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AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.*

NO. 1.—INTRODUCTION.

By Dr. L. COCKAYNE, F.R.S.

GENERAL.

AFTER crossing the actual divide of the Southern Alps from the west a point is soon reached at about an altitude of 2,000 ft. in the north to 1,000 ft., more or less, in the south, where the dense forest of the west gives place, all on a sudden, to a curious grassland composed for the most part of brown tussocks. This point marks the average limit of the heavy western rainfall. Frequently such rain extends to the very margin of the forest, while less than a mile to the eastward the sun is shining, or, at most, a few drops of rain are carried by that furious gale which nearly always accompanies the downpour. So sharp is this distinction between western forest and eastern grassland, commencing at the

* Dr. Cockayne was recently appointed by the Department to conduct an economic investigation of our montane tussock-grassland, and has now carried out a good deal of preliminary work. The present is the first of a series of articles on the subject which he will contribute to the *Journal*.—EDITOR.

River Wairau (Marlborough) in the north and ending at the forest of Southland, that hardly a single tree invades the grassland, but the forest stands a dense, dark barrier with clean-cut margin, whence extends eastwards the tussock-grassland. The change in the scene is instantaneous—there is no transitional phase. The average amount of rain and number of rainy days at this critical line—the junction of forest and grassland—is a fair gauge of the minimum demand of that special forest-association (usually southern-beech—*Nothofagus*) with regard to rainfall, but it does not indicate how much rain tussock-grassland itself can tolerate, since the extension of the latter plant-formation westwards is barred, not by climate, but by the forest-mass. Where the forest has been destroyed by fire, and the surface soil not become too greatly eroded, grassland is readily established beyond its natural western limit. Eastwards the tussock-grassland extends, it may be, to the coast as the main type of vegetation ; but in various localities, especially near the coast-line or in mountain-gullies or shady slopes, there were originally considerable areas of forest. These have been greatly reduced by fire, milling, or other causes, so that now, at above 1,000 ft. altitude, the tussock-grassland of the South Island is more extensive than in the early days of settlement. At a lower altitude much of the plant-formation under consideration has given way before the plough, and now is in permanent pasture or undergoing rotation-farming. Other lowland tussock-grassland, extending southwards to about the River Waitaki, has spontaneously become danthonia pasture.

There is even yet a good deal of lowland tussock-grassland, but it does not concern this series of articles and the special research they are intended to chronicle, which is primarily connected with the tussock plant-covering, much of which is unploughable, situated on the eastern slopes and in the valleys of the Southern Alps and other eastern ranges. From the economic standpoint this grassland is the main grazing-ground of the back-country sheep-stations.

The term "montane," as here used, needs a brief explanation. Probably the average length of time during which the main winter snowfall lies upon the ground at different altitudes regulates the distribution of the species and the character of the vegetation of a high mountain. Thus the plant-covering of such a mountain is arranged in distinct belts, each of which has its own special plant-associations, while a number of species are either confined to it alone or much more common on that belt than on any of the others. Obviously, then, each belt provides a different type of pasture for sheep. The lowest—that extending, according to latitude and climate, from, say, 1,000 ft., more or less, to 3,000 ft., more or less—is here called the *montane belt ;* above this, extending upwards for some 2,000 ft., comes the *subalpine belt ;* and all above this up to the actual summits of the mountains forms the *alpine belt.*

Although certain tussock-grasses may ascend to the actual summits and be common enough at all altitudes the main tussock-grass community is that of the montane belt. This great grassland spread over an area of some 6,000,000 acres is, as already noted, the pasture-ground *par excellence* for the mountain flocks of sheep of the South Island.

Owing to the treeless character of the montane tussock-grassland and its accessibility it was early in the history of settlement rapidly

converted into sheep-runs, so that at the beginning of the "sixties" of the last century almost as great an area was occupied by sheep as at the present time, while not a few of the runs date back to the early "fifties." The grassland under consideration has therefore been continuously grazed for close on sixty years. During that rather long period nothing of moment has been done to improve the carrying-capacity of this grassland, but, as will be seen, quite the contrary has been the case. "It may appear strange," writes A. H. Cockayne (Trans. N.Z. Inst., vol. 48, p. 155), "that in New Zealand, where the general trend of farming operations is in the direction of increasing the carrying-capacity of land, comparatively no effort is made towards any improvement in the utilization of the montane tussock-grassland. For the past fifty years the methods adopted have not varied except in one particular—namely, in a change in the type of sheep used." Again, the same author emphasizes an important fact when he says (*loc. cit.*), "They [the montane tussock-grasslands] represent one of the few natural resources of the Dominion that have remained a permanent asset without having to be intentionally modified or specially treated to render them capable of continued production."

An area of montane tussock-grassland, where the tussocks stand thickly side by side, might, at first glance, well be considered pasture of a fairly high quality. Yet the fact stands out that were such an area capable of grazing one sheep to three acres it would far exceed in its carrying-capacity most parts of the tussock-grassland. Much at the present time will not carry even one sheep to five acres, and some parts are virtually barren. Nor do the above statements of necessity apply to those areas where the plant-covering has been greatly damaged and modified by the presence of rabbits in their thousands. Without going into special details, it stands out clearly that the agricultural position of the montane tussock-grassland is far from satisfactory, but it seems hopeful that methods can be devised for raising its carrying-capacity—or, indeed, such methods may be in practice on certain runs. New methods for improvement must be based on an accurate knowledge of the present plant-covering of the area, of the natural changes taking place, of the climate and soil conditions to which the species are exposed, of the effect of the operations of man and his grazing-animals, of the life-histories and physiological requirements of the species, of the germinating-capacity of their seeds, of the histories of the plant-associations, and of other matters connected with the relation of the plants to their extremely complex surroundings.

COMPOSITION OF THE MONTANE TUSSOCK-GRASSLAND.

A detailed account of the composition of the montane tussock-grassland and the differences it exhibits in various parts of its area may form the subject of some future articles of this series. It is intended as the study of the grassland proceeds to try and find out with fair accuracy the contents of various types of pasture at different altitudes, aspects, and so on, so as to gain a much greater understanding of the composition of the grassland than is at present available. Naturally, the all-important classification of the different types of tussock-grassland would result.

Speaking quite generally, and taking the montane tussock-grassland of the South Island in its entirety, it is made up of some 210 species of indigenous plants which belong to 39 families and 98 genera. Even more important from the economic standpoint than the specific distinctions of the plants are their growth-forms, for the actual form of a plant tells a good deal about its requirements; in fact, a knowledge of the growth-forms suitable for a certain environment may give a clue as to what plants of economic value are suited for introduction or experiment. But this matter of growth-forms is too complicated to introduce into this introductory article; here it need only be pointed out that the tussock form, the mat form, the tufted form, the turf-making form, the rosette form, and the cushion form are of great importance amongst the grasses, sedges, semi-woody plants, and herbs of the grassland. With regard to the shrubs, the leafless flat-stemmed form and the prostrate or dwarf (perhaps creeping and rooting) form are of considerable moment. Annuals are very few in number. Plants whose above-ground parts die to the ground yearly—*e.g.*, the various forms of tutu (*Coriaria*)—are not many, but such plants may become extremely aggressive, as they can defy fire.

Besides the indigenous species of the montane grassland there are more than forty introduced species, some of them—*e.g.*, cocksfoot, red clover, and white clover—of a much higher food-value than any of the indigenous species. It is doubtless the presence of the introduced plants which has saved the grassland from further deterioration. Some of these plants would not be thought desirable by the farmer of the lowlands, but anything which sheep will eat can fill a want in the mountain pastures. Amongst widespread plants of this latter class are the following: Sweet vernal grass (*Anthoxanthum odoratum*), fiorin (*Agrostis stolonifera*), red-top (*A. vulgaris*), Yorkshire fog (*Holcus lanatus*), meadow-grass (*Poa pratensis*), broom (*Cytisus scoparius*), sorrel (*Rumex Acetosella*), winged thistle (*Carduus pycnocephalus*), and catsear (*Hypochaeris radicata*).

The dominant species of the montane tussock-grassland is the fescue-tussock (*Festuca novae-zealandiae*), just as the silver-tussock (*Poa caespitosa*), a grass of very similar appearance, dominates the lowland tussock-grassland. These two associations are called "low tussock-grassland," to distinguish them from "tall tussock-grassland," where the red tussock (*Danthonia Raoulii* var. *rubra*), or one of its allies, are the dominant tussock-grasses. Frequently in montane tussock-grassland the small blue tussock (*Poa Colensoi*) is extremely common; generally that dark-stemmed spinous shrub, the wild-irishman (*Discaria toumatou*), is dotted about here and there. There are many other common members of the association, of which only a few can be cited here—*e.g.*, various species of piripiri (*Acaena*), the spear-grass (*Aciphylla squarrosa*), the spaniard (*A. Colensoi*), certain turf-making raoulias (*Raoulia subsericea, R. glabra*), the mountain-groundsel (*Senecio bellidioides*), and the pungent heath (*Leucopogon Fraseri*); but the frequency of any species differs greatly in different localities and under different conditions in the same locality.

CERTAIN GRASSLAND PROBLEMS.

There is problem after problem awaiting solution in order to prepare a path for advance in improving the montane grassland. The following

are some, out of the many, problems which are being attacked, and they may serve to give some idea of what is meant by the title of this article, "An Economic Investigation of the Montane Tussock-grassland of New Zealand."

(*a.*) *Botanical Names of Plants.*

A few lines back certain species were cited under their botanical names. These names are those of science, and one might confidently anticipate that they would represent definite unchangeable entities of the plant-world, for science is supposed to be exact. But such a belief would lead to great confusion; indeed, for economic purposes certain of these botanical names are highly misleading. In fact, they do not refer to groups of similar individuals which reproduce their like from seed, but to mixtures of such groups, although possibly each group of the mixture is quite distinct from all the other groups of which this is made up in regard to its soil-requirements, its palatability,* and its other characters of fundamental economic importance. Such composite species which are ideas only and do not exist in nature are termed *aggregate species*. They are a botanical convenience only in the early stages of investigation of a flora. To look upon such names as final would be equivalent to abandoning the agricultural names of cultivated plants, and, using a concrete example, to clump together swedes of all kinds, soft turnips of all kinds, and garden turnips of all kinds under the comprehensive name "turnip." Needless to say, a field sown with such a mixture would be a remarkable sight as the crop developed.

It is clear, then, that the actual segregation of the various races of palatable grasses and other herbs of the tussock-grassland, and the giving to such unnamed races definite names, is an important preliminary to economic advance. This study is being prosecuted not only by the aid of specimens living and dried and field observations, but by cultivating numbers of plants of the same aggregate species side by side in different gardens—*i.e.*, under different environments.

(*b.*) *Relative Palatability of the Various Species.*

With regard to the palatability of the various species of the montane tussock-grassland very little is known. Two sheep-farmers, both men of the greatest experience, expressed to me totally divergent views as to the value of Chewings fescue, the one asserting that sheep hardly touch it, and the other that it was a valuable feed. Even regarding the actual feeding-value of the fescue-tussock and the silver-tussock nothing definite is known. The blue tussock (*Poa Colensoi*) has been asserted again and again to be highly palatable, yet there is considerable evidence come to hand that it is rarely eaten. In short, most that has been recorded regarding the palatability of the indigenous grasses and herbs is mere guesswork. On the other hand, a purely scientific study of the high-mountain plant-associations has shown that the greater part of the tussock-grassland species are not eaten at all. Unfortunately, many of these are able to spread so rapidly by means of certain of their vegetative parts (underground or creeping stems, for example) that when the balance of nature is disturbed by fire, or the palatable species are

* In most dictionaries this word is not given, but in its place is "palatableness." The Oxford Dictionary, however, gives both words, and I chose "palatability" because it is much more easily pronounced.

kept in bounds through grazing, these non-palatable plants increase their area of occupation by leaps and bounds and become true noxious weeds. Thus wide breadths of the grassland become for pasture purposes just as barren as if no plants were present—more barren, indeed, than most parts of the depleted area of Central Otago.

The following are some of these indigenous induced weeds: The red piripiri (*Acaena microphylla*), the spineless piripiri (*Acaena inermis*), the turf-coprosma (*Coprosma Petriei*), the mat-raoulia (*Raoulia subsericea*), the mountain-twitch (*Triodia exigua*), the swamp-lily (*Chrysobactron Hookeri*), and, above all, the pungent heath (*Leucopogon Fraseri*).

Coming now to actual measurement of palatability, an experiment is to be carried out at Hanmer Springs this month in order to ascertain the relative palatability of certain plants both indigenous and introduced. A paddock of 25 acres is fenced in with rabbit-proof fencing. Its plant-covering, consisting of 100 species or so, available for sheep, has been noted. Labels, 270 in number, have been fixed here and there telling what species are in their vicinity. Five hundred sheep are to be turned on to this area, and the plants they feed on are to be carefully noted. Early in the first day the most palatable are expected to be chosen, and so on until at the end of perhaps a week only those species will be getting eaten which, under ordinary circumstances, would not be eaten at all. By means of experiments of this nature and by extended observations in the field it should eventually be possible to assign to each species a number denoting its palatability. Then, when the composition of the plant-covering of a tussock-area is accurately estimated, so that the amount of ground occupied by each species is approximately known, it should be feasible to give such a combination of plants a number which would denote its value as a wool-producing crop, and thus various areas could be compared in this regard. But for such a distinct advance the time is still distant.

The sheep-runs of the Waimakariri River basin (Canterbury) offer an exceptional advantage for observing what sheep eat, because in that area the rabbit has never become a pest; indeed, rabbits are so few as to be negligible.

(c.) The Question of Burning the Tussock.

Even in the earliest days of sheep-farming it was found that the fescue-tussock and the silver-tussock were but little relished by sheep, but that, on being burnt, green leaves upon which sheep could feed were put forth in abundance. Burning, then, has taken place yearly in some part or other of most montane sheep-runs since the "fifties" and "sixties" of the last century. Generally speaking, such burning has been *indiscriminate*, with the consequence that acres and acres of tussock-grassland have been turned into stony debris; that indigenous weeds, as described above, have replaced wide areas of more or less palatable grassland; that the subalpine shingle-slips have increased in size; that forest and shrubland—both valuable for shelter purposes—have disappeared; and, finally, that the depredations of the rabbit have become intensified.

It should not be a difficult matter, by aid of observations and experiment, to study the actual effects of burning, and to arrive at a better understanding as to how, when, and where burning should be carried out. Even at this early stage of the montane grassland investigation,

but bearing in mind the observations of many years, it may confidently be asserted that indiscriminate burning is a dangerous practice even when carried out at what is considered the best time—the month of August or thereabouts. There appear to be definite cases in which burning is indefensible. Some of such cases are the following: (1) Where the tussocks are obviously weakly and small; (2) on stony slopes readily turned into shingle-slip; (3) in the subalpine or alpine belts; (4) in the neighbourhood of rabbit-warrens; (5) where there is a chance of greatly increasing an unpalatable plant, especially the swamp-lily (*Chrysobactron Hookeri**).

(d.) The Rabbit Question.

That a sheep-run may be rendered valueless by "overstocking" with rabbits need not be emphasized. Nevertheless there is much to be learnt regarding the control of the rabbit and the relation of this pest to high-mountain sheep-farming. That so much of Central Otago is "depleted" is not altogether the effect of the rabbit. There has been indiscriminate burning and more or less overstocking with sheep. But the climate is the driest in New Zealand, and this to no small extent is also responsible for the state of affairs in Central Otago.

In parts of the Upper Awatere Valley (Marlborough) the progress of damage by the rabbit may readily be studied. On the rather loose side of gentle slopes where there are thickets of the wild-irishman† (*Discaria toumatou*) are many rabbit-warrens, where every stage of grassland destruction may be observed. Taking the case of a piece of ground closely occupied by tussocks, the bare earth stands out conspicuously dotted with rabbit-holes and surrounded by a wall of tussocks, which in many places, owing probably to the heavy manuring they undergo, are more or less moribund, especially where bare ground and tussock meet. The first stage of depletion by no means removes all the vegetation, but the primitive tussock-association is replaced by somewhat the following combination of species: Sorrel (*Rumex Acetosella*) in great abundance, and forming the groundwork of the new induced association; the small rosettes of the mountain cranesbill (*Geranium sessiliflorum* var. *glabrum*) dotted here and there, a remnant of the primitive plant-covering not eaten even by rabbits; the pale-leaved willowherb (*Epilobium novae-zealandiae*), a slender, small, semi-prostrate herb, also not eaten; sage-green, more or less circular mats of the mountain piripiri (*Acaena sanguisorbae* var. *pilosa*); brown, flat, circular mats of the spineless piripiri (*Acaena inermis*); the small, grass-like sedge *Carex breviculmis;* some Scotch thistle (*Carduus lanceolatus*); chickweed (*Stellaria media*); and the larger mouse-ear (*Cerastium triviale*). The three last-named species and the sorrel are introduced plants, the remainder are indigenous. The oldest part of the infested ground is distinguished by the rabbit's unmistakable trade-mark—the great circular, silvery or green, dense, low cushions of the scab-weed (*Raoulia lutescens*), between which, especially where exposed to the wind, there may be no other plants. Where no depletion is taking

* Acres and acres on many sheep-runs are now occupied and rendered useless by this pretty but economically worthless plant.

† To some better known as "Matagowrie," a corruption of the Maori *tumatukuru*.

place the scabweed is confined to river-bed or other stony ground, but when the tussock and most of its accompanying plants are removed there is bare ground for the germination of its wind-borne "seeds."

(e.) The Distribution of Danthonia.

If it were possible for danthonia (*Danthonia pilosa* in one or other of its unnamed varieties) to become established in sufficient quantity on the montane tussock-grassland, then the carrying-capacity of the pasture would be greatly increased. The exact altitudinal distribution of danthonia is not at present known. From my observations in October last I found that it reaches to somewhat over 2,000 ft. in the Awatere Valley (Marlborough). Experiment and observations are urgently demanded in the following directions: (1) To find out the exact altitudinal range of danthonia at the present time in various mountain areas; (2) to sow and plant danthonia at various altitudes under different conditions; (3) to separate from the complex mixture of races known collectively as Danthonia pilosa one or more races (varieties) which are hardy and capable of holding their own in the montane tussock-grassland.

(f.) Surface-sowing.

Surface-sowing on the montane tussock-grassland is practised but little at the present time, but formerly it was carried out to a considerable extent. Seed was scattered here and there on various parts of the run, but, so far as I am aware, the results were not satisfactory. The causes of failure were, in part, the use of unsuitable species, such as rye-grass (*Lolium perenne*); sowing at the wrong time of the year; and, especially, using seed of an extremely poor quality, anything being considered good enough. Above all as a cause of failure is the fact that the hard soil is altogether unfavourable for the germination of seeds. Thus it seems necessary to find out accurately how seeds of different species of edible plants behave with regard to germination under different conditions of the surface soil. Seeds of various grasses and other plants will therefore be sown in small patches on a piece of montane tussock-grassland enclosed for the purpose. The physical condition of the surface soil upon which the seeds are sown will be carefully noted, and the various seed-beds will be chosen so as to differ greatly in this regard, just as the actual grassland where sheep graze offers a considerable diversity of stations for the germination of seeds. Then, it is also proposed to carry out a number of surface-sowings on the ordinary pasture, using as the seed-bed burnt tussock, unburnt tussock, ground with the surface slightly broken up, stony river-flat, and so on. Seed-mixtures for this purpose have been designed and carefully prepared by the Biologist of the Department. As this matter of surface-sowing develops it will be dealt with in future articles. The Waimakariri sheep-runs with their almost entire absence of rabbits offer special advantages for these experiments.

(g.) Cultivation.

A certain amount of cultivation is carried out on the land in the vicinity of the homesteads of most sheep-stations. This is usually for the purpose of providing chaff for the working-horses. Usually no provision is made for furnishing winter feed, but for such the

sheep are dependent on that supplied by the "winter country"—*i.e.*, certain slopes facing the sun or the lowest parts of the run.

It is important to find out exactly what cultivation is being carried out at different stations, and especially at what altitudes paddocks of permanent grasses such as cocksfoot (*Dactylis glomerata*) have been established. This most valuable grass is now growing on certain mountain sheep-runs as if it were indigenous. In the valleys, for instance, between Molesworth and Tarndale, drained by the Acheron and its tributaries, in many places splendid cocksfoot grows naturally, and also white clover (*Trifolium repens*) is in astonishing abundance. This area is reached by a good deal of western rain, so the foregoing is no criterion as to the behaviour of cocksfoot and white clover elsewhere.

