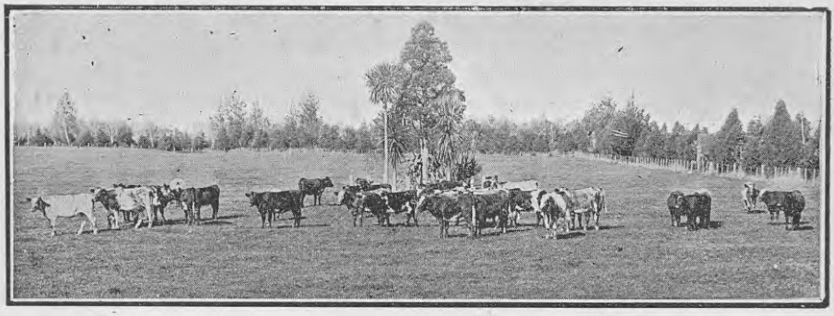


The New Zealand

Journal of Agriculture.

VOL. XVIII.—NO. 6.

WELLINGTON, 20TH JUNE, 1919.

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

II. RELATIVE PALATABILITY FOR SHEEP OF THE VARIOUS PASTURE-PLANTS.

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

GENERAL CONSIDERATIONS REGARDING PALATABILITY.

AS explained in the introductory article to this series (published in the *Journal* for January last) one of the first duties in the economic investigation of the grassland is to ascertain with exactitude what species are eaten by sheep, and especially the relative palatability of such species. It is, indeed, obvious that an accurate knowledge of these matters is fundamental to any scheme for improving the pastures. That this knowledge is not already the common property of sheep-farmers after their experience of nearly seventy years' continuous grazing of the pastures is, at first thought, hardly to be believed. Nevertheless, in large measure it is true. This unexpected state of affairs is due to various causes, not the least of which is that the sheep-farmer is concerned rather with the number of sheep his land can profitably carry than with the

special reasons for such carrying-capacity. Further, excepting those few grasses easily recognizable for which there are popular names —names, however, used quite loosely—he knows but little regarding the composition of his pastures. Even with regard to the known grasses, as pointed out in my last article (p. 5), two neighbouring sheep-farmers, each of exceptional experience, may hold diverse views with regard to their palatability. Nor is such divergence of opinion confined to the pastoralist, for when the writings of New Zealand botanists regarding the palatability of the indigenous grasses are compared the divergence of opinion becomes still more marked. This may readily be seen from the table drawn up as an appendix to this article, where various opinions of botanists are compared, commencing with those of Buchanan (for many years the leading authority on New Zealand grasses) in 1869 ("Transactions of the New Zealand Institute," 2nd ed., Vol. i, pp. 182–84), but first put forth so early as 1865, and ending with the provisional results of my present investigation.

Most of the statements made, up to the present, regarding what sheep eat only say that such-and-such species are eaten, but nothing is definitely said as to relative palatability. This latter is the crux of the whole question. From what I have observed sheep do not take their food haphazard; they distinctly select—their feeding, indeed, may be called "selective." *The term "palatability" as here used is not primarily concerned with what species are eaten, but with what species are preferred before all others when the sheep have a choice.* For instance, certain plants may be eaten by starving sheep which under ordinary circumstances are not touched; other plants, again, are only eaten if more palatable species are absent. Several interesting examples of this latter class are dealt with farther on. Each species appears, indeed, to have its special measure of palatability, so it should ultimately be possible, as explained in my last article (p. 6), to assign to each species a number denoting its palatability. This plan is tentatively adopted in the appendix to this article, the number 5 denoting the maximum of palatability, while the number 0 means that a species is not eaten under any circumstances. The remaining numbers, 4 to 1, show, of course, different degrees of declining palatability. It must be pointed out that these palatability numbers are merely my interpretation of the various authors' statements. Another matter which leads to confusion is that, in estimating palatability, frequently no distinction is made between grazing by stock as a whole and grazing by the different kinds of stock. Nor has any notice been taken of the different races of species: *e.g.*, red tussock and snow-grass—two very different plants from the standpoint of palatability—have been treated as one species under the name of *Danthonia Raoulii*.

