts of the 10,500,000 acres, much of which has been allowed to become burdened with rights.

The timber plantations of exotics have been continued on the lines of previous years, but with better supervision and a correction of the faults reported in the Forest Commission Report of 1913. The total area planted up to date is 35,444 acres, of which two-thirds is in the North Island on pumice land. The economic position of planting timber on easily ploughable pumice lands may be open to question, but in the South Island the economic position is stronger both as regards quality of soil and accessibility, especially since the opening of the new plantation at Balmoral on very poor soil, and on the Culverden railway-line. Prison labour is now confined to one station on the Kaingaroa Plains. A well-organized tree-planting camp for returned soldiers (named Waireka) was formed near the Waiotapu Plantation. It affords outdoor employment on a healthy site, and may develop into a forest settlement. The most urgent matter now facing the plantations is to replace the present casual labour by that of permanent settlers on small farms in the neighbourhood. In the early days it was not realized that forestry means continuous labour—that it is not merely planting a tree to-day and cutting it forty or fifty years hence.

The forest revenue for the year was £26,375, but of this only the sum of £4,937 was paid into the State Forest Account. With book-keeping such as this—and it has been the same for many years past—the forest finance of the Dominion remains an unknown quantity. The expenditure seems to have amounted to about £42,000, deducting the merely book entries shown in the statement. There was a special forest vote of £200,000, and the comparative small amount of forest work accomplished during the year was due to delay in getting together a forest staff, which in this report is forecasted at one research officer and six forest inspectors, together with the office staff in Wellington. The rank and file of the Department, consisting of resident foresters and rangers, remains for the future. The active organizing of the forests into working units has not yet begun.

The report describes several important departures which can only be touched upon in this brief review. Regulations have been made which are some advance towards a valid Forest Act for New Zealand. Provisional State forests—lands reserved pending regular forest demarcation—have been set on foot, and 1,800,000 acres were ready for proclamation at the close of the year under report. The anomaly of Mining Wardens possessing destructive forest powers has been reduced but not abolished.

The year's output of sawn timber in the Dominion amounted to nearly 228 million superficial feet, of which almost exactly one-half was rimu; the output of kauri was under one-tenth that of rimu. Something like 15 million superficial feet of timber may have been imported during the year, but, the accounts not being kept in one unit, the exact amount cannot be ascertained. Government sawmilling is to be commenced in one of the State kauri forests.

A report on the demarcation and management of the Waipoua Kauri Forest by Mr. (now Sir) D. E. Hutchins was published during the year. The author has had a long experience of this class of forest, and maintains that it can easily be worked and much improved by ordinary forest methods. He indicated at the last annual meeting of the Forestry League that something like £85,000 yearly is being lost in postponing the working and rejuvenation of this forest, which is full of over-mature timber. There is also a staff occupied at present only on police work, which is costing some £575 per year. When the forest is worked and developed this police work will become nearly automatic and costless.

The useful distribution of forest-trees and seeds at cost price was continued, 420,412 young trees and a small quantity of seed being sold to farmers and local bodies. The issue of rooted plants in trays is being largely adopted. It much reduces the tree-planter's risks.

A burning question during the year has been the increased limitation of the export of white-pine timber. Measures were taken through the Board of Trade to limit the export of this timber to 40 per cent. of the total production. Strong representations to both increase and decrease this limit were received. The real position, as to whether in any given forest or group of forests it is more advantageous to work off the old timber and put a timber-increment on the forest, or to keep the forest unworked like gold in a stocking, an idle capital but a necessary reserve —the exact economic position in any given forest—cannot be ascertained until the Forestry Department is much stronger than at present. In the meantime the cautious policy of restricting export seems to be obviously the wiser one.

Some pertinent observations are made on the rate of growth of native trees. The initiation of the great work of interplanting seedlings in the native forest to grow up as standards and improve the stocking is also recorded.

The report, which may be regarded as historical as the first of a series, is submitted by Mr. E. Phillips Turner, for a number of years connected with the Forestry Branch of the Lands Department and now Secretary of the Forestry Department. It shows a notable advance in New Zealand forestry, and comes as a happy augury for the successful work of the technically trained Director of Forestry, Captain L. M. Ellis, who arrives this month from overseas to take up his appointment.