At Molesworth itself, where the climate is drier, at an altitude of about 2,800 ft., there is a good paddock of cocksfoot which has been established for more than ten years. I saw it only in the middle of October after an exceptionally late winter, and at that time the grass formed rather dense cushions between which were patches of ground occupied by sorrel.

At a height of 2,200 ft., more or less, at Castle Hill Station (Canterbury), Mr. J. Millikin grows most excellent cocksfoot. He also grows yearly, at the same altitude, 100 acres of Green Globe turnips on which sheep are fed, and 100 acres of oats for hay.

Lucerne (*Medicago sativa*) is virtually neglected by the back-country sheep-farmer, but many intend to put in a little as an experiment. As lowland Marlborough is the great centre for lucerne-growing, its cultivation, as might be expected, is extending into the mountain-valleys. Thus, Mr. W. Stevenson showed me at Upcot (Awatere Valley), at an altitude of about 1,800 ft., some excellent lucerne, and there is a small area at an altitude of about 2,200 ft. in the orchard at Langridge farther up the valley. Speaking of the mountain-valleys generally, there are many river-flats at an altitude of 1,500 ft. and upwards which look well suited for the growing of lucerne, and experiments as to their capabilities in that direction are urgently demanded. At present the excessive cost of fencing prohibits anything being done on a large scale, but quite modest experiments could demonstrate the feasibility or the contrary of lucerne-cultivation.

NOTE.—In this article and investigation the term "grassland" is used in its plant-geographical sense, and does not refer to land on which the grass grows, but to the plant-covering alone, which consists principally of grasses.

Small Sheep-dipping Plant.—Several inquiries have been received as to the quantities of concrete required for the bath and draining-floor of the one-man sheep-handling plant described and illustrated in the *Journal* for June last and reprinted as Bulletin No. 75. The quantities are as follows:—Dipping-bath: Concrete for walls and floor, $5\frac{1}{2}$ in. thick = $2\frac{1}{2}$ cubic yards; cement plaster for surface of same, 15 square yards. Dripping-floor: Concrete, 4 in. thick = 2 cubic yards; cement plaster on surface of same = 16 square yards. Concrete to be composed of 6 parts clean gravel, 2 parts clean sand, and 1 part cement. Plaster to be composed of 2 parts clean sand and 1 part cement.

SOME NOTEWORTHY FLIES AFFECTING LIVE-STOCK.

By DAVID MILLER, Entomologist.

THE value of a more intimate practical knowledge of noxious insects is now recognized as of considerable importance to those interested in the various branches of agriculture. As many such species have become established in this country we cannot afford to overlook their presence, particularly at the present time when the greatest efforts are required to fully develop the resources at our command.

Amongst these noxious insects are several forms of introduced two-winged flies (Diptera) which every one connected with live-stock should be capable of recognizing, although, fortunately, at the present time in New Zealand there is practically no serious loss to domestic animals through the agency of such species. However, it should not be forgotten that these flies cause considerable damage in their native homes, and may under favourable conditions resume their depredations in this country. It is also noteworthy that we have no record of any indigenous fly attacking domestic animals, a fact which may be due to the absence before the advent of the white man of any mammals suitable as hosts. Nevertheless, since there is the possibility of certain native forms developing injurious habits (as has been the case with several vegetable-feeders) a constant watch should be kept for such species amongst our live-stock.

Besides the bot-flies of the sheep and horse (Figs. 1–4), which are already well known, there are other forms which may now be given some explanation.

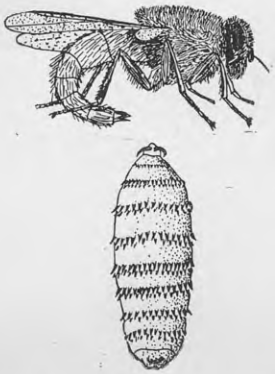
THE MAGGOT-FLIES.

Sheep are frequently exposed to the attack of the maggot-flies, the larvæ of which destroy the wool. Of these species occurring in New Zealand, the yellow or golden-haired blow-fly (*Pollenia villosa*, Fig. 5) is the most noteworthy. This fly is a native of Australia, and is easily distinguished by its golden-yellow head, abdomen, and legs, the abdomen being mottled in certain lights. In size and shape, but not in colour, it resembles the ordinary bluebottles.

When the wool is blown the larvæ or maggots quickly move away from the light down toward the skin—into which they may burrow—so that at first the wool appears perfectly healthy, but soon becomes discoloured, and eventually putrid and offensive, when it either peels or is rubbed off by the sheep against trees or posts. At such a stage the exposed skin is frequently covered with festering sores. The maggots usually frequent soiled wool, but they may sometimes enter the vagina of ewes, and, in cases of foot-rot, often occur in the feet. The pupæ are formed in some sheltered spot upon or in the ground.

Like most blow-flies, *Pollenia villosa* does not only breed upon the wool of sheep, but in any decaying matter (particularly animal), the wool-blowing apparently being a recent habit. In Australia this fly is a serious pest. In New Zealand, although at present not affecting wool-growing to any serious extent, it is perhaps one of the most abundant species of flies, and is often to be found in houses, where it is well known from its obnoxious habit of blowing meat.

The greenbottle-fly (*Lucilia sericata*) is another injurious form, although in this way it is a much more serious pest in Europe than in New Zealand, where recent observations show that greater injury is caused by the yellow blow-fly. However, since the greenbottle is more abundant in some parts of the Dominion than in others, it is probable that where it is plentiful its larvæ are of more frequent occurrence upon



FIGS. 1 AND 2. HORSE BOT-FLY AND LARVA.

Showing characteristic attitude of female fly.
Enlarged.

FIGS. 3 AND 4. SHEEP NASAL BOT-FLY AND LARVA.

Enlarged 2 diameters.

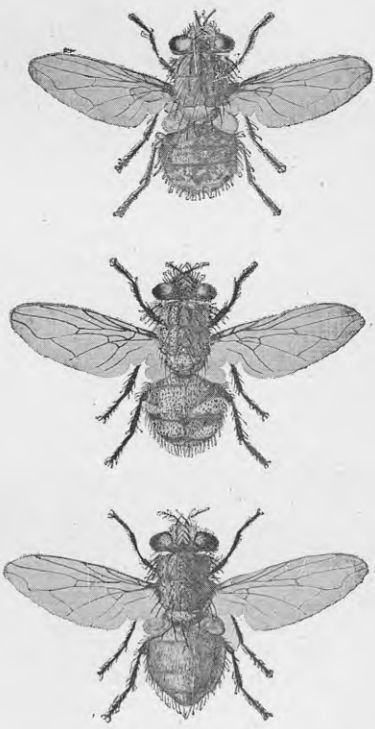


FIG. 5 (TOP). YELLOW BLOW-FLY. FIG. 6 (MIDDLE). EUROPEAN BLUE-BOTTLE. FIG. 7 (BOTTOM). NEW ZEALAND BLUEBOTTLE.

Enlarged 2 diameters.

sheep. On account of their somewhat similar greenish appearance several other species of greenbottles are often confused with *L. sericata*, and frequently if any of the former occurred in districts where were cases of blown wool they were immediately condemned as the culprits.

The other two species of blow-flies which should be closely observed in regard to the possible damage to wool are the European bluebottle

FIG. 8 (LEFT). COMMON STABLE-FLY. FIG. 9 (RIGHT). COMMON HOUSE-FLY.

Enlarged 3 diameters.

(*Calliphora erythrocephala*, Fig. 6) and the New Zealand bluebottle *C. quadrimaculata*, Fig. 7). They are both large flies of about equal size and very much alike in general appearance. They may be distinguished by the following comparative details :—

——	European Blow-fly (Fig. 6).	New Zealand Blow-fly (Fig. 7).
Face	Distinctly orange-red ..	Indistinctly orange-red, almost black.
Thorax ..	A single orange spot on each side behind the head	An orange spot on each side behind the head, another near the abdomen ; and a third at the base of the wing.
Abdomen ..	Prussian blue with silvery reflections	Altogether violet-blue.

THE STABLE-FLIES.

Besides the foregoing species, the larvæ of which are injurious, some forms of flies have harmless larvæ but are blood-suckers in the mature state. The stable-flies cause considerable discomfort to animals by piercing the skin with their awl-like mouth-parts and gorging themselves upon the blood of the beast which they attack. Not only the domestic animals but also man may be attacked. In consequence of such blood-sucking habits the stable-flies are believed to be capable of transmitting the micro-organisms of certain diseases.

The common stable-fly (*Stomoxys calcitrans*, Fig. 8) is well known as a frequenter of stables and even dwellings. It is of a dark-brownish colour, with four black stripes upon the thorax and a spotted abdomen ; the mouth-parts are in the form of an awl-like proboscis (Fig. 10) pro-

jecting in front of the head when not in use and adapted for piercing and blood-sucking. The larvæ live in manure or other decaying substance, but particularly in animal matter.

This fly somewhat resembles the common house-fly (*Musca domestica*, Fig. 10), with which it is usually confused, but the two are quite

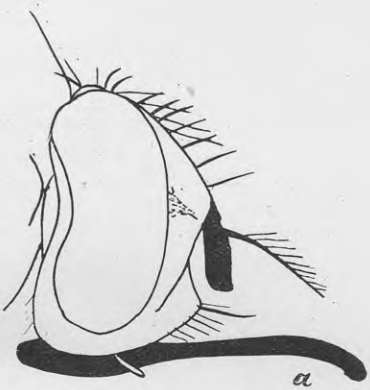


FIG. 10 (LEFT). SIDE VIEW OF HEAD OF STABLE-FLY; (*a*) PROBOSCIS.
FIG. 11 (RIGHT). SIDE VIEW OF HEAD OF HOUSE-FLY; (*a*) PROBOSCIS.

Highly enlarged.

distinct, as will be seen if Figs. 8, 9, 10, and 11 and the following table are compared.

——	Stable-fly (Fig. 8).	House-fly (Fig. 9).
Mouth-parts ..	Awl-like and adapted for piercing (Fig. 10, *a*)	Tube-like and adapted for sucking liquid food only (Fig. 11, *a*).
Posterior eye-margin	Concave (Fig. 10) ..	Straight or slightly convex (Fig. 11).
Fourth wing-vein ..	Only slightly upturned toward the end (Fig. 8)	Strongly upturned at end (Fig. 9).
Colour of the abdomen	Spotted (Fig. 8) ..	Without spots, but with a central blackish-brown stripe (Fig. 9).

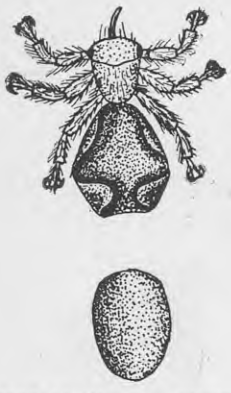
The stable-fly is a European insect, but there are species closely allied to it in other parts of the world. The writer found large numbers of an African species in the vicinity of water at Auckland.

THE SHEEP "TICK" OR KED.

Another blood-sucking fly, which has lost its wings through disuse, is the sheep tick or ked (*Melophagous ovinus*, Fig. 12). The use of the term "tick" in connection with this fly is really a misnomer, since the true ticks belong to another division of the animal kingdom and are not insects. The principal points of difference are the following: The

false sheep-tick possesses six legs and a more or less distinct head ; while true ticks possess eight legs when mature, and no distinct head.

The so-called sheep-tick measures about $\frac{1}{4}$ in. in length, is flattened from above and below, and is of a dark-brown colour on the abdomen but lighter on the thorax and head. Owing to its permanent parasitic habits—its whole life-history being spent upon the sheep and the parasite not living long if removed from its host—the wings have been lost through disuse, and the legs, with their claws strongly developed, are thus adapted for clinging to the wool. The abdomen is leathery in appearance, and just before a larva is deposited is considerably distended. The proboscis, or beak, is armed with teeth at the tip, and may be entirely withdrawn when not in use.



FIGS. 12 AND 13. SHEEP-KED AND LARVA.

Enlarged 4 diameters.

Unlike most other flies the female does not deposit eggs, but at intervals gives birth to a single larva, which is attached to the wool of the sheep by a glutinous substance produced by the mother. This pear-shaped larva (Fig. 13), which is about $\frac{1}{3}$ in. in length and of a dirty-white colour, is inactive and almost immediately becomes a pupa. The latter is similar in form to the larva, but is dark-brown owing to the formation of a hard shell. The mature insect escapes through the top end of the pupa, which opens like a lid.

[*Drawings and photos by the Author.*]

Plant-identification.—In this work, as carried out by the Biologist, an effort is made to supply information other than the mere naming of the specimens. In all cases the agricultural significance of the plants sent is of more importance than the actual names, and those submitting weed-specimens should, whenever possible, supply information regarding the distribution of the plants concerned in their districts and in what crops they are found.

Strychnine-poisoning of Rabbits.—Fields Inspector W. Wilson, Queenstown, reported as follows in December : "I carried out another poisoning operation with strychnine and oats on the Frankton Flat between 2nd and 7th instant. I started feeding on the 2nd and fed up till the 5th. Owing to rain falling on the day I should have poisoned I fed an extra day. On the 6th I laid the poisoned oats, using 3 oz. of strychnine and 40 lb. of oats. On the following day Rabbiter McNaughton and myself picked up 770 rabbits, which I consider is very satisfactory. A large percentage of the number destroyed were half-grown rabbits ; at that age they seem to take this poison very well. In my opinion from now on until the month of May is the best time of the year to use strychnine."

IMPROVEMENT OF POOR PASTURE.

INVESTIGATION AT WALLACEVILLE LABORATORY FARM.

By B. C. ASTON, F.I.C., Chemist to the Department.

INTRODUCTION.

PREVIOUS experiments on the improvement of poor sheep-pasture effected by top-dressing with various substances, and judged in the main by the live-weight increase of the animals grazed and the carrying-capacity of the pasture, and to a lesser degree by the yield and improved composition of the pasture, were initiated in England in 1896 and carried on for several years. The chief seat of these was at Cockle Park, a farm on the Duke of Portland's estate near Morpeth, Northumberland. The land is naturally poor, being valued in the natural state at 5s. per acre per annum.

The analysis of the unmanured soil from Cockle Park showed: Nitrogen, 0·2 per cent.; total phosphoric acid (P_2O_5), 0·07 per cent.; phosphoric acid soluble in 1-per-cent. citric acid, 0·005 per cent.; total potash (K_2O), 0·50 per cent.; potash soluble in 1-per-cent. citric acid, 0·013 per cent.; total lime, 0·70 per cent.

Dr. Sommerville, the initiator of the Cockle Park experiments, considers that this represents a perfectly normal soil, rather rich than otherwise in nitrogen and potash, but deficient in "available" phosphoric acid and rather low in lime. The "lime-requirement" method was not in use when the analysis of the Cockle Park soils was made, but a comparison of the other figures with the Wallaceville soil can be made, from which it will be seen that the Wallaceville soil is much richer in total nitrogen than that of Cockle Park, but is about the same in phosphoric-acid content ("available" and total), and, like that of Cockle Park, it contains plenty of potash (total and "available"), but is poorer than the Cockle Park soil in total lime. It is also to be noted that in the Cockle Park experiments the addition of 4 tons of quicklime produced no appreciable results on that soil, a strong boulder-clay situated at 300 ft. altitude, overlying the Millstone grit of the Carboniferous system. The land has been down in grass for some forty years, and was certainly not worth more than 5s. per acre per annum in the unimproved state—some farmers even said not more than 2s. 6d.

Contrary to what is found in New Zealand, burnt lime at 4 tons per acre was practically without effect at Cockle Park, even when repeated in the eleventh season. It became evident as time went on that it was hopeless to expect any profit from the use of this substance, and in the fifteenth season since the first dose of lime was applied its position is practically as hopeless as ever. When, however, smaller amounts of lime were applied in conjunction with phosphatic manures the

addition has sometimes been justified. The botanical analysis of the hay of the limed plot at Cockle Park showed that in the third season after the application, although the percentage of poorer grasses (Agrostis sp.) had been much decreased and the percentage of good grasses—crested dogstail and cocksfoot—much increased, there was no increase in the white clover; whereas on the phosphate plots there was considerable increase in the white clover.

The carrying-capacity of the untreated Cockle Park land for the twenty weeks' grazing season was 2 sheep to the acre, which was increased to 4 sheep on the slagged and 2·7 on the superphosphate-dressed plots. The average live-weight gain per head of the sheep on the unmanured plot was 14 lb. for the first and 24 lb. for the second season's grazing respectively, lasting from sixteen to twenty weeks.

Previous experiments in New Zealand on the improvement of pasture on the lines of the Cockle Park experiments have been attempted at Moumahaki and Ruakura Experimental Farms (see Department's Annual Report, 1909, p. 390, and *Journal*, July, 1914, p. 39). These pastures, whatever it may have been originally, was hardly what could be called poor sheep-pasture, the unmanured plot at the former station carrying 5½ and at the latter over 10 sheep on the average, and the top-dressing only increasing the carrying-capacity by about 1 sheep.

Mr. A. H. Russell (now Brigadier-General Sir A. H. Russell), at Tunanui, Hawke's Bay, in 1910 increased the carrying-capacity of 130 acres from 1·24 sheep to 2·07 sheep to the acre by manuring with 2 cwt. superphosphate and 2 cwt. bone-and-blood manure per acre, increasing at the same time the percentage of lambs and the quality of the wool, at a cost of £1 10s. per acre for fertilizer and distribution expenses (*Journal*, p. 352, 15/4/11).

Mr. G. L. Marshall, of Greenbank, Marton, in 1910 top-dressed a 5-acre paddock with a little under 1 cwt. per acre of basic slag, and estimated the carrying-capacity of the slagged paddock as 5·32 sheep, as against 2·98 sheep on an untreated paddock of same size (*Journal*, April, 1911, p. 218).

It will be seen in the foregoing experiments that these lands, judged by their carrying-capacity, are all of much greater value than the Wallaceville land, and that even the poor Cockle Park land will carry during its comparatively short grazing season nearly half a sheep more on the untreated pasture than that of Wallaceville, which in a favourable season will carry only 1·6 sheep per acre. On the limestone-dressed paddock at a cost of 15s., and on the limestone and phosphate paddock at a cost of £1 19s. 6d., per acre for fertilizers, however, since 1st November last nearly 5 sheep per acre have been carried, with every prospect of this capacity being maintained for another month or so.

THE WALLACEVILLE EXPERIMENTS.

The experiments here recorded embody all that has resulted from an extensive experimental scheme of pasture-improvement which, based on the Cockle Park experiments,* was drawn up by the writer in 1914 and submitted to the Board of Agriculture. The Board

* See "Influence of Manures on Mutton," Jour. Board of Agriculture of England, Vol. vi, No. 3, Dec., 1899; and Vol. vii, No. 3, 1900; and Supplement to same, Vol. xvii, No. 10, Jan., 1911. All articles by Dr. Somerville, Professor of Rural Economy, Oxford University.

approved of the scheme, and appealed to representative farmers in various parts of the North Island to carry it out on different types of soil. Although several offers were received, owing to various circumstances it was not possible to do anything further in the matter except at the Wallaceville Laboratory Farm, at which the former Director of the Live-stock Division (Dr. Reakes) enthusiastically entered into the scheme and gave or obtained all necessary authority for the work* conducted under the writer's supervision. Mr. J. Evans, Farm Overseer at Wallaceville, has been in direct charge of the experiments, and it is largely due to his keen interest that it has been possible to carry out these experiments in war-time. The area selected is of very inferior carrying-capacity in the unimproved condition, and as it represents a considerable area of similar land it is a suitable site for experiments of this nature.

SOME ACCOUNT OF THE SOIL AND ORIGINAL VEGETATION.

The soils of the Laboratory Farm, which adjoins Trentham Racecourse, are situated on the Upper Hutt gravel plain, the subsoil of which, to a depth of many feet, always consists of boulders and gravel mixed with a smaller amount of finer material, sand, and clay. Some idea of the mechanical composition of the subsoil may be gathered from the analyses of the adjoining Trentham Camp soils analysed in August, 1915.