This matter of palatability has little to do with the relative food-values of the plants, except that it is probably true that one kind of natural food specially liked by an animal may be quite equal as a food, or even better, than another more unpalatable kind which, on chemical analysis, shows more nutritive qualities.

The palatability of a species must vary considerably according to the season of the year, the general climate of the locality, the climate for the time being, the nature of the soil, and so on; in fact, it must be greatly influenced by its environment. So, too, must different

races of the same botanical species differ considerably in their relative palatability. Bearing the foregoing in mind, it is obvious that an accurate knowledge of the palatability of species is by no means the easy matter to acquire which might be expected. Accurate field observations in many parts of the tussock-grassland are essential, together with carefully conducted experiments. To ascertain that certain plants have been eaten, though useful and suggestive, is not at all conclusive that such eating is due to sheep. The final decision must come from actually seeing a sheep feeding on a particular plant, and proving from an examination of the plant itself that a portion has just been bitten off. This is no easy matter. In the majority of cases, even where a sheep has been grazing steadily for some time, it is difficult to find the exact spot where the sheep has been, and equally if not more difficult to find the plant or plants which have been nibbled. The difficulty of these observations is partly due to the timidity of the sheep and partly to the uneven nature of the ground—often extremely steep—which has to be traversed without taking one's eye from the spot where the sheep was observed feeding. As for judging from the plants themselves, the matter is greatly complicated when rabbits are present. In the case of tussocks these latter animals eat them down very closely and evenly to a few inches above the ground, so that the plant looks like an inverted scrubbing-brush, and such is almost always a reliable indication of the work of rabbits. Even where rabbits are wanting, and apparently sheep alone are present, horses may have been feeding. In short, the only truly trustworthy records are those made from plants actually eaten in the presence of the observer.

PALATABILITY EXPERIMENT ON CONICAL HILL, NEAR HANMER SPRINGS.

With the object of gaining a little first-hand knowledge of palatability so far as sheep are concerned I carried out in January last an experiment—intended to be one of a series—near Hanmer Springs. Thanks to the assistance of Mr. C. E. Christensen (Tourist Agent, Hanmer), an able botanist keenly interested in the economic aspects of the science, I was enabled to use the Conical Hill Reserve for the experiment. This reserve is a portion of a little hill rising from near the base of Mount Isabelle. Its summit is about 570 ft. above the adjacent plain, and consequently about 1,770 ft. above sea-level. The reserve, 25 acres in area, is closely covered with a dense vegetation consisting principally of grasses, though many other herbs and a few shrubs are present. At the lower part of the reserve the European grasses cocksfoot (*Dactylis glomerata*) and sweet vernal (*Anthoxanthum odoratum*) form the largest part of the vegetation, but the upper portion, which includes the greater part of the reserve, consists of tussock-grassland similar in character to that which clothes the adjacent mountains up to a height of about 3,000 ft. The total number of the species of the Conical Hill grassland is about a hundred. The grasses are the most important members of the pasture from the standpoint of this experiment. The following is a list of those present, species not indigenous being marked with an asterisk :—

Agropyron scabrum (blue-grass) ; *Agrostis alba** (fiorin) ; *Anthoxanthum odoratum** (sweet vernal) ; *Dactylis glomerata** (cocksfoot) ;