FRUIT-EXPORT REGULATIONS.

THE following regulations relating to the export of fruit from New Zealand, made by Order in Council under the Orchard and Garden Diseases Act, were gazetted on 4th March, and came into force on the same date :—

REGULATIONS.

1. In these regulations, if not inconsistent with the context,—

"Appointed store" means a store appointed by the Minister for the inspection and examination therein of fruit for export.

"Blemish" means an injury detrimental to the appearance of fruit, and includes branch-rubs, scratches, insect-bites, unnatural russeting, bruises, excrescences, sun-scalds, and hail-marks, but does not include spray injury.

"Brand" means to mark clearly and legibly by stencil, imprint, or label.

"Clean" means free from dirt, insect-stains, and spray-stains.

"Director" means the Director of the Horticulture Division of the Department of Agriculture.

"Export brand" means an export brand registered by the owner of fruit for export in accordance with the provisions of these regulations.

"Fruit" means apples, pears, or peaches.

"Inspector" means an officer of the Department of Agriculture authorized to examine fruit for export in accordance with these regulations and duly appointed an Inspector under the Orchard and Garden Diseases Act, 1908.

"Mature" means having the degree of ripeness suitable for export.

"Owner" means any owner, shipper, or consignor of fruit, and includes the agent or servant of any such owner, shipper, or consignor, and also includes, in the case of a company, the managing director, manager, director, secretary, or other principal officer of the company in New Zealand.

"Pack" means to regularly and compactly arrange fruit in a package.

"Package" means a container for fruit.

"Size" means, when used as a noun, the diameter of fruit measured from cheek to cheek at the widest part, and when used as a verb means to sort according to size.

"Solid red variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

"Spray injury" means the russeting of, or other injury to, fruit as the result of spraying.

"Standard bushel case" means a case of the following dimensions (inside measurements): Length, 19¾ in.; depth, 10 in.; width, 11¼ in. The thickness

of timber used in the construction of the cases shall be $\frac{3}{4}$ in. for the ends and $\frac{5}{16}$ in. for the sides, tops, and bottoms. Provided that on written application being made to him by the owner the Director may, if satisfied as to its strength, allow thinner timber to be used for the tops and bottoms of the cases, or may allow thin timber adequately strengthened by cleats to be so used.

"Standard half-bushel case" means a case of the following dimensions (inside measurements): Length, $19\frac{3}{4}$ in.; depth, 5 in.; width, $11\frac{1}{4}$ in. The thickness of timber used in the construction of the case shall be the same in all respects as for the standard bushel case.

"Striped or partial red variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

"Yellow or green variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

2. No fruit shall be exported from the Dominion unless it has been passed for export by an Inspector, and unless all the provisions of these regulations have been complied with.

3. (1.) Only such varieties of fruit as are approved by the Minister shall be exported from the Dominion. Such approval in regard to any variety may permit the export either generally or to any specified country or countries only. (2.) Notification of the varieties which have been approved as aforesaid shall be published in the *Gazette*.

EXPORT BRAND.

4. Every package of fruit exported from the Dominion must be branded with the registered export brand of the owner of such fruit.

5. Every person who exports or intends to export fruit from the Dominion shall apply to the Director for the registration of an export brand, enclosing with his application a facsimile of the brand he desires to register.

6. (1.) Every export brand shall contain the particulars set out in the First Schedule hereto. (2.) The size of the export brand shall coincide as nearly as possible with the size of the end of the package on which it is to be branded, but the prescribed particulars shall be displayed in characters of not less than 1 in. block type for the name of the kind of fruit and of not less than $\frac{1}{4}$ in. or more than $\frac{3}{4}$ in. block type for the other particulars. (3.) There may be used in conjunction with the prescribed particulars a design or other particulars.

7. If the application for registration of an export brand is in order, and if in his opinion the use of such export brand is not likely to lead to mistakes or confusion, the Director shall register such export brand, and shall notify the applicant in writing accordingly.