	Laboratory Number.							
	G/257.	G/258.	G/259.	G/260.	G/261.	G/262.	G/272.	G/273.
	%	%	%	%	%	%	%	%
Stones and boulders (above 12 mm. diam.)	24·8	32·1	42·5	..	..	..	48·0	39·0
Gravel (2–12 mm. diam.) ..	19·1	7·9	5·9	5·4	3·7	4·0	19·0	19·0
Fine earth (below 2 mm. diam.)	56·1	60·0	51·6	94·6	96·3	96·0	33·0	42·0
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Locality No. ..	1	2	3	1	2	3	3	1
	First foot, including top few inches.			Top few inches analysed separately.			Second and third feet.	

Geologists consider that these gravel-boulder beds are not those of an ancient lake, but that the area they occupy was a rock basin gradually formed in the Hutt Valley by faulting and warping, and which the Hutt River filled with boulders, gravel, and finer material as fast as the basin was formed. This possibly accounts for the fact that large boulders are often found near the surface. The depth of soil above the gravel is very shallow, sometimes not more than 1½ in., but usually from 4 in. to 9 in. The effect of such a porous subsoil so near the surface is that the soil tends to dry up rapidly in the summer, and is dependent mostly on the summer rains and dew for the supply of water necessary to keep a grass-covering alive. On the shallower soils of the farm, such as those of paddocks Nos. 1 to 5 (which have never been ploughed since the forest was destroyed, and are very uneven in surface, as all forest soils are before ploughing), the grass which is the dominant constituent of the pasture is Danthonia pilosa, a highly drought-resisting native grass and eminently fitted to survive on the shallow dry soils of this area. The forest, which has been destroyed, was undoubtedly the black-birch (*Fagus Solandri*), which still exists

* See parliamentary paper H.–29A, Report of Department of Agriculture, 1915–16, page 5.

in the vicinity, mixed with a little maire (*Olea Cunninghamii*), pokaka (*Eleocarpus Hookerianus*), black-pine or matai (*Podocarpus spicatus*), and totara (*Podocarpus totara*). In some places this shapely tree has been allowed to remain in the paddocks, and might mislead the observer into thinking that totara was perhaps an important constituent of the beech forest, but this was not so—at all events within recent times. The undergrowth of the forest consists chiefly of various shrubs; species of Coprosma—*C. rotundifolia, C. rhamnoides, C. crassifolia, C. areolata, C. parviflora, C. propinqua, C. robusta, C. Cunninghamii;* and *Carpodetus serratus, Leucopogon fasciculatus, Myrtus pedunculata, M. bullata, Melicytus ramiflorus, M. micranthus, Myrsine Urvillei, Pittosporum tenuifolium, Panax anomalum, P. arboreum, Melicope simplex,* and the giant sedge *Gahnia zanthocarpa,* and the climbing plants *Clematis indivisa, Muehlenbeckia australis,* and *Parsonsia heterophylla.*

The analyses of virgin and unploughed soils from the Wallaceville Farm are as follows:—

	G/247.	H/405.	K/455.	K/456.
Moisture	10·24	9·49	8·55	10·72
Loss on ignition	14·75	19·15	11·72	10·99
Nitrogen	0·366	0·47	..	..
Hydrochloric-acid extract—				
Potash (K_2O)	0·320	0·31	0·42	0·50
Phosphoric acid (P_2O_5)	0·078	0·08	0·06	0·09
Lime (CaO)	0·407	0·33	0·42	0·68
Magnesia (MgO)	0·444	0·38	0·70	0·75
Citric-acid extract—				
Potash (K_2O)	0·057	0·040	0·030	0·037
Phosphoric acid (P_2O_5)	0·007	0·014	0·006	0·009
Lime requirement (Hutchinson-MacLennan method), per cent. ($CaCO_3$) ..	..	0·57	0·25	0·06

The results (except for "moisture" and "lime requirement") are percentages on soil dried at 100° C.

Description of Samples.

G/247: Sampled 26/7/15 in three places to a depth of 3 in. to 5 in. on danthonia pasture, unploughed.

H/405: Forest soil sampled in several places in *Fagus* forest adjoining the virgin danthonia pasture, 22/11/16.

K/455: Sampled 12/11/18 in about six places to a depth of 6 in. to 9 in. on No. 2 paddock, unmanured.

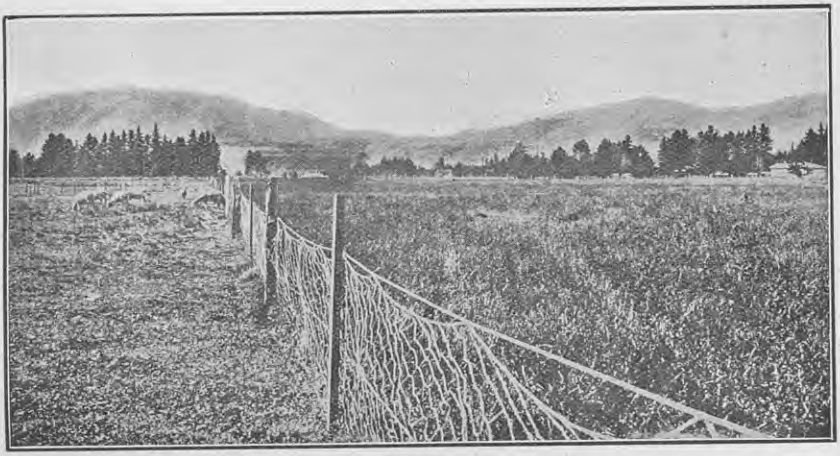
K/456: Sampled 12/11/18 in several places on No. 3 paddock, manured with phosphate and limestone.

A mechanical analysis of sample H/405 showed,—

	Per Cent.		Per Cent.
Coarse sand	11·4	Fine silt	10·6
Fine sand	22·5	Clay	Nil.
Silt	24·1	Moisture, organic matter, &c. ..	29·6

The results show the soil to be a sandy silt, fairly well supplied with total potash and nitrogen and available potash, but deficient in available phosphoric acid. The excess of magnesia which is often found in "birch" or beech (*Fagus*) country supports the view that liming with limestone would be beneficial, and the lowness of the total and available phosphoric acid compared with the excessive amount of potash suggests that phosphate in conjunction with limestone would be the appropriate manurial treatment.

THE WALLACEVILLE PASTURE EXPERIMENTS.



VIEW OF PADDOCKS NOS. 2 AND 3, LOOKING WEST.

No. 2 (left hand), untreated Danthonia pilosa pasture, carrying 1½ sheep to the acre; separated by netting from No. 3 (right hand), treated with unground native limestone rubble and 5 cwt. finely ground phosphate rock per acre in August, 1915, carrying 5½ sheep to the acre. Taken 19/12/18. [*B. C. Aston, photo.*

VIEW OF PADDOCK NO. 3, LOOKING NORTH INTO PADDOCK NO. 4 (LIMESTONE ALONE).

Taken 19/12/18. [*B. C. Aston, photo.*

The chemical composition of the forest soil compared with the adjoining danthonia pasture soil is interesting, as both no doubt were originally very similar in composition, but the destruction of the forest and its replacement has had a profound effect on the humus-content, the organic matter and nitrogen being much lower in the pasture soil. The lime-requirement method shows that larger quantities of carbonate of lime would be necessary for the forest soil than would be sufficient on the pasture soil.

Other soils of the farm, from paddocks which have been ploughed, slagged, and grazed for several years and the pasture entirely altered, are as follows :—

	G/245.	G/246.
Moisture	3·98	3·98
Loss on ignition	9·73	11·05
Total nitrogen	0·248	0·376
Hydrochloric-acid extract—		
Potash (K_2O)	0·358	0·340
Phosphoric acid (P_2O_5)	0·074	0·093
Lime (CaO)	0·301	0·364
Magnesia (MgO)	0·460	0·428
Citric-acid extract—		
Potash (K_2O)	0·020	0·027
Phosphoric acid (P_2O_5)	0·008	0·008

G/245 : Collected 26/7/15 from front paddock adjoining road, 9 in. deep.
G/246 : Collected 26/7/15 from septic-tank paddock, 4 in. to 9 in. deep.

METEOROLOGY.

It is interesting to note that these experiments happen to coincide with a gradually increasing rainfall during the last three years, if one may accept the figures obtained at the Whiteman's Valley Meteorological Station, Silverstream, as being correct for Wallaceville. Silverstream Railway-station is only two miles from Wallaceville Railway-station. Mr. B. V. Pemberton, Assistant Director of the Dominion Meteorological Office, kindly supplies the figures which follow, showing the number of inches of rain, and rainy days, per month for the last three years. It will be noticed that the figures for November and December, 1918, of both the number of rainy days and total rainfall are abnormally high compared with those of previous years, whereas the figures for the winter months July, August, and September show a tendency in the other direction. The rainfall this season being greater and more evenly distributed than usual was therefore much more favourable to the continuous growth of pasture on shallow soils.

Rainfall and Rainy Days at Whiteman's Valley, Silverstream.

—	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
1916.													
Inches..	1·89	1·81	0·85	3·61	5·08	1·55	5·27	5·64	4·38	6·62	7·26	0·27	44·23
Days ..	(10)	(6)	(9)	(10)	(17)	(12)	(14)	(17)	(12)	(17)	(11)	(3)	(138)
1917.													
Inches..	2·52	1·59	1·29	5·67	7·41	7·14	8·37	5·21	6·58	4·39	1·82	3·28	55·27
Days ..	(6)	(9)	(4)	(10)	(15)	(10)	(25)	(20)	(16)	(17)	(7)	(10)	(149)
1918.													
Inches..	1·96	3·50	3·89	5·28	3·88	6·64	7·17	3·39	5·28	5·61	5·84	5·86	58·30
Days ..	(7)	(8)	(11)	(8)	(8)	(13)	(22)	(11)	(11)	(17)	(13)	(17)	(146)

THE SOIL-DRESSINGS DESCRIBED.

In the Wallaceville experiments some effort is being made to improve the feeding-capacity of the pasture on these soils by top-dressing the land. The general surface, save for the unevenness already mentioned, is level. This area is a good sheep-grazing paddock in winter, but in summer the pasture is apt to dry to such an extent as to be extremely liable to catch fire from sparks from the adjoining railway. The experimental paddocks, which are contiguous to the Wellington–Upper Hutt Railway line, near Wallaceville Station, were, through the courtesy of the Lands and Survey Department, laid off into $5\frac{1}{2}\frac{1}{0}$-acre plots, the subdivisions being made by sheep-netting. Five of these paddocks, Nos. 1 to 5, were on shallow soil with numerous depressions in the surface, the pasture being mostly Danthonia pilosa, but, in addition, two other portions of the same size were fenced in from the adjoining area of the farm, which has been improved by ploughing and seeding with better grasses, among which cocksfoot, rye-grass, and clovers may be mentioned. From paddocks Nos. 6 and 7 danthonia had been largely displaced by better pasture-plants. The pasture on these paddocks was obviously of much better quality than on the first five, the soil being deeper and the pasture of better composition, having been top-dressed with slag and superphosphate some years ago. The results of grazing these paddocks must therefore only be compared with the danthonia paddocks in a very limited way, really only the sheep and the climatic conditions being comparable. The top-dressings used were,—

(*a.*) Rough rubble limestone from the Mauriceville limeworks. This was the rough rejections from the Mauriceville quarry, which were of too mixed a nature either to burn into a quicklime or to use in any other way. It had accordingly accumulated for years on the hillside dump, and contained many large lumps of limestone as well as much fine material. It was purchased at 2s. per ton, and was trucked without bagging and railed free to the Upper Hutt Station, whence it was carted to the farm, one mile distant. This material had the following mechanical composition :—

	Per Cent.
Residue on 12 mm. (about $\frac{1}{2}$ in.) sieve	7·0
Passed 12 mm., retained on 5 mm.	21·3
Passed 5 mm., retained on 2 mm.	16·5
Passed 2 mm., retained on $\frac{1}{3}\frac{1}{0}$ in.	12·0
Passed $\frac{1}{3}\frac{1}{0}$ in., retained on $\frac{1}{6}\frac{1}{0}$ in.	19·7
Passed $\frac{1}{6}\frac{1}{0}$ in., retained on $\frac{1}{9}\frac{1}{0}$ in.	15·4
Passed $\frac{1}{9}\frac{1}{0}$ in., retained on $\frac{1}{1}\frac{1}{2}\frac{1}{0}$ in.	5·2
Passed $\frac{1}{1}\frac{1}{2}\frac{1}{0}$ in.	3·0

The amounts supplied to paddocks Nos. 3 and 4 were at the rate of 3 tons per acre, applied in August, 1915, when all the dressings were applied.

(*b.*) Finely ground Makatea Island rock phosphate containing about 85 per cent. tricalcic phosphate.

(*c.*) Basic slag, " Star " brand, containing 17 per cent. phosphoric acid (P_2O_5).

(*d.*) Basic superphosphate : Mount Lyell superphosphate mixed with 15 per cent. slaked lime.

(*e.*) Finely ground carbonate of lime. This was obtained from the Mauriceville limeworks and was the commercial kiln-dried and ground carbonate of lime sold by that works. The amount applied proved altogether inadequate to effect any appreciable results, and the paddock No. 1 may therefore be regarded as an additional control paddock. One of the reasons for applying this was to compare it with the cheap unground limestone purchased at 2s. per ton.

The cost of the various dressings per acre was therefore,—

	£	s.	d.
Paddock No. 1: ⅝ ton fine carbonate of lime	0	13	0
Paddock No. 2: Control.			
Paddock No. 3: Dressing as on No. 4 plus 5 cwt. Makatea Island phosphate	1	19	6
Paddock No. 4: Rough unground limestone at 2s. per ton and 3s. per ton cartage, and extra cost of spreading	0	15	0
Paddock No. 5: Ephos phosphate, 5 cwt., at £4 17s. 6d. per ton	1	4	6
Paddock No. 6: Basic superphosphate, 5 cwt., at £5 per ton	1	5	0
Paddock No. 7: Basic slag, 5 cwt., at £5 10s. per ton	1	7	6

BOTANICAL SURVEY OF THE PASTURE.

With the co-operation of Mr. A. H. Cockayne the assistance of Mr. E. Bruce Levy, Biological Assistant, was obtained to inaugurate a botanical survey of the Wallaceville pasture. The method used by Mr. Levy was that of Runkauer, which is recorded in the *Plant World* for June, 1918. Briefly described, it may be stated that it consists in taking a note of the characters and occupants of a number of small areas in a paddock selected in such a way that the field is traversed by two paths which intersect at their centres. At equal distances along these paths an area of definite size (a few inches square) is selected, and a note taken of the names of every grass or character present. Assuming that a hundred of these areas are investigated (in practice it may be only necessary to take one-half or less of these), then the number of times in which a certain plant or character occurs may be set down, and gives the relative frequency of occurrence of that constituent or character in the pasture.

The figures in the next table attempt to show the influence which dressings of limestone alone and limestone and phosphate together are having on the danthonia pasture. These data will be compared in the future with the area left to go to hay, but the present results are most instructive, as they tend to show that the poor native danthonia grass is reduced by dressings of limestone and of the mixture of limestone and phosphates, and that the poor exotic grass, sweet vernal, is also somewhat diminished by these dressings. On the other hand, the valuable suckling-clover is increased by phosphate and limestone, while the valuable white clover is very greatly increased by phosphate and greatly by limestone. The valuable exotic crested dogstail is greatly increased by limestone and phosphate, and more greatly by limestone; the valuable exotic cocksfoot is also much increased by phosphates and limestone. The deleterious moss is diminished by liming, and almost disappears with phosphates and limestone. Bare ground has almost disappeared with the aid of phosphates and limestone. The other figures do not call for any special comment, save that perhaps the broad-leaved weeds are somewhat increased by the dressings.

THE WALLACEVILLE PASTURE EXPERIMENTS.

ANOTHER VIEW OF PADDOCK NO. 3.

Looking south across the paddocks into paddock No. 2 (control). Taken 19/12/18. [*B. C. Aston, photo.*

VIEW OF PADDOCK NO. 4, LOOKING SOUTH.

Treated with 3 tons unground native limestone rubble in August, 1915; carrying 4 sheep to the acre. Taken 9/12/18. [*B. C. Aston, photo.*

Botanical Survey, Wallaceville, 12th November, 1918.

The figures show the relative frequency of occurrence of each constituent per cent. analysis.

Constituents of Pastures.	Paddock No. 2 (Control).	Paddock No. 3 (Phosphate and Rough Limestone).	Paddock No. 4 (Rough Limestone).
Danthonia pilosa (native)	97·5	87·5	80
Sweet vernal (*Anthoxanthum odoratum*) ..	100	97·5	87·5
Suckling-clover (*Trifolium minus*)	77·5	95	75
White clover (*Trifolium repens*)	27·5	75	52·5
Crested dogstail (*Cynosurus cristatus*) ..	67·5	82·5	92·5
Catsear (*Hypochaeris radicata*)	67·5	65	77·5
Rib-grass (*Plantago lanceolata*)	57·5	70	75
Poa pratensis	25	20	32·5
Cocksfoot (*Dactylis glomerata*)	30	67·5	60
Hair-grass (*Festuca bromoides*)	7·5	12·5	5
Bracken (*Pteridium esculentum*)	2·5	7·5	5
Field-daisy (*Bellis perennis*)	5	12·5	22·5
Moss	25	5	12·5
Thelymitra sp. (wild native orchid)	5	0	2·5
Bare ground	25	2·5	22·5
Selfheal (*Prunella vulgaris*)	7·5	7·5	10
Lesser mouse-eared chickweed (*Cerastium triviale*)	2·5	5	2·5
Yorkshire fog (*Holcus lanatus*)	10	27·5	10
Perennial rye-grass (*Lolium perenne*) ..	2·5	5	7·5
Muehlenbeckia (native climbing shrub) ..	0	2·5	0
Hawkweed (*Crepis capillaris*)	0	2·5	0
Stones	2·5	2·5	5
Tarweed (*Bartsia viscosa*)	0	10	2·5
Sheep's burr (*Acaena ovina*)	0	2·5	0
Dandelion (*Taraxacum officinale*)	0	2·5	2·5
Piripiri (*Acaena sanguisorbae*)	5	2·5	2·5
Redtop (*Agrostis vulgaris*)	2·5	2·5	15
New Zealand rice-grass (native) (*Microlaena stipoides*)	0	0	2·5

The following plants were also noted throughout each paddock: *Juncus effusus*, gorse (*Ulex europeus*), *Polytrichum* sp., *Juncus* (stoloniferous type), sweet-brier (*Rosa rubiginosa*).

Summing up, it may be said that the indications are that the dressings may be expected to increase the carrying-capacity of the land because they—

(*a.*) Diminish the inferior native and introduced grasses;

(*b.*) Increase the exotic grasses of approved feeding-value;

(*c.*) Increase the leguminous constituents (clovers) of the pasture, and hence the albuminoid content of the food to a great extent (the most valuable effect);

(*d.*) Diminish bare space and moss; and hence create a closer and more nutritious sward.

RESULTS OF GRAZING EXPERIMENTS.

These experiments, as indicated, are being conducted on poor danthonia pasture following the clearing of *Fagus* (beech or "birch") forest land, which, although on level land, is far inferior in quality to any of the hillside soils on the west side of Wellington Harbour, "birch" or beech country being generally recognized as the worst

type of forest country to bring in, and far inferior to mixed tawa (*Beilschmiedia*) and rimu (*Dacrydium cupressinum*) forest. The results of the two first seasons' experiments are mitigated by the fact that the summers were exceptionally dry, and in one season (1916–17) the pasture caught fire and burnt in two of the paddocks (Nos. 3 and 4), necessitating the suspension of the experiments. In the season 1915–16 dogs worried some of the sheep and were shot in the act. It is advisable that the results obtained should be recorded, as, however small, they point the way for further efforts in the right direction.

In the first season seven numbered sheep (two-toothed ewes and hoggets of mixed crossbred Romney-Lincoln type) were placed on each 5-acre paddock on 13th December, 1915, and the same animals were carried right through the season until 7th March, 1916.

In the second season a different set of eight animals (two-toothed wethers and hoggets, four of each on each plot) instead of seven were grazed from 10th December, 1916, to 12th March, 1917.