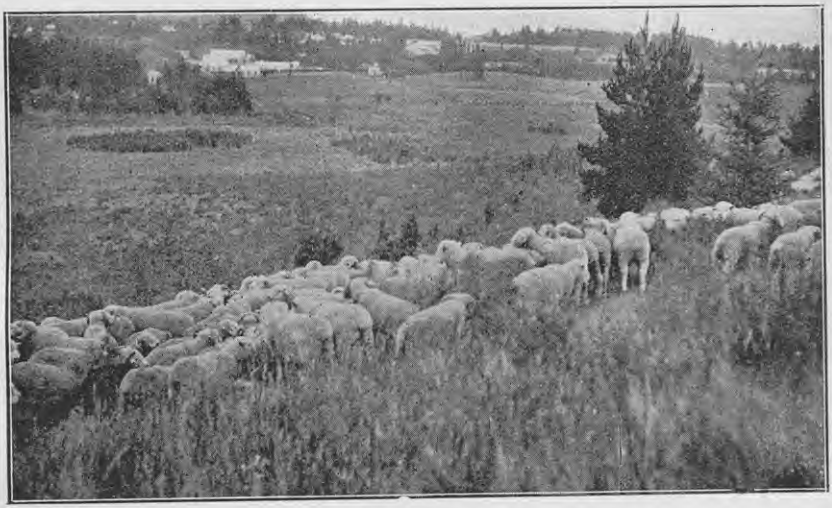
Danthonia semiannularis var. (tufted danthonia); *Danthonia semiannularis* var. *setifolia* (alpine danthonia); *Deyeuxia avenoides*; *Dichelachne crinita* (plume-grass); *Festuca novae-zelandiae* (fescue-tussock); *Hierochloe redolens* (holy-grass); *Holcus lanatus** (Yorkshire fog); *Poa caespitosa* (poa-tussock)—the "silver tussock" of my first article (p. 4), but as this name is used indiscriminately for both this species and the fescue-tussock I am giving this new vernacular name; *Poa Colensoi* (blue-tussock); *Poa intermedia* (tall blue-tussock); *Poa pratensis** (meadow-grass). The greater part of the remaining species—mostly rather lowly herbs, but a few shrubs—are hardly likely to come into the category of palatable plants, but *Crepis capillaris* (hawksbeard), *Hypochaeris radicata* (catsear), *Trifolium dubium* (suckling-clover), *Trifolium repens* (white clover), and *Carmichaelia subulata* (New Zealand broom) are notable exceptions.

The slope of the hillside is for the most part steep. Towards the bottom of the reserve a good many trees have been planted, especially species of pines; there are also alders and cypresses. These trees afford a good deal of shade, but elsewhere the grassland is exposed to the full sunshine for a considerable part of the year. The reserve is surrounded by a rabbit-proof fence. However, during the heavy snowfall of June, 1918, the fence was broken down in several places by the weight of the snow, so that a few rabbits gained access and remained within the reserve after the fence was put in order a week or two before the experiment commenced.

From what has gone before it can be seen that the plant-covering of Conical Hill and the area itself were well fitted for the experiment in relative palatability. There was abundant feed; there were two distinct types of grassland—one where introduced grasses dominated, and the other fairly typical tussock-grassland; the plant-covering consisted of many species; plants of different species grew side by side; the area was small enough to be rapidly examined, especially as a zigzag path extended from the base of the hill to the little kiosk on its summit (see photo); finally, the situation close to Hanmer Springs makes it easy to visit the hill at sunrise—an excellent time for observing sheep feeding.

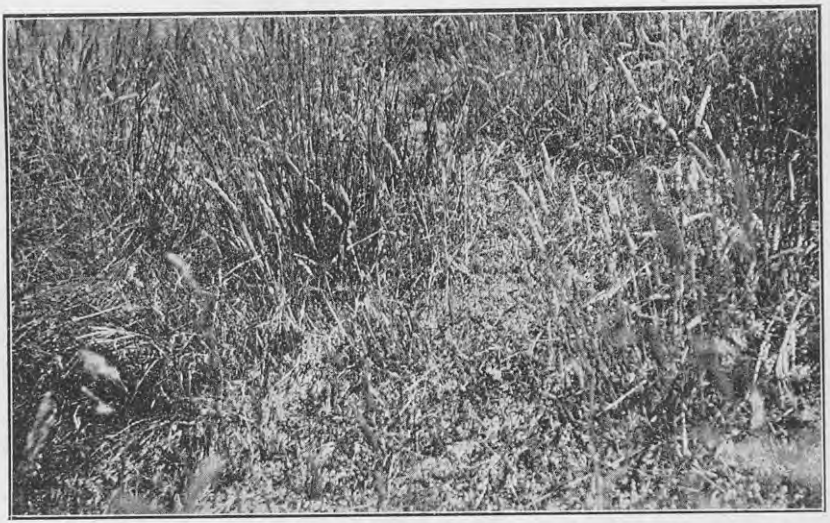
At 12 noon on Tuesday, 21st January, 281 rams were put into the reserve by way of the little gate at its base. These rams were partly Merino and partly Lincoln crossed by Merino. They were lent for the experiment by Mr. F. J. Savill, of St. Helens, Hanmer, who took the greatest interest in the experiment. Both he and his manager, Mr. D. Manson, gave me every assistance not only in this experiment, but in many other ways furthered my grassland investigations. I take this opportunity of thanking them most sincerely.