8. No person shall use any export brand unless and until he has been notified by the Director in writing that it has been registered.

9. No person shall alter, by addition, deletion, or in any other way, the non-variable particulars of a registered export brand without the consent of the Director first had and obtained in writing.

10. The Director may at any time, after giving one month's notice in writing to the owner thereof, cancel the registration of any export brand if satisfied that it has not been used during the preceding two years in connection with the export of fruit.

GRADES OF FRUIT.

11. The following are the grades of fruit which may be exported from the Dominion:—

Extra Fancy Grade,
Fancy Grade;

and the words "Extra Fancy" and "Fancy" shall be known as and are herein referred to as "grade-marks."

APPLES.

12. The following are the standards by which the grade of apples shall be determined:—

Extra Fancy Grade.—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Very slightly blemished apples may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished. The individual apples of solid red and

striped or partial red varieties shall carry not less than 75 per cent. and 50 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

Fancy Grade.—Apples of this grade shall be of not less size than 2¼ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by spray injury may also be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. The individual apples of solid red and striped or partial red varieties shall carry not less than 50 per cent. and 25 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

13. (1.) No apple shall be deemed to fall in either of the above grades if, notwithstanding that in other respects they conform to the standards set out, they have been taken from trees which have been planted out in the orchard less than seven years, and no such apples shall be exported. (2.) If an Inspector examining fruit for export as hereinafter provided has reason to doubt whether any apples submitted for examination are from trees which have been planted out in the orchard at least seven years, he may require the owner of such apples to furnish a statutory declaration that they are from such trees.

PEARS.

14. The following are the standards by which the grade of pears shall be determined :—

Extra Fancy Grade.—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and 2¼ in. if round in shape. They shall be clean, sound, clear-skinned, and of bright appearance. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, skin-puncture or skin broken at stem, and other defects. Very slightly blemished pears may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished.

Fancy Grade.—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and 2¼ in. if round in shape. They shall be clean, sound, mature, well formed, hand-picked, true to name, and free from disease, skin-puncture or skin broken at stem, and other defects. Slightly blemished pears may be included in this grade, provided that no individual pear shall have more than 5 per cent. of its surface affected thereby. Pears affected by spray injury may be included in this grade, provided that no individual pear shall have more than 20 per cent. of its surface affected thereby. Pears having characteristic russeting shall not be deemed to be unfit for inclusion in this grade.

PEACHES.

15. The following are the standards by which the grade of peaches shall be determined :—

Extra Fancy Grade.—Peaches of this grade shall be of not less size than 2½ in., well formed, true to name, free from disease and blemish, and exceptionally well coloured according to variety.

Fancy Grade.—Peaches of this grade shall be of not less size than 2½ in., well formed, true to name, free from disease and blemish, and of good colour according to variety.

PACKING OF FRUIT.

16. Prior to being placed in packages fruit shall be sized, and only fruit of as nearly as possible the same size shall be packed together in a package.

17. In sizing fruit in any particular size for the purpose of packing a variation of not more than ¼ in. above the size in question will be allowed; but no fruit shall be included in a package which is of less size than that set out in the owner's registered export brand hereinbefore required to be branded on such package.

18. Fruit of one grade only shall be packed in each package. Provided that fruit of different grades may be contained in the same package if the grade-mark to be placed on the package as hereinafter prescribed is that of the lower grade of fruit contained in such package. Provided further that nothing in this clause

shall be construed to authorize the packing-together in one package of fruit of different kinds or of different varieties of the same kind of fruit.

19. (1.) All fruit for export shall be properly wrapped in new paper having one or both surfaces glazed or in some other paper approved by the Director. (2.) Not more than two papers shall be wrapped round any one fruit.

20. (1.) Wood-wool or corrugated strawboard shall be placed at the top and bottom of each case or tray in which the fruit is packed, but in such quantities only as shall be necessary for the protection of the contents. (2.) If in his opinion the quantity of wood-wool or corrugated strawboard used is excessive, the Inspector may reject the package for export until the matter has been remedied.