In the third season, a very wet one, from 30th May, 1918, to 11th December, 1918, the effect of the dressings of limestone and phosphates on paddocks Nos. 3 and 4, compared with the control paddocks, Nos. 1 and 2, was very marked. Eight sheep (four wethers and four hoggets) were placed on each of the paddocks Nos. 2, 3, and 4 on 30th May. Additional temporary sheep were put on to keep the grass down, twelve extra sheep being put on all the paddocks on 1st November, but on the 22nd it was necessary to take off No. 2 the twelve extra sheep and place four of them on No. 3. (On 27th December four more sheep were placed on No. 3. At the time of final writing (13/1/19) No. 2 is carrying only eight sheep; No. 3 is carrying twenty-eight; No. 4 is carrying twenty; and the experiment is being pushed well on into the summer.)

The animals were weighed every month, and the following table shows the differences in the average live-weights in pounds per sheep, due to feeding on the pastures. Multiplying this by the number of permanent sheep on each 5-acre paddock the total live-weight increases are obtained.

Poor Danthonia pilosa Pasture following Beech or "Birch" Forest on Gravel.

——	Paddock No. 1 (Control). ¾ ton Fine Carbonate of Lime.	Paddock No. 2. No Dressing.	Paddock No. 3. 3 tons Rough Limestone; 5 cwt. Phosphate Rock.
First season (12 weeks)	16·3 (× 7 = 114·1) lb.	20 (× 7 = 140) lb.	21·1 (× 7 = 147·7) lb.
Second season (13 weeks)	11·0 (× 8 = 88) lb. . .	12 (× 8 = 96) lb.	15 (× 8 = 120) lb.
Third season (28 weeks)	. .	41·7 (× 8 = 333·6) lb.	46·5 (× 8 = 372) lb.

——	Paddock No. 4. 3 tons Rough Limestone.	Paddock No. 5. 5 cwt. Ephos Phosphate.
First season (12 weeks)	17·6 (× 7=123·2) lb.	17·8 (× 7 = 124·6) lb.
Second season (13 weeks)	12·25 (× 8 = 98) lb.	12·7 (× 8 = 101·6) lb.
Third season (28 weeks)	50 (× 8 = 400) lb.	. .

Improved Pasture (mostly Rye-grass, Cocksfoot, and Clovers) sown down and manured previously on Better Adjoining Soil.

—	Paddock No. 6. 3 cwt. Basic Superphosphate.	Paddock No. 7. 5 cwt. Basic Slag.
First season (12 weeks)	30·3 (× 7 = 212·1) lb.	25·5 (× 7 = 180·5) lb.
Second season (13 weeks) ..	20·25 (× 8 = 162) lb.	24·6 (× 8 = 196·8) lb.

In the third season only paddocks 2, 3, and 4 were g[illegible] grazed.

In addition to the gains shown paddock No. 2 must be credited with grazing twelve temporary sheep for three weeks, paddock No. 3 with twelve temporary sheep for six weeks and four for three weeks, and paddock No. 4 with twelve temporary sheep for six weeks to 11/12/18.

Detailed Weighings.

The result of the weighings of the period from May to December, 1918, are considered important enough to give in full for paddocks Nos. 2, 3, and 4, and are as follows (in pounds) :—

Sheep's No.	May 30.	June 24.	July 13.	July 31.	Aug. 13.	Aug. 30.	Sept. 24.	Oct. 8.	Nov. 1.	Nov. 26.	Dec. 11.
Paddock No. 2 (Control).											
58	93	105	99¼	100½	100	98½	101½	102½	112¼	119½	124
63	69	70½	69¾	74	74¾	77½	78	83¾	95	103	106
66	120½	135	133¼	135	138¼	139	142	146½	162	168¼	176¾
67	117	130¾	122½	125	128¼	127¾	136½	138	152¼	163	166½
70	127½	133¼	126¾	129	133¼	137½	139	141½	149¼	160½	165¼
94	90½	94½	89	85	88	87½	92¼	96	104½	116	121½
95	67½	78½	74¾	76½	77½	78½	81	84	96½	108	111¼
98	67	77	71½	73½	72½	76	78½	82½	96½	108½	114¼
Total weight	752	824½	786¾	798½	812½	822¼	848¾	874¾	968	1046¾	1085½
Average weight	94	103	98¼	99¾	101½	102¾	106	109¼	121	130¾	135¾
Paddock No. 3 (Rough Limestone and Island Phosphate).											
27	58½	61½	61½	61½	61½	64¾	66¼	69½	74¼	85	98½
60	69¾	77	76	80	81¼	83½	89¼	97	106¼	114½	108¾
61	65	66½	66	68¼	68¾	69	73	79	89	99½	104¾
62	116	121	120½	121¾	124¼	128	133¼	140	152	155¾	162
65	106¼	116½	116	120	125	124½	126½	127	134½	145¾	150
92	63¼	75	74¼	76½	78	84¼	92	97¼	112¾	118¾	130
93	95½	104½	103¼	105¾	108	112	115	122¼	129	139½	141½
97	94	100	94½	99½	97	92	98	105½	117	128¼	134
Total weight	668¼	722	712	733¼	743¾	758	793¼	837½	914¾	987	1029½
Average weight	83½	90¼	89	91½	92¾	94¾	99¼	104½	114½	123¼	128¾
Paddock No. 4 (Rough Limestone).											
28	61¼	67½	65	68	70	73	78½	83¾	100	113	119
29	71½	75½	75¼	78	80½	84	91	97¼	113½	123	126½
30	57¾	62	59¼	64½	65¼	68½	72¾	77	90	99	103¼
59	72¼	77	76¼	79	81	84	91	96½	107	115	121
64	106	111½	110	114	116½	118¾	124½	132	144	158¾	162
68	114	115½	115¼	118½	120	121¼	126	130½	146¾	156¼	160
69	120	123½	122¼	125¼	129¼	130½	137	143½	154	164¼	164¾
96	114	115¾	113	120½	121½	123¾	127½	134	143¾	152¾	157¼
Total weight	716¾	748¼	726¼	767¾	784	803¾	848¼	894½	999	1082	1113¾
Average weight	89½	93½	90¾	96	98	100½	106	111¾	124¾	135¼	139¼

It will be seen that the average weight of the sheep at the commencement of the experiments was: No. 2 (control), 94 lb.; No. 3, 83½ lb.; No. 4, 89½ lb.; and that if any advantage was to be gained it was given to the control paddock, and next to the limestone paddock, the poorest average-weight sheep being put on the phosphate and limestone paddock.

On the control paddock the animals all gained in weight up to 24th June, when they began to lose weight owing to the very inclement weather—snow and hail with bitterly cold winds and rain. Frosty nights followed, and on 31st July most of them had started to pick up again, but it was not until 24th September that they had all recovered condition, from which date they all made increases until the final weighing on 11th December. On paddock No. 3 (rough limestone and phosphate) the influence of the better quality and quantity of feed in combating the effects of the inclement weather is seen. As in the control paddock, the animals suffered a check in growth from 24th June till 13th July, but contrary to the results on the control all the loss in weight had been made up on 31st July, the progress of each animal from this date onward (with one slight exception) being uninterrupted.

On the paddock No. 4 (rough limestone alone) the slight check of June–July will also be noticed, but the animals had all recovered by 31st July, and thereafter until the final weighing progress without exception in every animal was continuous.

CONCLUSION.

In conclusion it should be pointed out that these experiments at Wallaceville are being carried out under exceptional difficulties, chief of which are the rapid drying-up of the soil and pasture in summer, the proximity of the railway—always a menace to dry pasture from the danger of fire—and the incursions of dogs from the thickly populated adjoining areas and camp. Further, although the very good results obtained this year may be largely due to the abnormally favourable rainfall, and therefore should be continued for a series of years before it is possible to obtain an idea of the average improvement due to fertilizers, it is desirable to draw early attention to any possible method of improving poor danthonia country following "birch" forest, of which there are such large areas in the Dominion.

Mr. H. A. Goudie remarks as follows in the annual Forestry Report: "Several uncultivable areas within the Rotorua nursery enclosure were planted with *Eucalyptus*, principally *E. Macarthuri*. Very good results have been obtained with these, and it is intended to make further plantings of a similar nature during the coming year. In addition to the prospective value of these small areas for the production of fencing-material, the tree-growth is badly needed in the meantime to suppress the growth of blackberry, a weed that is likely to become a serious nuisance in this district."

FOXGLOVE AND ITS CONTROL.

By A. H. COCKAYNE, Biologist.

FOXGLOVE (*Digitalis purpurea*) is a regular garden-plant that has become widely naturalized throughout New Zealand, often in quantities sufficient to impair seriously the potential carrying-capacity of the ground. It is especially abundant on land that at some past time was forest, or which now represents fresh bare ground, such as river-beds. It is not a weed of really well-grassed permanent pasture or of arable farming-land. On poorly grassed land of very low carrying-capacity it is often abundant, more especially on shady faces. Poorly grassed country that has reverted to bracken, badly burnt bush farms reverting to scrub, and milled forest and standing burnt forest are situations where foxglove is often prevalent. It also spreads into living forests wherever the sunlight can penetrate to the forest floor.

In certain districts it is a gazetted noxious weed, and much money is often spent on its cutting and pulling. In many cases, however, it is difficult to get farmers to carry out such work, especially where the infested land is of a low capital value and the areas involved extensive. Theoretically foxglove is either an annual or a biennial, but in practice, owing to the development of side shoots, the plant may be virtually perennial. The seeds are extremely minute and produced in countless numbers, and they often fall directly into the wool of sheep passing between the tall stems, and thus become widely distributed. Luckily the plant is rarely eaten by stock, as all portions of the plant are poisonous.

The acknowledged methods of control consist of either pulling up or cutting down the plant before flowering. As foxglove normally is in flower well before Christmas, the work must be tackled early in the season, and should be undertaken when the flowering-shoots are sufficiently long to enable the plant to be easily pulled out. If much earth adheres to the plants or if they are thrown in a moist place they will often take root again and flower. The main objection to early pulling is the fact that many plants that have not started to form flowering-stems may be overlooked, and these may probably bear seed in the autumn. On the other hand, if the pulling is delayed until the plants are in flower much seed may be matured before the work is completed.

Pulling is much preferred by farmers to cutting, but, personally, I have no great confidence in the process. The pulling-up of a large foxglove-plant loosens the earth for a considerable distance and makes a bare space admirably adapted for seed-germination. As the seed most likely to be in the ground is foxglove-seed, then the likelihood of further establishment of foxglove is extremely likely. I have often thought the scattering of vigorously growing grasses, such as cocksfoot and Italian rye, and on poor land Yorkshire fog, on the ground bared

by the pulling-up of plants would be a good thing, but in many cases the expense would be too great.

Many farmers consider that it is a waste of money to deal with foxglove at all, and under certain circumstances such a contention may be accepted as correct. On land that is virtually bringing no revenue, such as fern and scrub country, pulling cannot be regarded as a business proposition; but, of course, if the weed is a gazetted one it is a legal obligation to prevent it from flowering. If on such country it is a business proposition to pull foxglove, then how much more so is it to get rid of the fern and scrub and develop good grassland? On country where logs are numerous a good deal of cleaning-up of the ground, apart altogether from foxglove-pulling, should be carried out. It cannot be too strongly emphasized that a good sole of grass is one of the very best means of keeping foxglove out, and every effort should be made in laying down country liable to foxglove to use high-grade seed of grasses suitable to the soil, and in liberal amounts so as to secure a rapid development of a grass-sole. On farms where the amount of work to pull or cut all foxglove is excessive it is better to do a small piece properly than a large piece badly, and to begin with the main efforts should be directed to cleaning up the best land most likely to give the best return, leaving the other portions. The argument that the waste corners carrying foxglove are a menace to the rest of the land is often overemphasized, and sufficient stress is not laid on the importance of securing good thick permanent grass.

For my part, I consider—and there is much evidence to back this belief—that foxglove when left untouched will in the course of years naturally disappear. No doubt the time occupied will vary on different classes of soils, but there are many areas of good second-class country where foxglove has disappeared after being a bad weed from five to eight years. Of course, where a full return from the land is necessary to make a living the holder cannot afford to wait this period, especially as during several years when no control is undertaken large areas may be in almost complete possession of foxglove. When such a condition exists the farmer will have to pull or cut as much as possible. His work, however, should not be for the mere sake of pulling, but with the idea of getting good grassland. Hence it is folly to devote much time and money to those portions that even if devoid of foxglove would be of little immediate value. In other words, judicious selection should be made of the land over which vigorous action is to be taken.

The question of the most effective and practical methods of control on land where it will not pay to annually cut foxglove is one that must be answered by practical demonstration, and it may be mentioned here that a sum has been appropriated to carry out experiments in this direction.

Ensilage is specially valuable to dairymen who have to maintain a steady supply of milk all the year round for city consumption. It provides succulent feed at periods when pastures or forage crops are often deficient.

CERTIFICATE-OF-RECORD TESTING.

CURRENT LIST OF COWS.

By W. M. SINGLETON, Assistant Director of the Dairy Division

THE extent to which the testing of purebred cows has increased during the past spring is evidence of a virile spirit amongst many of the breeders of stud dairy stock. It may be that the good results obtained by many of the breeders who have been testing since the inception of the system has stimulated the interest of others. The fact remains, however, that with this increased support from the breeders the general aspect of the work is most encouraging and promises well for the future.

Since 1st November to time of writing some fifty-nine certificates have been issued on records, the details of which are appended. A further list will be issued later to complete the publication of records completed within the year 1918. Some declarations are still outstanding, and the return of these is essential before certificates are issued.

JERSEYS.

The most attractive record in the present list of Jersey productions is doubtless that of Lady Peggy, a daughter of K.C.B. from Magnet's Peggy. This record represents Lady Peggy's fourth milking-period. She has been on C.O.R. test during her first, second, and fourth seasons, and her butter-fat credits for these seasons are 534·31 lb., 650 lb., and 725·27 lb. respectively. With her last record she is a close second to Lady of Collingwood in the four-year-old Jerseys. It is a credit to K.C.B. that each of these cows bears such close relationship to him.

Three other cows in the list have exceeded 600 lb. of butter-fat. Pretty Polly, owned by Mr. A. Hodgkinson, of Takaka, has produced a high credit. Her breeding is of well-known strains, she being sired by K.C.B. from Darkie XV. Mr. Hodgkinson had five cows on test, and has done good work for the Jersey breed, which will, we hope, benefit his district and himself. Omata Queen, owned by Mr. C. W. Ruebe, and Mr. C. G. C. Dermer's Warrigal Lass have also qualified for the 600 lb. class.

FRIESIANS.

The Friesian records in the current list also show three cows in the 600 lb. butter-fat class, and one in the 700 lb. class. The highest honour goes to Mutual Pearl of Rock, imported from Wisconsin, U.S.A., by Mr. W. Barton, of Featherston. She is one of the many good daughters of Mutual Piebe de Kol. In New Zealand three of this bull's daughters have produced 529·76 lb., 545·41 lb., and 589·66 lb. respectively. The first two of these records were produced in 332 and 289 days respectively.

Buttercup of Kokatau has also placed a good record to the credit of the mature class. She is owned and was tested by the Cluny Friesian Farm Company. This record raises her credit from 562·81 lb. butter-fat for her first testing season. She was sired by Black Prince of Longbeach from Buttercup of Longbeach.

One of the most striking records in the list and of the year is that of Princess Pietertje de Kol, bred by Mr. J. Donald, of Westmere, and owned and tested by Mr. R. Melvin, jun., of Masterton. This heifer's dam is a full sister to Westmere Princess Pietertje, our present New Zealand champion. Princess Pietertje de Kol's sire is Netherland de Kol, who is a son of Paul Pietertje, and therefore half-brother to Westmere Princess Pietertje (939 lb. fat) and to Netherland Princess IV, the senior two-year-old leader with a record of 805 lb. fat. Princess Pietertje de Kol's record is 626·82 lb. fat, and is 376·12 lb. above her requirement for certificate. She displaces Lady Pauline as leader of the junior two-year-old class.

Another good record is that of Rosevale Beets de Kol in the junior three-year-old class. This cow is Canadian-bred and comes from known good strains. Her dam is half-sister to Burkeyje Sylvia Posch, a cow that is doing remarkable work for the Friesians in New Zealand.

CERTIFICATES ISSUED FROM 1ST NOVEMBER, 1918.

Name of Cow and Class.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs.dys.	lb.		lb.	lb.
Beaumont Duchess ..	D. H. Kilgour, Kiwitea	2 46	245·1	365	8,800·5	496·17
Ayliff's Zillah ..	Mrs. A. Banks and Son, Kiwitea	2 76	248·1	365	8,983·0	474·18
Greek Maid ..	Thomas Dixon, Masterton	2 11	241·6	365	7,594·9	448·39
Belvedere Thistle Rose	E. Eagle, jun., Carterton	2 59	246·4	365	7,166·7	404·84
Jerseydale's Dolly Dimple	J. Pettigrew, Pihama..	2 24	242·9	365	6,541·4	396·02
Miro Meadows Melba	A. A. Ward, Miro ..	1 358	240·5	365	6,688·5	394·35
Ticoma	P. R. Mitchell, Kiwitea	2 61	246·6	325	6,428·95	393·16
Miro Meadows Ella ..	R. J. W. Hancock, Tariki	2 88	249·3	358	6,944·35	391·86
Zara	T. S. Edwardes, Tiakitahuna	2 25	243·0	264	5,973·9	375·45
Lady Wattles ..	F. C. Ross, Kiwitea ..	1 323	240·5	365	6,759·8	372·09
Rarity of Bull's ..	J. Haskins, Manutuke	2 37	244·2	363	6,048·9	357·48
Maid of Riverside ..	J. T. Belcher, Cardiff..	2 31	243·6	365	6,543·4	333·60
Belvedere Cherry ..	E. Eagle, jun., Carterton.	1 335	240·5	365	5,664·1	329·56
Buttercup's Daisy ..	Chilcott and Webby, Frankton Junction	2 25	243·0	365	6,314·3	313·83
Jersey Brae's Flower	T. Church, Te Rapa, Hamilton	1 344	240·5	339	4,948·1	291·00
Loyalty	W. E. Wickham, Waitara	1 209	240·5	322	4,590·8	254·86
Senior Two-year-old.						
Swastika	F. S. McRae, Palmerston North	2 346	275·1	281	8,334·2	481·04
Waipiko Daylight ..	J. W. Bradey, Te Horo	2 316	272·1	365	8,308·9	445·19

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued*.					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Little Star.. ..	F. J. B. Ryburn, Paterangi	3 15	278.5	365	8,222·7	510·32
Jersey Bank Buttercup	A. Hodgkinson, Takaka	3 222	299·2	365	8,267·2	470·65
Springfield Rosie ..	C. H. Thompson, Twyford	3 278	304·8	365	7,514·1	419·63
Pencarrow's Lady Cornelia	C. Day, Tamahere ..	3 50	282·0	301	6,956·7	410·80
Cloth of Gold ..	J. Haskins, Manutuke	3 237	300·7	360	7,419·5	387·89
Jersey Bank Ruby ..	A. Hodgkinson, Takaka	3 343	311·3	321	7,310·6	322·80
Four-year-old.						
Lady Peggy ..	E. Griffiths, New Plymouth	4 353	348·8	365	11,546·75	725·27
Pearlie Maid ..	W. H. Tippins, Riverlea	4 352	348·7	299	8,025·0	515·03
Jersey Bank Flower	A. Hodgkinson, Takaka	4 332	346·7	365	11,361·2	512·78
Sea Queen.. ..	T. Church, Te Rapa ..	4 27	316·2	322	6,352·5	327·40
Mature.						
Pretty Polly ..	A. Hodgkinson, Takaka	8 353	350·0	365	11,016·5	648·51
Omata Queen ..	C. W. Ruebe, New Plymouth	6 351	350·0	365	11,470·0	621·48
Warrigal Lass ..	C. G. C. Dermer Cheltenham	7 338	350·0	365	11,488·3	602·88
Lady Princess IV ..	H. Salway, Bell Block	6 327	350·0	331	9,885·5	554·74
Jersey Bank Mayflower	A. Hodgkinson, Takaka	6 332	350·0	365	8,880·5	458·00
Pet IV	R. Harper, Woodhill	7 283	350.0	365	8.159·8	444·38
Queen Regnant ..	A. Buchanan, Palmerston North	6 269	350·0	283	6,375·2	383·09
	FRIESIANS.					
Junior Two-year-old.						
Princess Pietertje de Kol	R. Melvin, jun., Masterton	2 102	250·7	365	15,577·8	626·82
Monavale Madeline Paxton	C. C. Buckland, Cambridge	2 65	247·0	365	14,207·5	526·60
Monavale Norma Paxton	C. C. Buckland, Cambridge	2 47	245·2	365	12,135·8	429·28
Cluny Hengerveld Rosebud II	Cluny Friesian Farm Company, Wellington	2 107	251·2	347	8,229·8	296·59
Blanco III V of Ashlynn	R. T. B. Mellow, Inglewood	2 43	244·8	270	7,340·2	291·27
Senior Two-year-old.						
Pareora Glommen ..	A. S. Elworthy, Timaru	2 318	272·3	365	9,421·4	376·97
Pearl de Kol of Ashlynn	Lynn, R. McKelvie, Bull's	2 363	276·8	315	7,712·8	285·21
Junior Three-year-old.						
Rosevale Beets de Kol	H. North and Sons, Omimi, Otago	3 129	289·9	365	18,446·6	615·09
Lady Segis Van Cleve	W. McLachlan, Doylestown	3 92	286·2	365	17,087·9	571·49
Cluny Hengerveld Pietje Kate	Cluny Friesian Farm Company, Wellington	3 118	288·8	365	10,591·4	393·93
Cluny Hengerveld Rosebud	Cluny Friesian Farm Company, Wellington	3 10	278·0	365	8,432·6	336·59