There is no need to go into precise details of how the sheep behaved day by day, but rather is a summary of the results demanded. For some hours at first the sheep remained in the cocksfoot area near the entrance to the reserve, but long before this grass was eaten to the ground the majority of the sheep had straggled on to the tussock area, and there they remained until noon on Saturday, 25th January, when, as the weather had been hot and as there is no water on the reserve, it was thought prudent to take them to the nearest creek (Dog Creek, about a mile away) to drink. Most of the sheep on being returned



THE HANMER PALATABILITY EXPERIMENT.

Some of the rams just after they had been turned on to the pasture of Conical Hill.



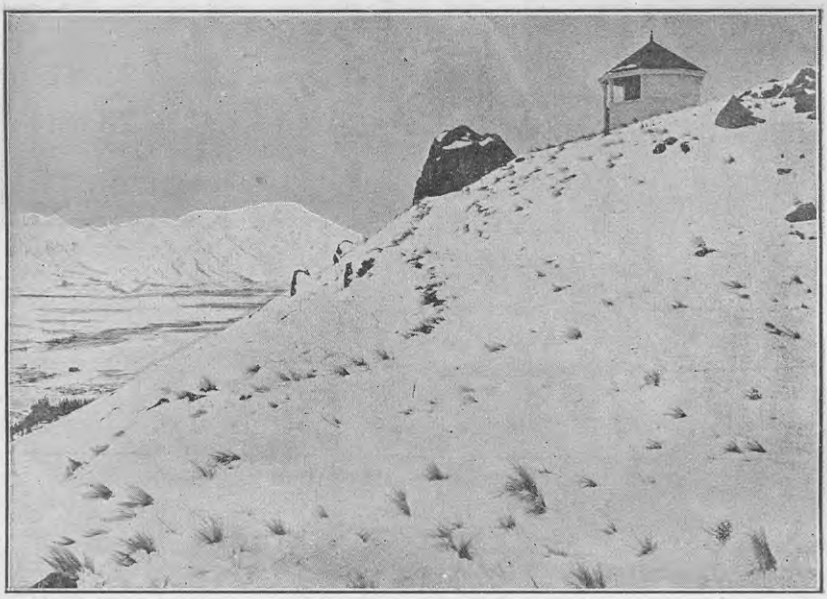
SECTION OF PASTURE ON CONICAL HILL IN HANMER EXPERIMENT.

Showing in centre and foreground Poa pratensis eaten to the ground, surrounded by uneaten cocksfoot.

[*T. L. Wright, photos.*

to the reserve quickly left the cocksfoot area—then mostly eaten close—and went again on to the tussock. On Thursday morning, 30th January, I visited the reserve for the last time.

Following are the principal points brought out by this nine-days grazing experiment. In considering these results it must be borne in mind that they only tell what happened on the particular area at the particular time, and that the data thus gained is insufficient for generalization. Nevertheless the results are of considerable interest; some are unexpected, and all are of value with regard to future investigations of relative palatability.



SUMMIT OF CONICAL HILL UNDER SNOW.

Three weeks after the heavy snowfall of June, 1918. Note the fescue-tussock just becoming uncovered.

[*C. E. Christensen, photo.*

Results of the Experiment.

1. In the presence of nearly all the palatable constituents of the pasture cocksfoot is eaten first of all.

2. But if meadow-grass (*Poa pratensis*) is present the cocksfoot is not touched until the meadow-grass is cropped close (see photo), after which the cocksfoot is eaten freely.

3. Willow (*Salix fragilis*) is greatly liked.

4. Holy-grass (*Hierochloe redolens*) is probably nearly, if not quite, as palatable as cocksfoot.

5. The ripening seed-heads of blue-tussock (*Poa Colensoi*) and fescue-tussock (*Festuca novae-zelandiae*) are eaten to some small extent in the presence of species eaten more freely.