21. All fruit for export shall be properly packed on the diagonal or pocket pack system.

22. All fruit for export must be packed in clean new packages, which must be properly constructed of well-seasoned timber.

23. The following are the types of packages which shall be used for the packing of fruit for export.

Apples.

(1.) Apples for export shall be packed in standard bushel cases.

Pears and Peaches.

(2.) Pears or peaches for export shall be packed in one of the following types of packages :—

(*a.*) A standard half-bushel case. (*b.*) A package of three wooden trays strapped together, one above the other, each tray having an inside measurement of 11¾ in. by 19¾ in., with a depth of from 2¾ in. to 3 in. The straps shall be of wood ⅜ in. thick and 1½ in. wide, secured to the ends of the trays, two straps to each end and flush with the sides of the package thus formed. The timber used for the construction of trays shall be of the same thickness as that prescribed for the standard bushel case. The method of strapping the trays is shown in the diagram set out in the Second Schedule hereto.

BRANDING OF PACKAGES OF FRUIT.

24. Every package of fruit for export shall, before being sent to an appointed store for examination as hereinafter provided, be branded with the registered export brand of the owner of such fruit.

25. The particulars in the export brand placed on any package of fruit relating to the grade, size, number, or variety of such fruit shall accurately describe the contents of such package, provided that a variation of not more than five per package shall be allowed in the number of fruit stated to be in such package.

26. No other brand or mark shall be placed on any package of fruit to indicate the grade or quality of the contents of such package than the grade-marks "Extra Fancy" and "Fancy" hereinbefore set out.

27. No other brand or mark shall be placed on the same end of a package of fruit as the registered export brand.

EXAMINATION OF FRUIT AT APPOINTED STORES.

28. (1.) The owner of fruit for export shall forward it, duly graded, packed, branded, and otherwise dealt with in accordance with the provisions of these regulations to an appointed store not less than two working-days before shipment. (2.) He shall at the same time give to the Inspector at the appointed store to which the fruit has been sent an advice-note in the form set out in the Third Schedule hereto or to the effect thereof.

29. Every owner of fruit sending the same to any of the appointed stores shall make his own arrangements for the transit of the fruit to and from the store, and also for its receipt, storage, opening up for examination, repacking, delivery, shipment, and any other service, including insurance and protection from damage or loss of any kind.

30. (1.) For the purpose of determining whether the particulars set out in the export brand thereon correctly describe the contents of packages of fruit submitted for examination at an appointed store, and whether all other requirements of these regulations in respect of such fruit have been complied with, the Inspector shall cause to be opened for examination 5 per centum of the packages in each line of fruit of the same variety and grade under the same export brand submitted, or such further number as he deems necessary. (2.) The decision of the Inspector in regard to the whole line shall be based on the result of his examination

of the packages so opened, being in no case less than 5 per centum by number of the line as aforesaid.

31. If after examining such fruit the Inspector is satisfied that the particulars set out in the export brand correctly describe the contents of the packages, and that all the other requirements of these regulations in respect of such fruit are complied with, he shall stamp each of the packages with a stamp (herein called the "official export stamp"), indicating that the contents have been officially passed for export, and shall issue to the owner of such fruit an export certificate in the form set out in the Fourth Schedule hereto.

32. (1.) If after examining such fruit the Inspector places it in a lower grade than that set out in the export brand on the packages he shall regrade such fruit, and shall cause to be erased the grade-mark on the packages. (2.) If in such regrading the grade is reduced from "Extra Fancy" to "Fancy" grade the Inspector may, on request from the owner of such fruit, have the grade allotted by him branded on the packages, and shall then stamp such packages with the official export stamp, and shall issue an export certificate as hereinbefore provided. (3.) Failing such a request, or if in such regrading the grade is reduced below the standard of "Fancy" grade, the Inspector shall reject such fruit for export.

33. If after examining such fruit the Inspector is of opinion that the particulars set out in the export brand on the packages of such fruit, other than those relating to grade, do not correctly describe the contents of such packages, or that any other requirements of these regulations in respect of such fruit have not been complied with, he shall reject such fruit for export.