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Lakeside Marie Kroons	R. Gilmour, Tiakitahuna	3 344	311·4	352	12,405·3	352·41
Senior Four-year-old.						
Lady of Tiak III ..	R. Colee, Greendale ..	4 356	349·1	365	12,978·0	499·71
Lady Fayne ..	J. Hart, Raumati ..	4 268	340·3	365	13,650·0	479·09
Penrose Nancy ..	F. C. Leonard, Papatoetoe	4 237	337·2	352	9,729·8	358·35
Mature.						
Mutual Pearl of Rock	W. Barton, Featherston	5 330	350·0	365	19,640·1	736·38
Buttercup of Kokatau	Cluny Friesian Farm Company, Wellington	7 59	350·0	365	17,181·0	642·22
Annette V of Brundee	Cluny Friesian Farm Company, Wellington	8 129	350·0	341	14,923·4	541·14
Rosebud of Kokatau	Cluny Friesian Farm Company, Wellington	6 311	350·0	365	9,230·9	407·77
	MILKING SHORTHORNS.					
Mature.						
Grassmere Dolly ..	W. Brady, Woodville	*	350·0	365	11,931·3	518·56
Willowbend Cherry	J. Smith, Te Rehunga	*	350·0	287	10,437·75	420·54
Rototane Lizzie ..	J. R. Anderson, Tiakitahuna	†	350·0	365	7,482·8	419·18
	AYRSHIRE.					
Mature.						
Nancy Lee of Ayrshire Moor	A. H. Clement, Rototuna	5 223	350·0	342	10,169·8	374·30

* Mature. † Taken as mature.

Reporting on the Whakarewarewa Plantation in the annual report of the Forestry Branch, Mr. H. A. Goudie states: Amongst the fine uniform growth of all species that of Monterey pine (*Pinus insignis* or *radiata*) deserves special mention, vertical growth of from 4 ft. to 6 ft. being quite common on the area planted with this species three years ago. Douglas fir planted during recent years has also done very well, but its comparatively slow growth during the first two years makes its maintenance on heavy bracken country somewhat costly, and in this respect it does not compare favourably with the faster-growing Monterey pine. Of the trees experimented with from time to time for underplanting larch, Californian redwood has proved itself well adapted for this purpose, and, as it ranks high as a timber-tree, it will probably be used extensively when the underplanting of larch becomes general. *Crytomeria japonica* and *Thuja occidentalis* are also species which have succeeded here as underplants, but their economic importance is probably insufficient to warrant their being used to the same extent as redwood.

THE TOKANUI MENTAL HOSPITAL ESTATE.*

KING-COUNTRY DEVELOPMENT.

By J. DRYSDALE, Estate Manager.

THE Tokanui Mental Hospital Estate comprises about 5,000 acres, situated to the southward of Kihikihi, on the northern limit of the district that is still known as the King-country. The boundary of the property extends to the Puniu, the river that for many years was recognized as marking the division between the pakeha and the Maori. That division, however, no longer remains: large areas of the tribal lands have been acquired by the State, and the European settler has also secured through the Native Land Boards assured leases for lands that aggregate hundreds of thousands of acres. The district south of the Puniu embraces a territory that is being rapidly developed. The settlers who are doing this are drawn from all parts of the Dominion, and if mistakes are to be avoided many of the methods that are profitably practised elsewhere must be discarded here. The district already supplies an important addition to the production of the Dominion, and it is safe to say that the volume of its output will immensely increase in the near future.

The general features of the district and of the Tokanui property are those of low hills, wide valleys, and swamps, some of the latter being of considerable extent. The hills are in the greater proportion ploughable and suitable for cultivation. The open valleys are extensive, and the swamps easily drained and decidedly fertile.

The natural vegetation is bracken-fern, manuka, and tutu (taupaki), with a proportion of flax (*Phormium*), toetoe, and koromiko. Introduced shrubs are gorse and broom, and with these is a heath that forms a very conspicuous feature when in flower. It is said to have been brought from South Africa, and to have escaped from confinement in the gardens of the earlier settlers of Pirongia—then known as Alexandra. There are but few native trees in the northern part of the King-country, and there are not any on the Tokanui property.

The soil is popularly described as of a semi-volcanic nature. It varies from a loam to a clay of comparatively open texture. Both the loam and the clay contain pumice in very varying proportions. These soils—with which the farmer and grazier are concerned—rest upon a rhyolitic formation which is in the form of rock of every degree of texture and appearance. Some of the rocks are soft, being

* At the request of local settlers and certain public bodies in the King-country it has been arranged to publish from time to time in the *Journal* accounts of farming operations on the Tokanui Mental Hospital Estate. It is the aim of the authorities to develop this property systematically on the best lines, and the experience gained should thus be of considerable value to the district generally. The present notes by Mr. Drysdale serve as an introduction to the proposed series.—EDITOR.

SCENE ON THE TOKANUI MENTAL HOSPITAL ESTATE, KING-COUNTRY.

Typical of conformation of country. Mangold crop heaped in paddock beyond fence.

simply loosely-held-together pumice, while others are almost as hard as limestone and at first sight not unlike that rock. In some places the rhyolitic rock is in the form of water-worn or weather-worn boulders. This is specially noticeable on the hill immediately above the road approaching the Hospital buildings, and it is interesting to note that the name Tokanui signifies large stones or rocks.

From the point of view of the farmer the soil would be described generally as being light and open, and easily worked. It is of a medium fertility, and is particularly responsive to the application of fertilizers, especially phosphatic manures. Lime also exerts a very marked and beneficial effect, even so small a quantity as 5 cwt. per acre of carbonate of lime soon manifesting its presence.

The soil is particularly adapted to the production of leguminous plants, the growth of red clover even at the first cultivation being phenomenal. The Waikato in the earlier days of settlement was famed for its red clover, and that characteristic is being exemplified again in this new territory of the King-country. Root crops of turnips and swedes are the mainstay of the winter, but with the advent of certain diseases that affect these plants, especially the latter, farmers are giving more attention to the growing of mangolds.

Lucerne promises to become popular in the district. A small area of 4 acres sown on the Tokanui Estate in January of last year has given excellent results. A liberal quantity is being fed daily to the dairy herd of fifty cows. This is cut in the morning with the mower and carted out in the evening. This area of 4 acres produces more than sufficient green feed for the herd, and the surplus is being converted into hay for winter use. While relying mainly on the pasture it is important for the dairy-farmer to supplement the pasture during the dry season with some green fodder, than which nothing is better than lucerne.

Cereals, such as wheat and oats, produce fair crops, but the soil is not of a sufficiently strong character to permit of the raising of grain crops becoming general. The river-flats of the Waipa and the Puniu are well adapted for the purpose, but these lands are of limited extent. In grassland lies the future prosperity of the district, and it is towards the establishment of productive pastures that the work of the Tokanui farm and that of settlers generally is mainly directed.

In preparing the land for grass it has been fully proved that useful pasturage cannot be secured by burning off alone. Some form of cultivation must precede the sowing of grass-seed. The method generally adopted is to cut the natural vegetation and then burn off. There is then an alternative of ploughing, harrowing, &c., or disk-harrowing, followed by sowing the seed. This latter system (disking) has been very considerably adopted, as it does not involve the cost of clearing or grubbing out the heavier roots of manuka and tutu. Disking should immediately follow the burning, so as to obtain the best results from the valuable ash. With one to two hundredweight of manure per acre on this burned and disked surface a useful and profitable pasturage will be provided for probably three years. Then the plough can be used without further cost, the roots during that time having decomposed.

It will be recognized that at an institution such as a mental hospital the provision of an ample supply of milk is essential. For this purpose, as already indicated, a herd of fifty cows is maintained at Tokanui. A number of these are registered Shorthorns, the sire being from imported stock. Naturally the farm also provides the inmates of the Hospital with potatoes, vegetables, fruit, &c. It is proposed in future contributions to deal with the growing of root crops and lucerne, dairying, &c.

SELECTION OF SEED-POTATOES.

By W. H. TAYLOR, Horticulturist.

THE significance of the old saying "Like begets like" is doubtless appreciated by every one, yet very few apply the principles involved to so important a crop as are potatoes. It is quite common experience for a farmer to grow an admirable crop for one or two years, and then a very meagre crop. Bad seasons or something too mysterious to be understood is usually set down as the cause.

There are doubtless a number of factors that may be at work to cause failures, and some of these may be beyond the powers of a grower to alter. It is well known that environment and soil have effect on tubers for seed purposes, but little or nothing is known on that phase of the question as it affects potato-growing in New Zealand. That environment does have great effect is proved by the transformation that takes place, for instance, in the well-known variety Up-to-Date. In the South Island, particularly in Otago, it exhibits its true form, a half-round with a somewhat rough skin. Sets obtained from there and planted in the North Island produce fluke-shaped tubers with a smooth skin. This alone is evidence of the need for investigation. In other ways there is no lack of information or knowledge, and many failures can be distinctly traced to bad practice. It is a general custom to select the seed-tubers from the crop after it is harvested. All sizable tubers are sold; the discards are then sorted, and those large enough are kept for seed. The sets are all small; although most of them are fair seed-size, some are really too small, but would be good enough if they were of a good strain.

Unfortunately, it is practically impossible to keep a strain strong by such methods of seed-selection. When a crop is lifted some of the hills give nothing but small tubers, while others give a preponderance of small ones with a few large. In both instances there is evidence of deterioration or possibly disease. Hills that are good have but few small tubers. It is evident that when seed is saved in an indiscriminate manner many of the tubers will be from hills that have shown deterioration, the proportion being dependent on the extent of such deterioration. The longer the process is carried on the weaker the strain becomes. It must be evident that this indiscriminate way of saving seed-tubers is attended by very grave risks. Even if large or medium-sized tubers were selected in place of small ones there is an almost undiminished

risk, for many of the hills give very few tubers, itself a sign of weakening in the strain.

BETTER METHODS.

If a strain is to be kept strong, methods other than those just outlined must be adopted. There must be special selection, and in many cases special planting of selected sets for seed-production. Selection from the growing hills is recognized the world over as the best way to obtain prolific sets. When the tubers have nearly finished growing, but before the haulm begins to wither, the most promising-looking hills are lifted. Those that come up to the desired standard, both in the number of tubers and their form, are kept for planting purposes, discarding those below a certain standard. Appearances are sometimes deceitful, and promising hills are not always good. Tubers lifted in this way will of course be immature, but it is an accepted fact that such tubers produce heavier crops than do those that were fully matured. Where this cannot be done great improvement could be effected by instituting a process of selection while the ripened crop is being lifted, laying aside the tubers of a sufficient number of good hills. Of course, either plan involves an extra amount of labour, but this is well spent, and improvement in crops cannot be assured without it.

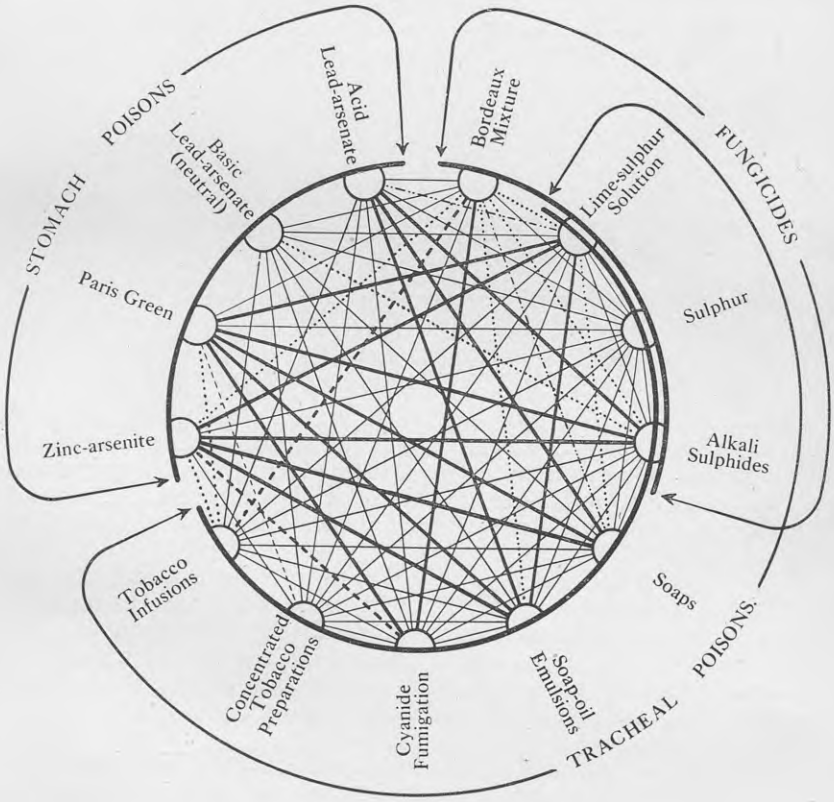
So far the only sets here mentioned for planting have been small ones. Sets cut from large tubers are frequently planted, but these do not always give the crops hoped for. A process of selection is just as necessary with these as with the small sets. They should be taken from good hills, and not from the general bulk of stored tubers. Reverting to small tubers, it is a question how long these could be used without weakening the strain. If small sets are planted and small ones taken from the crop for the next planting, and so on year after year, it is reasonable to expect the strain to weaken, though the period of safety would be extended by annual selection from the hills. It appears reasonable to think that it would eventually be necessary to get back closer to matured parents.

In former years there was an excellent system in vogue in one potato-growing district by which small sets were secured direct from matured tubers. Well-grown specimens were planted about the middle of December, the tubers being whole, and the result was a large crop of seed-size tubers. Several advantages were secured besides the one already mentioned. The sets were a nice size for economical planting, they were not fully matured, or at least not so ripe as the earlier crop, and being later grown they were more easily kept till planting-time. This plan is one that could be generally followed with advantage. I believe it is not carried out in the district referred to at the present time, due no doubt to rush methods and the passing of many of the original growers. However that may be, the fame of the district as a potato-growing centre has faded away.

The method adopted this season at Ruakura of sowing the root crops, including mangolds and carrots, on clean land ploughed out of clover has been well substantiated by results. Weeds are conspicuous by their absence in these young crops as compared with some other fields, and the labour of hand-hoeing has been reduced to a minimum.

REVISED COMPATIBILITY CHART OF INSECTICIDES AND FUNGICIDES.

In the *Journal* for March, 1916 (p. 194), was published, under the heading of "A Chemical Guide Chart for Fruitgrowers," a diagram showing the effect of mixing various spraying-compounds. The chart was



KEY TO CHART.

Dangerous combinations	———	Data lacking:—	
Recommended combinations	———	Probably dangerous	- - - - -
Doubtful combinations, useful under some conditions	—·—·—·—	Probably safe	- - - - - -
		Doubtful	·····

based upon a compatibility table by Mr. G. P. Gray, of California, and investigations by Mr. W. C. Morris, Agricultural Instructor to the Hawke's Bay Board of Education. A revised chart by Mr. Gray was recently published by the University of California College of Agriculture,

and is here reproduced* for the further information of orchardists and others. It will be seen that the stomach poisons are arranged about the upper left segment of the circle, the fungicides about the upper right segment, and the tracheal poisons (contact insecticides, gaseous, liquid, and solid) about the lower segment. Lime-sulphur solution, sulphur, and the alkali sulphides have important uses both as insecticides and fungicides, consequently (explains Mr. Gray) the segments upon which they are arranged are made to overlap, in order to indicate their double utility, and to avoid duplication and an unnecessary number of lines. The materials named have been confined to the standard remedies in use in orchard and spray practice.

* In the original the various lines are distinguished by different colours. Lineal variations are here substituted for such colours.

THE HOME ORCHARD.

SIMPLE DIRECTIONS FOR DEALING WITH THE COMMONER PESTS AND BLIGHTS.

BY THE HORTICULTURE DIVISION.

THE information which follows is published in response to numerous inquiries from occupiers of the smaller farm and suburban orchards. The directions are given in an elementary form to suit requirements for the control of codlin-moth, scale insects, woolly aphis (American blight), red mite, black-spot of apples and pears, and peach-curl in such orchards.

The accepted method of effectively dealing with these orchard pests and blights is that of spraying, different sprays being used as required. For instance, the codlin-moth grub, which directly feeds upon the fruit, is destroyed by keeping the fruit covered with a film of arsenate of lead during the few months when this pest is active. It has been found that this compound renders the skin, when eaten, noxious to the insect, which is thus destroyed. On the other hand, scale insects, woolly aphis, and red mite feed upon the juices of the fruit, stem, and foliage by means of a beak which penetrates the surface and sucks up the natural juices of the plant. For such pests, it will be readily seen, arsenate of lead would be useless as a remedy. The present method is to destroy them with a contact spray, which is effective as soon as they receive a coating of the mixture, this being generally of a caustic or oily nature.

Black-spot on the apple and pear is a deformity of the surface of the fruit, which is not due to insects at all, but a parasitic fungus, for the prevention of which a different spray, again, must be used. During the period of the year when this blight is prevalent it is customary to cover the surface of the fruit-tree with a spray, which prevents the almost invisible spores of the fungus from germinating and establishing themselves in the fruit or leaves.

Money and time are often spent on spraying without obtaining the expected results. This is because it is not properly performed. A few points which will make for effective work are given here.

Spray-pumps.—The effective spraying of the home orchard requires a pump in good order. For a few trees the well-known bucket pump is quite suitable, but it should be clean, and the packing and unions tight. The small length of hose usually supplied with the pump is unsuitable for orchard spraying. 8 ft. of good ¼ in. hose and a 4 ft. directing-rod improve the outfit very much. To do good work requires one person to carry the bucket of spray and pump and another to apply the spray to the trees. This operation must be done thoroughly and systematically, for most of the pests and blights shelter in the angles of twigs, under the leaves, and in abrasions of the bark of the tree. Commence at the top and work downwards; consider the wind-age, and work in dull weather or afternoons if possible. For larger areas a barrel pump is more suitable than the bucket pump.

Attention to Details.—Another important point affecting results is the preparation of sprays. Buckets used for oil should not be used for bordeaux mixture or lime-sulphur without being washed, or *vice versa;* it is a good plan to keep separate vessels for the purpose. Weighing and measuring of ingredients must be accurate. A little too much or too little may burn the trees and cause loss of the crop. When mixing have a batten handy to stir the mixture well, and again occa-sionally while applying it, so as to prevent any settlement of the ingredients.