6. In the general tussock-grassland, catsear (*Hypochaeris radicata*), hawksbeard (*Crepis capillaris*), and Yorkshire fog (*Holcus lanatus*) are eaten freely before any other of the grasses or herbs are touched

7. Next in palatability to the plants mentioned in No. 6 is probably tufted danthonia (*Danthonia semiannularis* var.).

8. Blue-tussock (*Poa Colensoi*) and tall blue-tussock (*Poa intermedia*) are eaten more freely than the two larger tussocks.

9. Sorrel (*Rumex Acetosella*) growing luxuriantly is apparently of high palatability.

10. When the more palatable plants are eaten to the ground the two large tussocks, poa-tussock (*Poa caespitosa*) and fescue-tussock (*Festuca novae-zelandiae*) are sparingly eaten, and are apparently about equal in palatability.

11. All the tussock-grasses seem to be more palatable after rain or heavy dew.

12. Broom (*Cytisus scoparius*) is eaten early.

13. Sweetbrier (*Rosa rubiginosa*) is eaten to some extent.

14. Alder (*Alnus glutinosa*) appears to be eaten early.

15. Scotch thistle (*Carduus lanceolatus*) is eaten to some slight extent.

16. *Deyeuxia avenoides* is occasionally eaten.

17. Swamp-lily (Maori onion) (*Chrysobactron Hookeri*) was eaten in one or two cases, but probably this was the work of rabbits.

18. After nine days continuous grazing by sheep in the proportion of about twelve sheep to the acre (*i.e.*, making allowance for rocks, paths, &c.) the following supposedly extremely palatable species were not touched: (*a*) White clover (*Trifolium repens*), (*b*) suckling-clover (*Trifolium dubium*), and (*c*) blue-grass (*Agropyron scabrum*). With regard to white clover, it may be pointed out that Mr. J. E. P. Cameron, of Ben Ohau Station, and myself observed some extremely hungry sheep feeding* which had just been turned into the station orchard where was a close growth of rye-grass and white clover. In no instance did we see them eating the clover, but they pushed it aside in order to get at the rye-grass, which they ate greedily. As for the blue-grass of Conical Hill, it was not merely growing in the tussocks—its usual habitat—but there were occasional tufts on the ground between the tussocks along with Yorkshire fog, catsear, &c. The suckling-clover for the most part consisted of insignificant plants, nevertheless it was common, as evidenced by the fact that it occurred in fifteen out of forty-three pieces of tussock-grassland each 1 square foot in area and taken at a distance of about 10 ft. apart.

19. The following list is a rough approximation of the order in which the various species were eaten: (1) Meadow-grass, (2) cocksfoot, (3) holy-grass, (4) willow, (5) catsear, (6) Yorkshire fog, (7) seed-heads of blue-tussock and fescue-tussock (but only here and there), (8) hawksbeard, (9) luxuriant sorrel, (10) broom, (11) alder, (12) tufted danthonia, (13) blue-tussock and tall blue-tussock, (14) sweetbrier, (15) fescue-tussock and poa-tussock, (16) Scotch thistle, (17) *Deyeuxia avenoides*, (18) sweet vernal (but hardly at all).

* This was on 21st February last.

20. Excepting the New Zealand broom, which is eaten freely, the remainder of the 100 species were either not eaten at all, or they may have been eaten by rabbits and not by sheep. It must not be forgotten that these quite unpalatable species form a large percentage of the vegetation.

OTHER OBSERVATIONS REGARDING SPECIES EATEN.

The observations which follow refer to what plants are eaten rather than to their palatability. They are the result of observations made on each occasion that I was in the field. They are classified according to localities.