34. Notwithstanding the foregoing provisions as to the rejection of fruit for export, nothing in these regulations shall be deemed to forbid individual fruits taken out of packages of fruit rejected for export being repacked and resubmitted at an appointed store if such individual fruits comply with the requirements of these regulations.

35. If any fruit sent to an appointed store is found to be diseased or infected fruit the Inspector shall condemn such fruit, which shall be destroyed or otherwise dealt with as the Inspector directs. The expense of such destruction or treatment shall be borne by the owner of the fruit.

36. Notification of any regrading, rejection, or condemnation of fruit for export shall be made immediately to the owner of such fruit by the Inspector.

37. No person shall remove from any appointed store, except for the purpose of immediately shipping it beyond New Zealand, any fruit for which an export certificate has been issued unless the export certificate is surrendered to the Inspector and the official export stamp upon the package or packages containing such fruit has been erased or cancelled to the satisfaction of the Inspector.

38. If any fruit which has been examined by an Inspector and passed for export has become, prior to its export from the Dominion, damaged, or in the opinion of an Inspector has deteriorated, the owner of such fruit shall, if and when directed by an Inspector to do so, submit such fruit for re-examination, and shall on demand surrender to the Inspector the export certificate issued in respect thereof.

39. In respect of fruit submitted for examination at an appointed store the decision of the Inspector as to grade, packing, branding, or other compliance with the provisions of these regulations shall be conclusive, and no action or other proceedings shall lie against an Inspector or other officer of the Crown, or against the Crown, in respect of any erroneous decision of the Inspector.

PENALTIES.

40. Every person who—(1) Forwards to an appointed store any fruit which is noticeably at variance in any particular with the description of such fruit set out in the export brand on the packages containing the same; or (2) forwards to an appointed store any fruit which is diseased or infected; or (3) exports or attempts to export, or forwards to an appointed store, any apples taken from trees which have not been planted out in the orchard at least seven years; or (4) exports or attempts to export any fruit which has been rejected for export by an Inspector or for which no export certificate has been issued; or (5) exports or attempts to export or is concerned in exporting any fruit of a variety approved for export to a specified country or countries only, to any other country; or (6) except as otherwise provided in these regulations, alters or obliterates wholly or partially, or causes to be altered or obliterated, any official export stamp on any package of fruit, or counterfeits or improperly impresses any official export

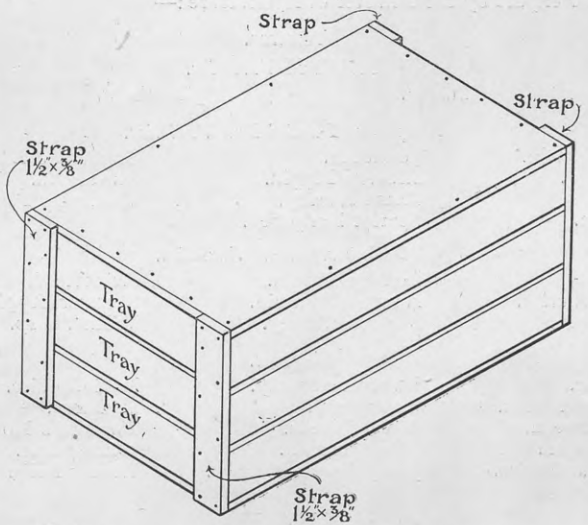
stamp on any package of fruit for export; or (7) commits or is concerned in committing any breach of these regulations, shall be liable to a penalty not exceeding £20.

FIRST SCHEDULE.—(REG. 6.)

EXPORT BRAND FOR FRUIT.

NEW ZEALAND [*State kind of fruit*].
Variety :
Grade :
Size of fruit :
Number of fruit in package :
Packed for export.

SECOND SCHEDULE.—(REG. 23.)



A Package of Three Trays strapped—End View.

THIRD SCHEDULE.—(REG. 28.)

ADVICE-NOTE SUBMITTING FRUIT FOR EXAMINATION PRIOR TO EXPORT.

The Fruit Inspector,
Department of Agriculture,

.....

IN compliance with the regulations under the Orchard and Garden Diseases Act, 1908, and its amendments, I hereby submit for examination the undermentioned fruit for export, which I have forwarded this day per to the appointed store belonging to at .