Spray at the Right Time.—To be effective sprays must be applied at the right time. Codlin-grubs are feeding in November, and are about until February and March, the period varying slightly with locality. Scale insects are dealt with at almost any time, but are more easily destroyed in early spring just before their eggs begin to hatch. Woolly aphis is most dangerous in autumn, when winged immigrants appear, which establish new colonies. Red-mite eggs, which are often found about the base of leaves and twigs, hatch in early spring, and egg-laying is active about the month of March in such places; effective work can be done by spraying at these times. Black-spot spores issue in early spring from the fungus wintering on leaves and branches; they are so small as to be invisible, and settling on the leaves and fruit, under suitable conditions, make root-like growths which penetrate the tissues of the host. Usually the most dangerous period is during September, October, and November.

These facts are given to show the importance of spraying at the time mentioned in the directions which follow.

CODLIN-MOTH.

Considerable loss results each season from the depredations of codlin-moth in apples, pears, and quinces. This can easily be remedied by careful and systematic spraying with arsenate of lead. Although it may not appear so, codlin-moth is one of the easiest insect pests in the orchard to control, always provided that the main principles are adhered to—namely, correct strength of arsenate of lead and thorough-ness of application at the correct times.

A knowledge of the habits of this insect at once indicates a method of intelligent control. We have learned that (1) it lives by eating the

fruit, therefore we cover the latter with a weak poison, such as arsenate of lead, thereby forcing the grub to commit suicide ; (2) the grubs hatch in late spring and through summer from eggs laid by the female moth on the young forming fruit or leaves, consequently we commence spraying the young forming fruit early, and continue at frequent intervals throughout the summer ; (3) as a large proportion of the grubs enter through the eye or calyx end, we endeavour to fill the calyx-cavity with spray before it finally closes ; (4) the grub changes into a moth, which will again lay eggs to hatch into more grubs, and we must therefore destroy all grubby fruit to reduce the numbers for further infection.

From these considerations we may therefore deduce the following spraying treatment :—

Proportions : Arsenate-of-lead paste, 2 oz. (if in powder form, 1 oz.) ; water, 4 gallons.

Preparation : Weigh out 2 oz. of arsenate of lead and place in a small vessel ; slowly add a very small quantity of water, mixing thoroughly all the time. When the whole is about the consistency of milk pour into a kerosene-tin or other vessel and make up to 4 gallons with water. This wash requires to be frequently stirred while being used.

Application : Spray when two-thirds of the blossoms have fallen, with considerable pressure, and force the liquid into the " eyes " of the young fruit. Repeat every three weeks until February. Future applications will depend on district and climatic conditions. Usually it is necessary to spray towards the middle of February, and in some of the northern districts again a month later. These late sprayings, in conjunction with the earlier ones, are also necessary for the control of leaf-roller.

In addition to the spraying treatment advocated, it is absolutely necessary to gather all grubby fruit from the trees and ground as soon as they appear infested, so that it may be destroyed before the grub leaves it.

SCALE INSECTS.

Scales, being sucking-insects, are found adhering to the bark of the tree or to the surface of the fruit and leaves, and are mostly armoured—that is, covered by a natural shell-like shield.

Mussel Scale.—This is a scale which attacks the apple, pear, and plum, and treatment gives considerable trouble to orchardists throughout the Dominion. If its presence is not detected and speedy and effective steps taken for its control it spreads very rapidly, a large number of eggs being produced by the female insect during the season.

Maire Scale.—A native scale attacking deciduous and citrus fruit-trees, ornamental trees, and shrubs generally. Infection from this pest spreads very rapidly. The scale is somewhat round, of a dirty-greyish colour, and usually about the size of a large pin-head.

San Jose Scale.—A troublesome insect pest attacking both stone and pip fruits, and one which may be considered to cause considerable damage in the orchard if not detected and effectively controlled. This scale, as compared in size with those already mentioned, is miniature, is of a greyish-white colour, and circular. Upon close examination it

may be found that the immediate centre is of a yellowish colour, and in this respect it is easily distinguishable from the other scale insects mentioned herein.

Treatment.—The above-mentioned scales are easily controlled by spraying with red-oil emulsion, 3 pints to 4 gallons of water, during the dormant season, preferably in July.

WOOLLY APHIS (AMERICAN BLIGHT).

This is an insect pest too well known to need much description. It attacks many varieties of apples, and is most destructive. Its appearance is easily noticeable—a white woolly substance forming on the parts of the tree attacked. Infestation generally commences on the young wood or at the base of a leaf-stalk—the insect penetrating the wood tissues and sucking the plant-juices therefrom, causing the formation of warty growths on the parts affected. The insect increases rapidly, and, being protected naturally by the woolly substance and also by the growths and crevices caused by its attack, it is very necessary in combating this pest by spraying that the compound used should be applied with considerable force in order that the insect may be well reached.

Spraying is recommended as follows: During the dormant season, with red oil at a strength of 3 pints in 4 gallons of water; and during summer months, with Black-leaf 40, four-fifths of a fluid ounce (3 teaspoonfuls) to 4 gallons of water, to which is added 2 oz. of paste arsenate of lead.

RED MITE.

This pest, like the scales, is a sucking-insect living on the plant-juices of the leaves during the summer, and harbouring during the winter months in crevices in the bark or under forks of the branches, &c., on apple and stone-fruit trees. The insect itself is very small, brick-red in colour, and increases very rapidly. When neglected, the affected leaves are distinguishable at a considerable distance by their sickly appearance, and eventually drop off.

On apple-trees the treatment during the winter is similar to that advocated for woolly aphis—namely, spraying with red-oil emulsion at a strength of 3 pints in 4 gallons of water. For stone-fruits use 2 pints of oil in 4 gallons of water.

FUNGUS BLIGHTS.

Fungus blights include black-spot on apples and pears and leaf-curl on peaches and nectarines.

Black-spot (Apples).—This fungus winters on the fallen leaves, and when conditions are suitable in early spring spores develop. These latter settle on the leaflets at the base of the cluster of buds (known as blossom-buds), where the spores germinate and in due course attack the fruits.

The first spraying is directed to prevent their germination and is applied when the pink of the blossom is showing. Bordeaux mixture has proved most satisfactory, and is used at the following strength: Bluestone (sulphate of copper), 8 oz.; lime, 6 oz.; water, 4 gallons (See instructions for preparation.)

The second spraying is applied when two-thirds of the blossoms have fallen (coinciding with the first codlin-moth spray with arsenate of lead), and is as follows: Bluestone, 5 oz.; lime, 6 oz.; water, 4 gallons.

Black-spot (Pears).—The attack of this fungus is similar to that of black-spot on apples. The treatment is the same as recommended for the latter, excepting that where a severe infestation occurred previously, or on old or neglected trees, it would be advisable, when the buds are swelling in spring, to spray with bordeaux at the following strength: Bluestone, 13 oz.; lime, 10 oz.; water, 4 gallons. Further sprayings to be as for apples.

Black-spot (Apples and Pears).—An alternative treatment for both apples and pears is with lime-sulphur compound as follows: Winter formula—3 pints lime-sulphur to 4 gallons water; spring formula—$1\frac{1}{4}$ pints lime-sulphur to 4 gallons water; summer formula—$\frac{1}{3}$ pint lime-sulphur to 4 gallons water.

Leaf-curl (Peaches and Nectarines).—The fungus causing this disease settles on the buds in early spring, and is most troublesome during cold, wet seasons. It is readily held in check by spraying the trees in spring when the buds are swelling. Bordeaux at the following strength is advised: Bluestone, 13 oz.; lime, 10 oz.; water, 4 gallons, mixed as directed.

An alternative treatment for leaf-curl is as follows: Winter formula—Lime-sulphur, 2 pints; water, 4 gallons.

DIRECTIONS FOR PREPARATION OF BORDEAUX MIXTURE.

The following directions apply to the quantities of bluestone and lime already given:—

Dissolve the bluestone in 2 gallons of water; slack the lime slowly in another vessel, and make up to 2 gallons; then pour both solutions *simultaneously* into a third vessel. In using the mixture during the dormant season it should show a slight acid reaction—that is, when tested with litmus paper.

Bluestone is readily soluble when placed in a piece of sacking and allowed to touch the surface of the water or suspended an inch or so below it, or by using hot water.

The efficiency of bordeaux mixture depends upon the intimate blending of the two solutions obtained by pouring both of them simultaneously into a third vessel. It is imperative that the chemicals used be pure and the lime fresh. The best results are obtained when the application is made as soon as possible after blending the two solutions. If allowed to stand for more than eight hours the fungicidal properties of the mixture largely depreciate.

Over one hundred calves—Milking Shorthorns and Jerseys—are being reared at Ruakura this season.

Calcium carbide refuse is slaked lime, and can be used beneficially as a soil-dressing. If, however, kept for any length of time before use it will lose a large amount of its causticity by becoming recarbonated with the carbon dioxide of the air.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE fruitgrowing industry has no doubt been one of our primary industries most adversely affected by the war, although this did not occur altogether in the manner at first anticipated. The peculiar position of the industry at the beginning of hostilities could not fail to have a prejudicial effect. Large areas of fruit-trees had been planted annually, new areas were coming into bearing, and crops were increasing in proportion year by year. This, taken in conjunction with the early cessation of export owing to the lack of shipping, suggested a real danger of the overproduction point being reached well before the position again reached normal. Fortunately, however, nothing of a very disastrous nature in this direction has yet eventuated. Moderate crops on the one hand, and considerably improved marketing methods and the extension of cool-storage accommodation on the other, assisted very materially in saving the situation. Naturally, however, the war conditions did affect orchard-extension. Planting continued briskly for a season or two, but in the circumstances this could not be expected to continue, and as a natural consequence orchard-extension has for some time practically ceased. This fact, as may be readily appreciated, has had a very disastrous effect on the business of many New Zealand nurserymen who had their nurseries stocked with trees in anticipation of further orchard development. The fruit-tree-raising industry has, indeed, suffered to a decidedly greater extent than that of fruitgrowing.

However, the great war is now successfully concluded, and the fruitgrower is beginning to breathe more freely and to look with less misgivings upon the industry he is engaged in. The question of export is being taken up in many quarters as an immediate possibility. Oversea buyers are already making inquiries and announcing their willingness to trade, and all that remains is the assurance of shipping-space to allow of a reopening of our export trade being made this season.

Advice and reminders in orchard work for the coming month are given as usual in the district notes which follow. Owing to staff changes in progress the Canterbury notes are temporarily omitted.

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

AUCKLAND.

With the advent of February, bringing with it the full rush of the fruit season, the grower will find every moment fully occupied in attending to the proper picking, grading, packing, and marketing of his produce. The working methods adopted on quite a number of commercial orchards at the busy season are not conducive to the best results being obtained, and this is undoubtedly responsible for the loss of much valuable time. The adoption of a plan of methodical working is recommended, more especially when a large bulk of fruit is to be marketed—a certain fixed plan of picking and bringing to the sheds, handling, grading, and finally packing and stencilling. Assign to each hand employed at this work his or her certain duties, so that uniformity may be obtained.

The first and second early peaches and plums, and some early apples, will already have been marketed, and during the month the midseason peaches will be matured. Attention is directed to remarks in last month's notes regarding precautions to be taken by consignors of stone-fruit with respect to brown-rot infection. As a preventive measure against infection just at the ripening-period the application of commercial lime-sulphur, 1–125, or self-boiled lime-sulphur, 8–8–50, is recommended.

Growers are advised to continue with the three-weekly application of arsenate of lead for control of codlin-moth, leaf-roller caterpillar, and also leech on pip-fruit trees. Plums may be kept free from leech by the application of arsenate-of-lead paste, 1 lb. to 50 gallons.

Where lemons are affected by scale insects spray with red oil, 1–40, when the young late spring growth has hardened.

Clean cultivation should be maintained throughout the orchard.

Spraying summary.—Peach, nectarine, and plum: Commercial lime-sulphur, 1–125, or self-boiled, 8–8–50—when fruit begins to ripen, and further as circumstances demand.

Pear, apple, and quince: Commercial lime-sulphur, 33° test, 1–100, in conjunction with arsenate-of-lead paste, 1½ lb., or powder, ¾ lb., to 50 gallons—every twenty-one days.

Lemon and orange: Bordeaux, 4–4–40—when petals have fallen from main crop of blossoms; red-oil emulsion, 1–40—when young spring growth has hardened (following bordeaux). —*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Codlin-moth and leaf-roller: Regular applications of arsenate of lead, 1½ lb. paste, or 1 lb. powder, to 50 gallons water, must be maintained at intervals of about three weeks for the successful control of these pests. To minimize the danger of condemnation of fruit at its destination growers would be well advised to spray their fruits to within a few days of picking. At this season many grubs hatch out during transit.

Black-spot: Regular examinations of pears and apples should be made, and lime-sulphur or bordeaux applied on the first signs of live fungus. If there is any danger of black-spot development on susceptible varieties, such as Williams and Louise Bonne of Jersey, it is a wise plan to spray prior to picking or packing, so as to control the disease during transit.

Woolly aphis: A second spraying for this insect is usually necessary about the middle of January. Black-leaf 40 is giving the best results so far. This spray seems to have much better penetrating properties when combined with lime-sulphur or arsenate of lead, or even combined with the two compounds. Use lime with the arsenate: it will minimize the danger of burning.

General spraying: Keep leech under control on cherries, plums, and pears. Spray with arsenate of lead, 1 lb. paste to 50 gallons water. Plum-rust should be attended to and sprayed with bordeaux, 3–4–50, or lime-sulphur, 1–100. This spray will also assist in controlling brown-rot. For fungus diseases on peach-trees use lime-sulphur, 1–130. Spray mildew-infected apple-trees at regular intervals of about four weeks with either lime-sulphur or atomic sulphur.

Combined sprays: As the season advances and the foliage gets older it will not stand up to such severe sprays as it will when younger. This should place growers on their guard against possible injury to the foliage. Combined sprays are the most treacherous, and when used every care should be taken in their preparation and mixing. Considerable trouble can often be traced to not cleaning out the sediment in the spray-tank. Lime should be used if there is a risk of the spray being acid. If it is possible to reduce the strengths of the sprays do so, but these must not be reduced below the point of efficiency.

—*G. Esam, Orchard Instructor, Hastings.*

NELSON.

Spraying: Unusual variations of climate experienced in the Nelson District this season make orchard spraying a difficult subject. Applications of arsenate of lead will need to be continued to counteract the attacks of codlin-moth, leaf-roller, and leech. At this season red mite, mildew, or brown-rot fungus is apt to be troublesome; should this be the case, apply lime-sulphur, 32°, 1–125, or

26°, 1–98. Green aphis has been very prevalent on the peach-trees. The pest does serious damage unless quickly checked; not only does it destroy the foliage and restrict the growth, but the spread of parasitic fungi is greatly facilitated. These aphides are easily destroyed by two or three applications of tobacco concentrate.

Gathering the crop: Midseason varieties of apples and pears will soon demand all the attention of the grower. This section is a very large one in the Nelson orchards, as it includes, comparatively, all the export varieties of apples. It is a section where heavy losses have been incurred during the last four years of war, when the apple-export trade was completely stopped. A great deal of this loss can be avoided in future if the unfortunate experience of recent years is properly considered. Cox Orange and Jonathan apples and William Bon Chretien pears are some of the chief varieties concerned. The commonest mistake has been to pick these varieties too ripe, when they become spongy and decay at the core before they reach the consumer. The right time to pick this class of fruit varies with the class of land and orchard-management, which makes it impossible to lay down any ruling on the subject and necessitates each grower giving the matter careful consideration. The colour of the seeds and the red blush on some apples are some of the factors indicating maturity; another, very much stressed in an excellent bulletin recently issued by the United States Department of Agriculture, is the change in the green ground-colour of immature fruit, which begins to yellow slightly as it approaches maturity. These and suchlike varieties are best picked immediately they mature; this will necessitate at least two separate pickings. The experience of the last season or two has taught us that this class of crop must be handled with despatch, and should it for any reason be necessary to hold it for a while it must be done in cool store. Orchard fruit-stores—more or less insulated—often do splendid work storing some late varieties of apples, but with the higher temperatures of summer they are usually unsuitable for holding midseason fruits.

Budding: In reworking orchard-trees, specially the stone-fruit section, this operation is of great value. It may be carried out most satisfactorily at the present time. —*W. C. Hyde, Orchard Instructor, Nelson.*

OTAGO.

Stone-fruits will be in full swing from now on, and growers will be hard at work harvesting and marketing the crop. During this time other orcharding operations are liable to be neglected, much to the detriment of the quality and quantity of the later fruits of the orchard. This is often the case in regard to codlin-moth, and many hundreds of cases are destroyed through leaving the fruit unprotected for too long a period. Get a spray on as soon as possible; about the end of January is a critical time both as regards codlin-moth and leaf-roller caterpillar. Use arsenate-of-lead powder, ¾ lb. to 50 gallons, or paste, 1½ lb. to 50 gallons.

For all fungus diseases lime-sulphur and atomic sulphur are best from now on, as they act as insecticides as well as fungicides. Reduce the strength of lime-sulphur in this and subsequent sprayings to 1–120 to 1–130. Use atomic sulphur, 10 lb. to 100, on any varieties susceptible to burning, especially if using a combination spray.

Cherry and pear slug will now be troublesome, and trees will soon become defoliated. Do not neglect to spray with arsenate of lead even though the trees have no fruit. Neglect of this on young trees often means disappointment at next pruning-time, when it is found that growths have not developed as anticipated.

Where red mite and woolly aphis are both present make one spray do by combining lime-sulphur and Black-leaf 40. Use plenty of pressure and drive well into knots and crevices.

In the thinning of apples pay special attention to Scarlet Nonpareil where large crops are being borne. These are inclined to run small if not thinned, and trees suffer by becoming stunted if allowed to bear excessive crops.

Strawberries will soon be over and leaf-spot making its appearance. Spray with 4–4–40 bordeaux for this disease.

Where peach-rust has given trouble in previous years use lime-sulphur, 1–130, or atomic sulphur, 10–100. Choose cool weather for stone-fruits, as they are liable to scorch. This spray will also assist in checking brown-rot should it be in evidence.
—*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

WITH the hatching and brooding operations all over, and the youngest of the chickens at a safe age, February should be more or less a slack month on the poultry plant. Advantage may well be taken of the opportunity thus afforded of getting things in good order for the winter season by thorough spraying of the houses, cleaning up the runs, making any repairs, and generally attending to everything that had to be neglected during the busy time of hatching and brooding of the young stock. The poultryman's slack season is very short, and during the breeding season few primary producers have a more exacting time. If there is one man more than another who deserves a holiday it is he who has had the heavy strain of hatching and rearing a large number of chickens, and at the same time carried out successfully the many details in connection with the other branches of his business. Many breeders are looking forward to a well-earned holiday. Of course, this is impossible at the present time unless a thoroughly experienced person is available to take charge of the plant. In most cases the poultryman will prefer to delay his holiday until he sees his pullets well settled down in their winter quarters. Then instructions could be more easily carried out by whoever was left in charge, thus minimizing the risk of the birds receiving a set-back or going into a false moult.

No doubt many breeders are contemplating attending during their holiday period the annual poultry conference to be held at Christchurch in March. The conference promises to be of a most important nature; matters of vital importance to the industry will be discussed. Apart from this an opportunity will be afforded of coming into contact and exchanging opinions with leading poultrymen from various parts of the Dominion. Advantage can also be taken of the opportunity to visit the egg-laying competition at Papanui, when the competing birds may be studied, which in itself should be of great educational value. Furthermore, at these annual gatherings the executive pays due attention to the social side, visitors being afforded an opportunity of viewing the city and things of most interest. Since its initiation, only a few years ago, the New Zealand Poultry Association has built up a strong organization, for which it is to be congratulated. Although the membership does not number a quarter of what it should, the association has done good work, and if given the support it deserves it should in the near future be a big factor towards advancing the poultry industry of the Dominion. It is to be hoped that the conference will be a complete success in every particular, and that it will be the means of further advancing the true spirit of co-operation among poultry-keepers.

THE YOUNG STOCK.

Under summer conditions, and the runs getting into a more or less stale condition, the young stock are apt to leave their food. This does not necessarily mean that too much is being supplied. It more often indicates that the birds are tired of the one class of food that is being provided. When this occurs it is advisable to change the ration and

make it as appetizing as possible, otherwise the birds are apt to receive a set-back from which they will never recover. In this connection the value of an abundant supply of green stuff cannot be overestimated. Watercress is an excellent material; the young birds greatly relish it, and there is nothing better for toning up the system. A change on to a fresh run will also have a most desirable effect in this respect.

The growing pullets should on no account be forced to prematurity with meat, &c.—one of the greatest blunders made in poultry-keeping. The overforced bird may certainly commence to lay at four and a half to five months old, but in the long-run this is of no advantage to the poultry-keeper, as she neither gives the weight of eggs nor the yield for the season which is given by the bird which comes naturally to lay at, say, six months and is then full of constitutional vigour. In addition to being a more prolific egg-producer this properly developed bird is also vastly superior for the breeding-pen.

ALLEGED INFERTILE EGGS.

It is a difficult matter—in fact, almost impossible—to convince some people that if a fresh egg goes rotten in the short space of two or three weeks when placed under a sitting hen or in an incubator such an egg must necessarily have been fertilized to become in this condition. Recently a case in point came under my notice where a purchaser returned to the supplier a setting of eggs which had been sat upon for three weeks, and demanded a refund of the amount paid on the ground that the eggs were infertile. On testing, the eggs presented a black appearance; in other words, they were rotten. Their appearance gave positive proof that they had all been fertilized, as an infertile egg when held before a light, even after being sat upon for a period of three weeks, will be almost as clear as when first laid. Indeed, it is not uncommon for infertile eggs after being in an incubator for a week or even longer to be used for baking purposes. Of course, the hatching-qualities of eggs are often affected in transit, and they will fail to hatch even after making a healthy start. The breeder should therefore not always be blamed when a poor hatch is secured. Most breeders guarantee a reasonable number of fertile eggs in each dozen, and if these prove to be otherwise they replace them gratis. This is all that can be reasonably expected of them. They cannot be held responsible for damage done during transit, nor for mistakes made during the time the eggs are undergoing the process of incubation. Of course, even on the best-managed plants a breeding-pen may go off without the owner being aware of it, with the result that some infertile eggs may be sent out. It is to be feared, however, that too often breeders are condemned for sending out unreliable eggs when the real cause of non-hatching has been faulty management of the sitting hen or the incubator.

High perches and a hard landing where the birds jump from the perch is a frequent cause of disorders of the feet, especially corns.

Good clover hay is a first-class egg-food. It should be finely chaffed, scalded with boiling water, and allowed to stand overnight before mixing in the morning mash.

THE APIARY.

By G. V. WESTBROOKE, Apiary Instructor.

THE work of extracting will now be in full swing. Those who are inexperienced would benefit by carefully reading and closely following last month's notes on the subject.

FOUL-BROOD.

All cases of foul-brood should have been treated during the spring months. Those who have only now become aware of this disease should realize the necessity of treating affected colonies without a moment's delay. The only safe and sure method is that usually known as the "shake" or "McEvoy" treatment. This is fully described in the bulletin on foul-brood issued free by the Department. The only kind of foul-brood we have in New Zealand is *Bacillus larvae*, generally known as American foul-brood. Beginners should remember this when reading English or foreign papers, in which articles on the subject often refer to European foul-brood. The writer has known of several failures in attempting to treat American foul-brood by methods usually advocated for dealing with European foul-brood. Beekeepers should acquire the habit of constant vigilance when the brood is within view, always being on the lookout for the first signs of disease.

REQUEENING.

It has now become generally recognized that the main essential to successful beekeeping is to have the colonies headed by young vigorous queens. The present exceptionally late season has delayed the raising, mating, and distribution of early queens. Those who have not already done so would be well advised to send at once to a reliable breeder for young queens to replace old or failing ones. Do not kill the old queen until the new one arrives. Carefully examine each comb when looking through the hive for the queen about to be replaced, and destroy any queen-cells that may have been started. Be sure and read carefully the directions on the back of the address-label. If the beekeeper is a novice he should follow out the directions minutely.

When sending for queens, more especially for tested ones, request that one wing be clipped. This will often save unnecessary friction between the buyer and the seller. There have been many cases where the queen has been safely introduced, but shortly afterwards has been superseded, the bees having raised another queen, which probably mated with a black drone. After a month or so the buyer examines his hive, and, finding a mismated queen, assumes the breeder has been dishonest. Had a wing of the tested queen been clipped no mistake could take place. A good method is to clip the left wing on this season's queens and the right wing on the next season's. This will enable one to tell at once if the queen is old or young.

The great advantage in clipping is that when the hive swarms out the queen, not being able to fly, can easily be located, probably being found climbing up a stem of grass near the hive. She can then be

readily caged while the bees are clustering. Then remove the parent hive to a new location, and put the newly prepared hive on the old stand. In a short time the bees will miss their queen and come pouring back into the new hive, mistaking it for their old home. Then release the queen on top of the frames, and the bees will be happy. If no increase is desired, cut out all queen-cells in the old hive and place the latter above the new swarm over a queen-excluder. Should the queen be old and it is desired to replace her, leave only one queen-cell in the old hive, and do not replace this until the young queen is laying. Then kill off the old queen and unite. In this case do not shift the old hive far away, but place it alongside or behind the old stand with the entrance facing in a different direction. This will enable the hives to be united easily.

VITICULTURE.

By S. F. ANDERSON, Vine and Wine Instructor.

THE VINEHOUSE.

EXCEPTING the late varieties, most of the grapes will now be ripe. There are so many vinehouses where early and late sorts are grown together that advice given has necessarily to cover as nearly as possible both. Such conditions are by no means ideal, however. We will assume that the varieties grown are Black Hamburg and Gros Colman, as it is common to meet these two in the one house receiving the same conditions. The one is an early, the other a late variety. Now, the Black Hamburg in the cool-house ripens at the end of December or a few days into January, and requires care to keep it hanging. The Gros Colman, on the other hand, ripens very late. Therefore the conditions required are very different. It is obvious, then, that the two should not be grown in the same house if the best results are to be obtained. The crop of Black Hamburg should be gathered as soon as ready. If the house is kept open to suit the keeping of the Black Hamburg that practice retards the Gros Colman. Although the Gros Colman is a late ripener, in order to obtain the best colour it must be well on the way to maturity before the sun-heat begins to fail in February and March. The grapes should be a sooty black when well finished.

It is a practice with some growers when gathering the grapes to cut off the lateral carrying the bunch in order to get the piece of wood with it. This robs the vine of much foliage, which is required to go on growing into autumn. Growth should be encouraged from the time the fruit is gathered till winter. There is no necessity for removing it, and the plant is greatly benefited by allowing it full liberty in this respect.

Houses troubled with mealy bug may now be cyanided, the conditions being that the house and foliage must be dry, the temperature low, and the fumigation done after sunset. The method of work is fully set forth in Bulletin No. 40. Amateurs are, however, cautioned that the application of cyanide is dangerous, and should be done only under the direction of one acquainted with its use.

THE VINEYARD.

There is not much to add to the notes on cultivation of the vineyard in last month's issue. Before attempting any slashing in of the growth the strong shoots growing from the spurs provided on the crown of the plant for new rods should first be picked out and tied along the top wire. If this is not done first they are liable to be topped with the other superabundant foliage in strong-growing vines. After this is done the slashing should be done at a regular height about 9 in. above the top wire. Apparently a rough job, it is often done in too rough a way, but really requires careful workers to do it. It is a great mistake to allow the growth to become very strong and then cut off a great deal. It is better to go over the vines two or three times, commencing when they have produced only 6 in. or 9 in. of growth.

THE CELLAR.

February is generally a very hot month, but so far this season only cool weather has been the rule. The usual cellar practice is to move wines during this month only when absolutely necessary. If, however, the cool summer continues, some exceptions can be made in this respect where sales demand it. Some of the new wines will move if hot weather sets in, and may require attention. All empty casks should be seen to, and, if necessary, the hoops driven on. Any that require sulphuring should be attended to. The heat soon relaxes the staves of the empties and the fumes escape, then with damp weather following mould grows very quickly. A mouldy cask is a great trouble to thoroughly restore to perfect condition—much more trouble than sulphuring it regularly. Any alterations or additions to cellar equipment, building, stillions, &c., should now be carried out. There is nothing like having things ready in good time for the vintage operations.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE planting of cabbages, cauliflowers, broccoli, brussels sprouts, and various kales should in most places be already done. In the warmer parts of the North Island later planting is successful; in the coldest districts all such plants should be out during January; while in the middle districts the work should be finished by the middle of February. Any put out later cannot be depended on to attain to serviceable size for winter use.

French beans may be sown up to the middle of February. Swede turnips should now be sown for winter use. Thin to about 8 in. apart. White turnips should be sown as required, still in small quantity. Silver-beet may be sown now for winter use; also spinach for the same purpose should be sown about the middle of February. Silver-beet should be thinned to 10 in. or 12 in. apart, or it may be transplanted if convenient. Spinach for winter use should be thinned to about 8 in.

apart, taking care that the plants stand singly. Where supplies are insufficient or when young roots are preferred to old ones, red beet of a turnip-rooted variety may be sown, also turnip-rooted parsnip, and a stump-rooted carrot such as Nantes. Development will in no case be great, but these catch-crops often prove to be very useful.

Onion-beds should be kept free of weeds and the surface soil loose. No further attempt should be made to force growth, either by the use of artificial manure or by liquid manure, as such treatment increases the danger from mildew and also mars the keeping-quality of the bulbs. Bending the tops to assist ripening should not be resorted to except in extreme cases. In our climate the tops usually wither and fall naturally, and where this happens it is a sign of well-ripened bulbs and is very desirable. Bending the tops should never be done until it can be seen that they will not fall naturally. The latter state may be caused by wet weather, particularly if the soil is overrich. The giant kinds are those most affected in this way; it seldom happens to the medium-sized keeping varieties. If bending the tops is necessary it should be done carefully; the stem must not be broken, for if it is the plant will at once send up new growth through the broken part and the bulb be ruined. A stem should be taken between the thumb and fingers, bruising and bending over at the same time, so that it will lie down but remain intact.

Celery-planting should be finished. This vegetable may be put in much later in northern districts, but if planted now it will make larger heads. Planting later is therefore more a matter of convenience than a necessary practice. Where rust threatens the plant should be frequently sprayed with bordeaux mixture.

Planting of leeks should be completed within the coming month. Details of the method of planting were given in the December *Journal*.

Pumpkins, marrows, cucumbers, water-melons, pie-melons, and rock-melons may be left to grow in their own way—as they frequently are left in large cultivations. This, however, is merely a gamble; best results cannot be expected from such methods; if fruits of anything like even size are to be secured the growths on each plant must be controlled. The habit of growth is the same in all the gourd family, differing only in strength. In all cases a limited number of strong runners are sent out in the first place. These may be regarded as the framework of the plants. From these lateral or side shoots proceed. These are the fruit-bearers; although the main arms will bear fruit it is not profitable to allow this in a general way. When the main arms have made a few feet of growth their points should be cut off. This will encourage the growth of laterals, which will soon show fruit. After this the cultivator should decide on what he wishes to obtain—either a few large fruits or a number of smaller ones—and proceed accordingly. If hundredweight pumpkins are desired a plant can only grow one or two of them, and all others must be suppressed and the vines be kept pinched. If quantities of smaller specimens are the object more laterals are allowed to fruit, and pruning will be to stop each lateral a leaf or two beyond the fruit and to thin out or stop waste growth. Marrows and pumpkins produce fruit until stopped by cold weather; therefore in their case late growths may be allowed to run unchecked. Melons will not ripen late, and as this fruit is, of course, useless unless ripe, the

plant-growth should be checked for the benefit of the main crop, which is the only one that will ripen.

Insect Pests.

The larvæ of the diamond-backed moth, which is the greatest pest of the cabbage tribe, is unlikely to be present in devastating numbers this season, wet weather and cool conditions so far having restricted—in some districts quite prevented—hatching and breeding. When the infection is not bad I have found hellebore powder the best thing to use, it being easily applied, requiring no preparation. The grubs do most damage by eating the tiny leaves forming in the centre of the plants, particularly cauliflowers and broccoli. A little of the powder dusted on these centre leaves will save them from injury; no notice need be taken of the larger leaves, but fertilizing with nitrate of soda to assist growth should not be neglected. In the warmer districts celery and also carrots and parsnips are liable to be infested by small green lice. If these are left in possession the foliage turns yellow and growth ceases; soon the foliage withers away and the plants die. Spraying with Vistolene or XL All fluid kills the insect at once. The spray should be fine or it will not cling to the foliage, and, further, a coarse spray is very wasteful. The grey aphis that attacks the cabbage tribe in dry weather can be controlled in the same way. Brussels sprouts are liable to become badly infested with these insects after the sprouts are formed. In this case I prefer to treat them with boiling water applied forcibly with a garden syringe, and I have had complete success with this plan. The aphis in this case has usually appeared towards the end of summer when days are shortening and becoming cooler but when the soil is very dry. I have then always found one syringing sufficient, as rain is usually not long coming, the plants get more moisture, and the lower temperature prevents a reappearance of the pest.

Fertilizers.

Fertilizers, with the exception of nitrate of soda, should preferably be applied before planting. Some authorities advise the general use of basic slag for vegetables; it has the advantage of being non-acid, therefore does not encourage club-root disease. Four ounces per square yard is a suitable amount of slag. It may not be wise, however, to rely on the continued use of only one fertilizer. Blood-and-bone is useful for most crops, so also is superphosphate. Where the soil has been kept in good heart by a proper use of fertilizers, by rotation of crops, and by turning in green crops for humus, large quantities of fertilizers are not required. In such circumstances superphosphate, 1 oz., and bone-meal or blood-and-bone, 1 oz., each per square yard, is sufficient. This equals about 2 lb. per square rod, or 300 lb. per acre of each, and 600 lb. per acre in all. Nitrate of soda is of great value in vegetable-culture. All crops are benefited by light applications of this salt, but what may be termed green crops, as distinguished from root crops, are most benefited. The dressing should be light; heavy dressings are likely to induce a too luxuriant soft growth. Two dressings each of ½ oz. per square yard, equal to 150 lb. per acre, are better than one heavier dressing. The first dressing should be applied soon after the plants begin to grow after being transplanted, the second five or six weeks later.

ANSWERS TO CORRESPONDENTS.

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.

CONTROL OF PIRIPIRI.

A. C. WOOD, Lottin Point, East Coast :—

I have two paddocks (about 500 acres) which during the late wet seasons have become infested with biddy-biddy. This country is steep, faces due west, is warm, and usually very dry. The country was originally bush and has been felled five years. It was sown to cocksfoot, rye-grass, clover, &c. The grass took well, but only the cooksfoot has held. I propose this year, if dry enough, to get a second fire through the logs and then resow cocksfoot and Danthonia pilosa. Do you consider that by doing this the danthonia would smother biddy-biddy ? I should like to know anything there is to be learnt of control of biddy-biddy, as it promises to become a regular curse.

The Fields Division :—

To control piripiri it is essential that cattle-stocking be practised. No matter what grasses are sown, if sheep alone are used the weed is sure to spread. We are, however, confident that on coastal lands such as you describe there is no better grass-mixture than danthonia mixed with cocksfoot and crested dogstail for sowing second burns. About 6 lb. danthonia, 2 lb. dogstail, and from 4 lb. to 8 lb. cocksfoot (depending on the amount of the latter grass that is already established) is recommended. So far as cattle are concerned, we should use at least one cattle beast to four or five sheep. Heavy stocking with cattle both in the autumn and early spring will be found to gradually reduce the amount of piripiri.

LIME-SULPHUR FOR SPRAYING POTATOES.

P. V. LONGFORD, Kotinga, Takaka :—

Can you give me any information as to whether lime-sulphur spray has been tried with success for potatoes, and what strength would be necessary ?

The Horticulture Division :—

Lime-sulphur has been used to a limited extent in this country as a spray for potatoes, the strength being 1 in 125. Bordeaux mixture has, however, proved so effective that it seems wisest to continue its use, and particularly so as American authorities who have experimented with lime-sulphur warn potato-growers not to use it. There are practically no reliable data as to the effect of lime-sulphur on potato crops in New Zealand.

CALF WITH LABOURED BREATHING.

"SUBSCRIBER," Clyde :—

I have a calf, age about twelve months, which is running in good pasture and doing fairly well, but when feeding it breathes very heavily, almost like a broken-winded horse. Can you suggest what the trouble may be and a remedy ?

The Live-stock Division :—

There may be nothing seriously wrong with the calf, and we would advise you, so long as the only evidence of abnormal conditions is laboured breathing whilst eating, not to treat with medicines. It would be beneficial, however, to place a lump of rock salt where the calf can lick it freely.

FEATHER-PULLING AMONG FOWLS.

"SUBSCRIBER," Swanson :—

Would you please tell me the cause of fowls plucking the feathers out of one another, and give a remedy. Mine do not get a great deal of meat, and a neighbour's get a good deal of cooked meat, and a little raw, and they are worse even than mine.

The Live-stock Division :—

Feather-pulling among fowls is one of the most difficult ill habits to overcome. Usually it is the result of overcrowding and insufficient exercise. Birds that have free range seldom acquire the habit, and birds in full plumage are always the culprits. Sometimes feather-pulling is caused through birds being badly infested with vermin. Should a bird acquire the habit in a run where vermin is bad it will soon find every other bird willing to allow its feathers to be pulled out—this owing to the severe irritation caused by the lice. In watching a pen of feather-pullers it is surprising to see how the hens will invite the culprit to pluck them, and that all the damage is probably being done by one or two birds. Careful observation will locate these, and if they are destroyed and proper dusting-places at once provided for the flock the trouble may be stopped. Prevention is, however, the only real means of dealing with this trouble, a free range being the chief essential. The giving of raw meat to fowls cannot be recommended, especially when birds have once acquired the feather-pulling habit.

PREMATURE FALLING OF FRUIT.

COLEMAN PHILLIPS, Carterton :—

Would you please explain why it is that apricots and nectarines are withering away this season, and dropping off the trees. I never saw so good a setting of fruit, but the trees are now going bare.

The Horticulture Division :—

The withering-away of the young fruits of apricots and nectarines is probably due to imperfect fertilization, owing to adverse weather at flowering-time. Even in apricot districts there is never a crop when there is much rain at flowering-time. In addition to rain the temperature has averaged far too low this season for such fruits. The apricot in particular requires a fairly high temperature, and if this is accompanied with a dry spring the better are the prospects for a good crop. There is a possibility that brown-rot disease may be in part responsible for the losses, especially in cases where early spraying with a fungicide has been neglected.

DEALING WITH BLACKBERRY.

"BERRY," Paekakariki :—

I have some small blackberry-plants on my sandhill section. Please tell me the easiest way of eradicating. Are any of the poisonous sprays effective ?

The Fields Division :—

None of the poisonous sprays have proved really effective in general practice for the destruction of blackberry. The stems and leaves are destroyed, but the mixture does not penetrate to the roots. As you describe the plants as small ones and growing on sandhill, grubbing would prove the most satisfactory way of dealing with them.

PRUNING OF IRISH PEACH APPLE-TREE.

J. WHITEHOUSE, Waihi :—

Would you please advise regarding the pruning of the Irish Peach apple-tree—both summer and winter pruning.

The Horticulture Division :—

The pruning of the Irish Peach apple requires care if a good tree is expected. The natural habit of the tree is to bear fruit on the terminal buds of lateral growths. Fruit-spurs form but slowly, and usually only occur on laterals that have borne fruit on the terminal buds. When fruit-spurs thus form the lateral should be shortened to them at the winter pruning. When laterals are fairly short they should not be cut until they have borne fruit. Very strong laterals may be shortened back to a few inches in winter, and the subsequent growths thinned to one about midsummer, or they may be better cut out altogether, this depending on their number and position. The trees must not be crowded with growth. Laterals may be cut shorter—that is, to bear fruit nearer the tree—by cutting back such as are palpably too strong to three or four buds about the first week in January or soon after. New laterals are formed that frequently bear fruit the following season. Of course, this would not occur if cutting-back were done at a later period.

CONTROL OF PENNYROYAL.

H. OLIVER, Onehunga :—

Will you kindly tell me how to rid my land of pennyroyal. Last year I grubbed and burned, but it is thicker than ever now.

The Fields Division :—

Drainage, cultivation where practicable, and the free use of lime are the best means of ridding land of pennyroyal. As the plant does not root deeply, skim-ploughing and allowing to fallow for a time, especially in hot weather, will also be found a help. An account of experiments in the control of pennyroyal was published in the *Journal* for January, 1917.