Please send the export certificate to .

Shipping-mark.	Registered Export Brand.	Number of Cases.	Kind of Fruit.	Variety of Fruit.	Grade.	Size.

(*Address and date.*) (*Signature.*)

FOURTH SCHEDULE.—(Reg. 31.)

EXPORT CERTIFICATE FOR FRUIT.

I HEREBY certify that I have this day examined the undermentioned packages of , and, having found the contents free from disease and in conformity with the description branded on the packages, have passed them for export, and have stamped the packages with the official export stamp.

Number of Cases.	Kind of Fruit.	Variety.	Grade.	Export Brand.	Shipping-mark.

(*Place and date.*) , Inspector.

VARIETIES OF FRUIT APPROVED FOR EXPORT.

IN terms of the foregoing regulations the following varieties of fruit have been approved for export by the Minister of Agriculture :—

APPLES.

Solid Red Varieties.

Tasma. Spitzenberg.

Striped or Partial Red Varieties.

Adams Pearmain.	Jonathan.	Scarlet Pearmain.
Cox's Orange.	Ribston Pippin.	Statesman.
Delicious.	Rome Beauty.	Worcester Pearmain.
Gravenstein.	Scarlet Nonpareil.	

Yellow or Green Varieties.

Cleopatra.	London Pippin.	Reinette du Canada.
Dunn's Favourite.	Newtown Pippin.	Sturmer Pippin.
Golden Pippin.	Parlin's Beauty.	Willie Sharp.

PEARS.

Beurre Bosc.	Directeur Hardy.	Marie Louise.
Beurre Capiaumont.	Durondeau.	P. Barry.
Beurre Clairgeau.	Giblin's Nelis.	Twyford's Monarch.
Beurre d'Anjou.	Glou Morceau.	Winter Cole.
Doyenne du Comice.	Josephine de Malines.	Winter Nelis.

PEACHES.

Elberta.	Kia Ora.	Sea Eagle.
Hobbs's Late.	Lippiatt's Late Red.	Sea Eagle Improved.
James's Cling.	Paragon.	Solway.
Kalamazoo.	Prizetaker.	Wheatland.

GOVERNMENT GUARANTEE AS TO EXPORT OF FRUIT.

IN a *Gazette* notice, dated 16th February, 1920, the Minister of Agriculture notified that the Government guarantees to shippers a net return of 1d. per pound net weight on all fresh fruit exported from New Zealand during the present season, provided that the guarantee shall apply only to shipments complying with the Government stipulations and covered by a Government Inspector's certificate.

Areas in Orchards, Gardens, Plantations, &c.—Particulars of the area in occupation in New Zealand under this class in 1918–19 (aggregated as 142,115 acres on the opposite page) are as follows: Commercial orchards—bearing, 14,182 acres; not bearing, 12,968 acres: orchards for private use only, 7,572 acres; vineyards, 213 acres; market gardens, 2,472 acres; nurseries and seed-gardens, 501 acres; private gardens and grounds about residences, 55,226 acres; plantations, 48,981 acres.

OCCUPATION AND USE OF LAND IN NEW ZEALAND: 1917–18 AND 1918–19.

—	1917–18.	1918–19.	Increase.	Decrease.
	Acres.	Acres.	Acres.	Acres.
Grain and pulse crops	819,169	750,964	..	68,205
Grasses and clovers (cut for seed or hay), green and root crops	884,146	820,035	..	64,111
Sown grasses (not cut for seed, hay, or ensilage) ..	15,448,134	15,831,604	383,470	..
Fallow lands	77,791	68,619	..	9,172
Gardens, orchards, plantations, &c.	156,920	142,115	..	14,805
Unimproved land	25,825,919	25,729,369	..	96,550
Totals	43,212,079	43,342,706	130,627	..

DETAILS OF UNIMPROVED LAND: 1918–19.

Land District.	Phormium Tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush.	Barren and Unproductive Land.	Total Unimproved Occupied Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland ..	5,201	210,721	810,029	407,360	121,830	1,555,141
Auckland	11,194	435,049	1,001,829	731,545	63,197	2,242,814
Hawke's Bay ..	243	860,917	346,766	334,414	104,536	1,646,876
Taranaki	50	10,653	65,698	325,900	5,484	407,785
Wellington.. ..	19,249	502,302	282,345	448,560	91,660	1,344,116
Nelson	3,401	303,910	151,552	480,436	49,872	989,171
Marlborough ..	1,265	1,242,318	209,599	200,816	401,025	2,055,023
Westland	6,669	226,661	65,995	995,846	299,688	1,594,859
Canterbury.. ..	1,947	4,445,331	104,105	239,000	682,128	5,472,511
Otago	1,734	6,003,478	207,522	123,709	207,379	6,543,822
Southland	4,668	1,384,128	148,495	211,631	128,329	1,877,251
Totals	55,621	15,625,468	3,393,935	4,499,217	2,155,128	25,729,369

(From Agricultural and Pastoral Statistics: Government Statistician, 1919.)

IMPROVED WHEAT-SEED.

FOR the last ten years the authorities at Lincoln College, Canterbury, have been giving attention to the improvement of the different kinds of wheat commonly grown in New Zealand, and have distributed some strains which show considerable improvement over the commercial seed. The variety known as College Hunters or Red Chaff has now almost completely replaced the old Hunters grown five years ago, and a prolonged tour in mid-Canterbury did not reveal a single crop of this variety that was not grown from College seed. More recently improved strains of Pearl, Solid-straw Tuscan, and Purple-straw Tuscan have been distributed, and these have in nearly every case shown superiority over the old seed.

To keep up the supply of seed of these strains a Canterbury Seed-growers' Association was formed, and it has on hand seed of the varieties mentioned, each bag of which bears a certificate that it was inspected while growing, is true to name, relatively pure, and free from noxious weeds. Growers desiring seed of these strains should send applications early to Dr. F. W. Hilgendorf, Lincoln College, via Christchurch, who is acting as honorary secretary to the association.

DIATOMACEOUS AND SILICEOUS EARTHS.

DURING the past few years the writer has examined several specimens of diatomaceous or pure siliceous earths. In 1917 some excellent samples were sent in. The origin of these siliceous earths was difficult to account for, owing to the absence of any evidence of organized structure. Some specimens were submitted to New Zealand manufacturing firms, who reported favourably upon the material, and stated their willingness to adopt it in place of material which they had hitherto imported. The matter was mentioned in the annual reports for the years ending 31st March, 1917 and 1918. Since then some additional samples have been dealt with, and some have been utilized in glue-making and in one other industry which previously imported its kieselguhr or diatomaceous earth. Recently other material of this nature has been received, and on examination disclosed clearly the minute siliceous remains of a low form of life.

The position, therefore, appears to be that excellent samples of diatomaceous earth are available in widely scattered localities throughout the Dominion, and it is advisable that an endeavour should be made to utilize the more accessible deposits. Supplies of this material imported cost several pounds a ton, and in these days of high freights it might pay to give preference to the local supplies. This diatomaceous earth has many applications in the manufactures, and is used in glue-factories for filtering. It would probably be valuable as an insulating-material—very likely superior to pumice. It has also been used as an absorbent for nitro-glycerine in the manufacture of explosives.

The Department would be pleased to supply to any inquirers the names of those who have sent in samples of these earths.—*B. C. Aston.*

THE JOURNAL SUBSCRIPTION RATE.

OWING to the steadily increasing cost of production—chiefly in paper and other materials—it has been found necessary to raise the yearly subscription rate of the *Journal* from 2s. 6d. to 4s. The new rate will apply to all subscriptions, including renewals, from 1st April next. The charge for a single copy remains at 6d., but subscribers' extra copies will be 4d. instead of 3d. each. The Department, although much regretting the change, feels sure that subscribers will readily accept the position, and that the rural community would not desire an official agricultural publication of the class of the *Journal* to be maintained partially at the expense of the general taxpayer. It may be mentioned that the old rate of 2s. 6d. was fixed at the inception of the *Journal* in 1910.