SOIL-FERTILITY QUESTIONS.

G. H., Ramarama :—

If you can give me any information on the following I shall be obliged : Take two farms, with similar soil originally—No. 1 has been well looked after, top-dressed, &c., and is in really good heart ; No. 2 has been neglected and is in poor condition. If both get the same good treatment henceforth, how long, approximately would it take No. 2 to overhaul No. 1 ? Or will No. 2 always be the inferior farm unless it gets better treatment than No. 1 ? People speak of a farm as always having been " done well," implying that the manure sown nine or ten years ago is giving results even now ; but there must be some limit to the beneficial effects of even bonedust.

The Fields Division :—

The condition of soils known as " fertility " is a very complex matter indeed. When a soil is really run down this has generally been brought about by taking off successive white crops or hay, and the reduced fertility may be due to lack of readily available plant-food material in the surface soil, or to lack of lime, or lack of humus. Probably it is the lack of humus which gives rise to the most pronounced run-down condition of soils, and this is a lack which does not arise under a grazing system of utilizing land. Comparative unfertility due to reduction of the humus-content of a soil can be restored only by degrees, and with difficulty, whereas a simple lack of mineral ingredients can be rapidly overcome by the application of suitable manures. There is another aspect of the matter which must not be lost sight of. When land remains in pasture for a number of years there is a gradual accumulation of humus on the surface. What is necessary, then, is to get it mixed up with the soil by ploughing and cultivation, converting it from a more or less sour inactive condition to an active agent in promoting fertility. With this very brief explanation as a basis we would say that if farm No. 2 is ploughed and green-cropped, using small dressings of lime and ordinary dressings of phosphatic fertilizers, and is then laid down, it will within a year or two equal in production farm No. 1. A further question may be anticipated here—

namely, as to whether the act of top-dressing without renewal by cultivation might not bring farm No. 2 to the condition of farm No. 1. This is more than doubtful. Whereas good-class clovers and grasses may be retained in a pasture by top-dressing, it is practically impossible to bring them back by such means after they have been replaced by couches and weeds.

WOOD-BORER IN FRUIT-TREES.

N. B. COLLINS, Ohura :—

Please advise me as to the best way to deal with the small wood-borer in fruit-trees. It enters the dry wood and works down the green limb, causing it to die.

The Horticulture Division :—

If by "dry wood" you mean dead wood, it should have been cut off and burned. When borers are in twigs or small branches these are best cut off low enough to remove the insect, which works downwards. Portions cut off should be burned. On larger limbs benzine injected in the hole by means of a small oil-can will kill them, or a small piece of cyanide may be forced into the hole. In either case the holes should be stopped up with a spill of wood or by plugging them with hard soap.

AREAS UNDER PRINCIPAL CROPS.

THE following tables, compiled by the Government Statistician, afford a comparison of areas under the principal arable crops in New Zealand at quinquennial intervals since 1900–1, and in the two last seasons :—

GRAIN AND PULSE CROPS.

Year.	Wheat for all Purposes.	Oats for all Purposes.	Barley for all Purposes.	Maize for all Purposes.	Peas and Beans for all Purposes.	Other Crops.	Total Area under Grain and Pulse Crops.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1900–1 ..	208,084	641,041	35,337	15,751	8,960	6,146	915,319
1905–6 ..	223,571	599,256	32,914	13,110	15,718	5,532	890,101
1910–11 ..	336,389	593,396	38,131	18,857	17,336	11,713	1,015,822
1915–16 ..	335,423	642,125	32,244	8,710	9,209	2,515	1,030,226
1916–17 ..	224,352	564,812	30,886	7,070	11,905	5,617	844,642
1917–18 ..	286,071	488,176	19,494	8,764	11,685	4,979	819,169

GREEN AND ROOT CROPS.

Year.	Potatoes.	Turnips.	Mangolds.	Other Green and Root Crops.	Total Area under Green and Root Crops.
	Acres.	Acres.	Acres.	Acres.	Acres.
1900–1 ..	28,524	404,333	7,341	130,859	571,057
1905–6 ..	26,834	469,579	7,090	141,780	645,283
1910–11 ..	29,023	450,959	14,082	219,618	713,682
1915–16 ..	29,809	572,137	13,046	232,585	847,577
1916–17 ..	26,156	526,283	9,073	220,338	781,850
1917–18 ..	22,854	450,819	8,712	183,415	665,800

LAND IN OCCUPATION IN NEW ZEALAND: 1916–17 AND 1917–18.

—	1916–17.	1917–18.	Increase.	Decrease.
	Acres.	Acres.	Acres.	Acres.
Grain and pulse crops	844,642	819,169	..	25,473
Grasses and clovers (cut for seed or hay), green and root crops	1,000,263	884,146	..	116,117
Sown grasses not cut for seed or hay	14,971,725	15,448,134	476,409	..
Fallow lands	90,042	77,791	..	12,251
Gardens, orchards, plantations, &c.	158,125	156,920	..	1,205
Unimproved land	25,679,922	25,825,919	145,997	..
Totals	42,744,719	43,212,079	467,360	..

DETAILS OF UNIMPROVED LAND: 1917–18.

Land District.	Phormium tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush.	Barren and Unproductive Land.	Total Unimproved Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Auckland	15,112	742,896	1,651,568	1,206,434	184,518	3,800,528
Hawke's Bay ..	149	854,492	331,773	334,988	100,334	1,621,736
Taranaki	188	13,327	64,347	333,808	9,579	421,249
Wellington	23,108	515,044	261,296	459,997	95,290	1,354,735
Nelson	3,489	253,450	144,486	491,702	53,786	946,913
Marlborough ..	1,399	1,336,628	194,858	204,262	391,375	2,128,522
Westland	5,193	230,199	73,982	1,051,382	284,997	1,645,753
Canterbury	560	4,619,345	70,011	238,084	541,101	5,469,101
Otago	1,311	5,927,430	216,946	116,683	197,333	6,459,703
Southland	4,193	1,536,343	122,178	203,961	111,004	1,977,679
Totals	54,702	16,029,154	3,131,445	4,641,301	1,969,317	25,825,919

TENURE OF LAND OCCUPIED IN NEW ZEALAND: 1917–18.

Land District.	Freehold occupied by Owner.	Leased from Private Individuals.	Leased from Public Bodies.	Leased from Maoris.	Crown Lands.		Tenure not specified.	Total Area occupied.
					Held under Pastoral Lease or License.	Held under other Tenures.		
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Auckland ..	4,382,527	350,866	95,327	608,137	389,812	1,320,878	24	7,147,571
Hawke's Bay ..	2,543,847	260,867	160,994	701,884	258,766	643,865	..	4,570,223
Taranaki ..	743,739	250,303	65,974	138,225	80,326	417,218	10,015	1,705,800
Wellington ..	2,985,795	453,227	111,271	422,676	229,980	587,015	121	4,790,085
Nelson.. ..	598,540	69,254	9,554	13,230	148,731	461,728	..	1,301,037
Marlborough ..	804,250	53,312	7,144	35,224	1,197,588	451,938	..	2,549,456
Westland ..	147,487	18,909	18,348	5,569	1,129,168	462,580	336	1,782,397
Canterbury ..	3,061,027	469,416	333,797	12,945	3,985,331	438,026	55	8,300,597
Otago	1,604,817	238,552	98,643	6,727	4,299,931	1,609,304	..	7,857,974
Southland ..	1,387,955	129,040	135,935	4,865	1,128,339	420,805	..	3,206,939
Totals ..	18,259,984	2,293,746	1,036,987	1,949,482	12,847,972	6,813,357	10,551	43,212,079

[Tables from agricultural and pastoral statistics issued by Government Statistician, gazetted 12th December, 1918.]

LICENSING OF MEAT-EXPORT.

THE SLAUGHTERING AND INSPECTION AMENDMENT ACT, 1918.

FOR general information is published below the full text of the Slaughtering and Inspection Amendment Act, passed in the recent parliamentary session. The measure gives the Government further power of control over our meat-export trade, and is designed in the direction of countering any trust operations in connection with the trade. The Act is as follows :—

1. (1.) This Act may be cited as the Slaughtering and Inspection Amendment Act, 1918, and shall be read together with and deemed part of the Slaughtering and Inspection Act, 1908 (hereinafter referred to as the principal Act).

(2.) This Act shall come into operation on the first day of January, nineteen hundred and nineteen.

2. In this Act the term "meat-exporter" means and includes any person, firm, or company carrying on the business of exporting meat from New Zealand, but does not include—(*a*) The holder of a license issued under section twenty-five of the principal Act (relating to meat-export slaughterhouses) in respect of the export of meat from stock slaughtered in the slaughterhouse to which the license relates; or (*b*) any person in respect of the export of meat from stock raised or fattened by him for export.

3. After the commencement of this Act it shall not be lawful for any person, firm, or company to carry on, or to continue to carry on, the business of a meat-exporter unless authorized so to do by a meat-export license issued under this Act.

4. (1.) Any person, firm, or company desirous of carrying on, or of continuing to carry on, the business of a meat-exporter may apply to the Minister of Agriculture for a meat-export license.

(2.) The Minister may, in his absolute discretion, grant or refuse any such application as he thinks fit.

(3.) Every meat-export license under this Act shall be issued for a term of one year from the date thereof, but may be revoked by the Minister at any time before the due date of the expiry thereof if the Minister is of opinion, on such evidence as he deems sufficient, that the licensee has committed a breach of the terms of his license, or is carrying on business under the license in a manner contrary to the public interest.

5. (1.) Every person, firm, or company who carries on, or continues to carry on, the business of a meat-exporter contrary to the provisions of this Act shall be liable to a fine not exceeding two thousand pounds, and to an additional fine not exceeding four hundred pounds for every day during which such business is carried on after service of a notice, under the hand of the Minister of Agriculture, requiring such business to be discontinued.

(2.) All meat shipped or attempted to be shipped for export from New Zealand by any person, firm, or company carrying on business as a meat-exporter contrary to the provisions of this Act shall be forfeited to His Majesty, and may be sold or otherwise disposed of in such manner as the Minister directs.

6. The Governor-General may, by Order in Council, make regulations—(*a*) Prescribing the forms of meat-export licenses to be issued under this Act; (*b*) prescribing the terms and conditions of such licenses, including conditions as to the revocation thereof by the Minister pursuant to the provisions of this Act; and (*c*) prescribing the fees to be paid for licenses issued under this Act.

7. (1.) No license under the principal Act shall be granted, renewed, or transferred in respect of any meat-export slaughterhouse without the consent of the Minister of Agriculture.

(2.) Without in any manner restricting the discretionary power conferred on the Minister by the principal Act, he may refuse his consent under this section if he is of opinion, on such grounds as in his discretion he deems sufficient, that the business of the meat-export slaughterhouse has been carried on, or is about to be carried on, in a manner contrary to the public interest.

REGULATIONS.

The following regulations under the Act have been gazetted :—

1. A meat-export license shall be in the form in the Schedule hereto.

2. Every such license shall be granted on the following terms and conditions : (*a*.) That the licensee will at all times during the currency of the license supply to the Minister of Agriculture all such information as the Minister shall require regarding the business in respect of which the license is in force, and will, if so required by the Minister, cause any information so supplied to be verified by a statutory declaration. (*b*.) That the licensee will at all times during the currency of the license when so required by the Minister of Agriculture afford to the Minister, or to an officer of the New Zealand Government appointed by him in that behalf, reasonable facilities for examining all books, correspondence, or other documents relating to the said business.

3. The fees to be paid for a meat-export license shall be as follows : (*a*) On the issue of the first license in respect of any business, five pounds ; (*b*) on the issue of any subsequent license for the same business, one pound.

RABBIT-NUISANCE LEGISLATION.

THE RECENT AMENDING ACT.

THE full text of the Rabbit Nuisance Amendment Act, 1918, is here printed for the information of settlers and others, as follows :—

1. This Act may be cited as the Rabbit Nuisance Amendment Act, 1918, and shall be read together with and deemed part of the Rabbit Nuisance Act, 1908 (hereinafter referred to as the principal Act).

2. (1.) After service on the owner or owners of any private land of a notice under section six of the principal Act (requiring the immediate destruction of rabbits on that land) it shall be the duty of the owner or owners on whom such notice is served forthwith to commence and thereafter to continue to do to the satisfaction of the Inspector all such acts as in the opinion of the Inspector may be necessary to destroy within the shortest time possible all rabbits that may be on the land mentioned in the notice, and any owner who makes default in so doing shall be liable to a fine of not more than one hundred pounds.

(2.) For any continuance or repetition of any such default as aforesaid at any time later than one month after the date of any conviction therefor the person so convicted shall be further liable to a fine not less than five pounds and not more than one hundred pounds, and so on from time to time in respect of each succeeding conviction.

(3.) This section is in substitution for sections seven, eight, and nine of the principal Act, and those sections are accordingly repealed.

3. Section twenty-six of the principal Act* is hereby amended by inserting, after the words " any such animal," the words " or the skin of such animal " ; and after the word " animal," where it last occurs in the said section, the words " or the skin, as the case may be " ; and by omitting the words " twenty pounds," and substituting the words " forty pounds."

4. Section sixty-nine of the principal Act† is hereby amended as follows : (*a*) By omitting from subsection one the words " two hundred thousand acres," and substituting the words " two thousand acres " ; and by adding to the same subsection the words " Provided that no district shall be so constituted unless it contains the holdings of not less than ten ratepayers " ; and (*b*) by repealing subsection two.

5. Subsection one of section eighty-two of the principal Act‡ is hereby amended by omitting the words " three-sixteenths of a penny," and substituting

* Relating to the "natural enemy" and fines for killing, &c., any such animal. † Dealing with Rabbit Boards elected by ratepayers, and related districts. ‡ Power of Rabbit Boards to levy rates.

the words " one penny " ; and by adding at the end thereof the words " but the total amount payable by any one owner shall not exceed one shilling per acre of his holding."

6. The provisions of sections one hundred and four to one hundred and thirteen of the principal Act* shall extend and apply with the necessary modifications to the construction of rabbit-proof wire-netting fences by Boards elected by the ratepayers under Part III of the principal Act.

* Loans from the Government.

DISEASES IN PLANTATIONS OF EXOTIC TREES.

In his report on afforestation operations in the South Island, contained in the annual report of the Forestry Branch of the Lands Department, 1918, Mr. R. G. Robinson, Superintending Nurseryman for the South Island (since resigned), makes the following references to this important subject :—

It is obvious that with advancing age our plantations will require more intense watchfulness for early symptoms of fungus or insect disease, as in many cases remedial measures may be applied with successful results if undertaken at the right moment. The climatic conditions this season have evidently favoured the establishment and diffusion of fungus troubles. Although *Betula alba* (English birch) is not extensively used in our scheme beyond marginal planting, it is regrettable that this handsome tree has fallen a victim to the disorder—*Melampsoridium betulinae*—that causes much disfigurement to the foliage and hastens leaf-fall. The uredo-spores and teleuto-spores are produced on birch, and the other stages on larch, which tree usually acts as intermediate host. The seedlings at Tapanui, on disclosing symptoms of the trouble, were immediately sprayed with a fungicide—bordeaux mixture—but the difficulty in applying the spray evenly over the affected surface discounted to some extent the effectiveness of the treatment. The birches will be kept under special observation, and reported upon when circumstances warrant.

Another fungus disease that threatens to be troublesome is *Lophodermium pinastri*—pine-needle cast—which affects *Pinus radiata* in both the young and advanced stages. So far only isolated cases of the fungus on our nurseries are known. From the third year onward the affection is noticeable on certain trees, although occupying situations generally regarded as favourable for pine-growing. The tree leaders of affected trees appear to gradually decrease their annual vertical development, and lateral branches become comparatively bare. In view of the enthusiasm shown by experts generally towards and the projected increased planting of this fast-growing pine it would be wise to collect further evidence from districts where premature pine-decay has arisen from an unrecognized malady.

Each plantation contains a small area that is devoted to the production of *Pinus austriaca*. From the seed-bed stage these Austrian pines are attacked by the aphis, *Chermes pini*, and after eighteen years in permanent positions have failed to become free from the pest. Naturally progress is much interfered with, although more minute investigations disclose the fact that in humid situations, where tree-development is more rapid, the insects are not so numerically strong. In a great many instances, where the Austrian is used in admixture with one of the more healthful pines, early suppression of the infested tree may be looked for.

An interesting demonstration of the comparative resistance to the needle-shedding fungus of the European larch (*Larix europaea*) and the Japanese species (*Larix leptolepis*) is in evidence at Dusky Hill Plantation, where side by side may be seen the two species growing in precisely similar conditions. Trees of the European species under stress of a trying dry summer have been almost entirely defoliated, whilst the needles of their Japanese neighbours, even at this late date, are still hanging tenaciously to the twigs. The European larch, however, has proved so far to be a slightly faster grower, although there can be no doubt that it is more susceptible to the premature needle-shedding, and consequently more liable to decay before the millable stage has been attained.

Thanks are due to Mr. A. H. Cockayne, Biologist to the Department of Agriculture, for his cheerful co-operation in research matters.

FORTHCOMING AGRICULTURAL SHOWS.

Wairoa County A. and P. Society: At Wairoa, 29th January.
Helensville A. and P. Association: At Helensville, 29th January.
Woodville A. and P. Association: At Woodville, 29th January.
Otago A. and P. Society: At Dunedin, 29th and 30th January.
Feilding A. and P. Association: At Feilding, 4th and 5th February.
Tapanui Farmers' Club: At Tapanui, 5th February.
Central A. and P. Association: At Waipukurau, 5th February.
Te Puke A. and P. Association: At Te Puke, 6th February.
Pahiatua A. and P. Association: At Pahiatua, 7th February.
Hukerenui Agricultural Association: At Towai, 12th February.
Dannevirke A. and P. Association: At Dannevirke, 12th and 13th February.
Opotiki A. and P. Association: At Opotiki, 13th February.
North Kaipara A. and P. Association: At Paparoa, 14th February.
Northern Wairoa A. and P. Association: At Aratapu, 15th February.
Masterton A. and P. Association: At Solway, 18th and 19th February.
Whakatane A. and P. Association: At Taneatua, 19th February.
Waimarino A. and P. Association: At Raetihi, 20th February.
Rangitikei A. and P. Association: At Taihape, 26th February.
Egmont A. and P. Association: At Hawera, 26th and 27th February.
Ohura A., P., H., and I. Association: At Nihoniho, 27th February.
Franklin A. and P. Association: At Pukekohe, 28th February and 1st March.
Hawke's Bay A. and P. Society: At Hastings, 5th March.
Katikati A. and P. Association: At Katikati, 5th March.
Marton A. and P. Association: At Marton, 5th March.
Taranaki Agricultural Society: At New Plymouth, 5th and 6th March.
Hikurangi-Otonga Ridings A., P., and I. Association: At Hukerenui, 12th March.
Rotorua A. and P. Association: At Rotorua, 12th March.
Taumarunui A. and P. Association: At Taumarunui, 12th March.
Mangonui A. and P. Association: At Kaitaia, 14th March.
Ashburton A. and P. Association: At Ashburton, 20th March.
Matamata A. and P. Association: At Matamata, 20th March.
Strath Taieri A. and P. Society: At Middlemarch, 1st April.
Oxford A. and P. Association: At Oxford, 3rd April.
Methven A. and P. Association: At Methven, 3rd April.
Temuka and Geraldine A. and P. Association: At Winchester, 3rd April.
Malvern A. and P. Association: At Sheffield, 16th April.
Mackenzie County A. and P. Society: At Fairlie, 21st April.

(A. & P. Association secretaries are invited to supply dates and location of their shows.)

Hemp Prices.—The Department has received the following cablegram, dated 10th January, 1919, from the High Commissioner, London: War Office notifies that owing to decline market values in Philippine Islands, and also reduced transport charges, Government issue prices of all grades manila hemp have been revised. New prices: J, £80; K, £79; L, £78; M, £70; others in proportion. These apply to allocations dated on or before 15th November. Hemp Controller states that it was not considered necessary at same time to al er maximum price of New Zealand and St. Helena hemp, and sisal, which are influenced by manila prices, but it is proposed cancel maximum-prices order relating to these in the near future.

The photograph at the head of this issue is a wheat-harvest scene on the Ruakura Farm of Instruction.