1. Paddocks near shearing-shed, St. Helens (Hanmer Plains).—The sheep observed feeding had just been turned out of the shed. The following were the plants eaten: Fiorin (*Agrostis alba**), side by side with Yorkshire fog and white clover, both not eaten; Yorkshire fog, eaten freely and in presence of uneaten white clover; smooth-leaved mullein (*Verbascum blattaria*), eaten abundantly—grows on stony river-bed; rib-grass (*Plantago lanceolata*), when growing on stony river-bed—*i.e.*, where no competitors; ox-eye daisy (*Chrysanthemum leucanthemum*); white clover, rarely; green poa-tussock, to some small extent; blue-tussock, apparently eaten freely when not in company with specially palatable species; sweet vernal, eaten to some slight degree; Chewings fescue (*Festuca rubra* var.), eaten occasionally; sorrel (eaten freely when side by side with white clover), uneaten; *Elaeocharis acuta* and cutty grass (*Carex ternaria*), in wet ground; cocksfoot; catsear.

2. River Clarence Valley, between track over Jack's Pass and road over Jollie's Pass (altitude about 2,500 ft.).—The following were eaten: Cocksfoot in presence of white clover, uneaten; poa tussock and fescue-tussock (green leaves after burning), both species eaten freely and perhaps as early as the cocksfoot; fiorin, eaten to the ground; the pale rush (*Juncus pallidus*), eaten freely; *Elaeocharis gracillima*, eaten freely; tufted danthonia, just being eaten; snow-grass (*Danthonia flavescens*), the young leaves after burning, this being at a higher altitude than the valley-floor. About four thousand shorn ewes and lambs had been put into this area (No. 2) a few days before the examination of the pasture was made.

3. Pasture of old moraine near Lake Pukaki (altitude 1,600 ft. and upwards).—Here there are many rabbits, so the following list of species eaten may not be altogether reliable: Fescue-tussock which had been burnt, apparently eaten freely; Otago triodia (*Triodia Thomsoni*); *Carex breviculmis*; *Carex Muelleri*, to a slight extent; tall blue-tussock; sorrel, apparently greatly eaten; barley-grass (*Hordeum murinum*); thick-stemmed broom (*Carmichaelia Petriei*).

4. Central Otago (including the upper Clutha Valley, the dry area near Lake Wanaka, the Lindis Gorge and the sheep-runs near the entrance to the gorge, the Dunstan Mountains, the Maniototo Plain, and the Mount Ida Range).—Here again it is extremely difficult to

* No estimate of this apparently most valuable grass is given for the Conical Hill experiment, as the only plants there grew in a position not readily accessible to the sheep.

distinguish between plants eaten by rabbits and those eaten by sheep. The following is a list of the species apparently eaten by sheep: Winged thistle (*Carduus pycnocephalus*), observed sheep eating young plants in the Dunstan Gorge, while, on the other hand, on the depleted area of Galloway there were abundance of young plants, but except where one plant grew at the entrance to a rabbit-burrow I did not see one plant eaten even by rabbits; Otago triodia, apparently eaten freely; fescue-tussock; sorrel, apparently eaten freely; meadow-grass; barley-grass; smooth-leaved mullein (*Verbascum blattaria*); rye-grass (*Lolium perenne*); Scotch thistle, a little; Californian thistle (*Carduus arvensis*), perhaps eaten, but I am not at all sure; blue-tussock; tall blue-tussock.

These observations regarding the plants eaten where sheep are grazing freely are notes merely, and they are too fragmentary to allow any conclusions to be drawn.

APPENDIX.

TABLE SHOWING THE OPINIONS OF VARIOUS BOTANISTS REGARDING THE PALATABILITY OF THE INDIGENOUS GRASSES OF THE MONTANE AND SUBALPINE PASTURES.

The numbers 5, 4, 3, 2, 1, and 0 used below denote the relative palatability of the species, the number 5 denoting the highest palatability possible and the number 1 the lowest, whereas 0 denotes that the species is never eaten. The remaining numbers, 4, 3, and 2, denote a gradually decreasing degree of palatability. Buchanan's observations appear in two columns, the first showing his opinion in 1869 and the second his opinion in 1880.

Name of Species.	Buchanan.		J. C. and J. B. Armstrong.	T. Kirk.	J. B. Armstrong.	Petrie.	Cheeseman.	Cockayne.	Remarks.
Microlaena Colensoi ..	..	..	..	..	..	..	..	..	A rock-plant.
—— Thomsoni ..	..	..	..	..	..	..	..	..	A small bog-plant.
Hierochloe redolens (*holy-grass*)	4	3	2	2	2	..	..	5	..
—— Fraseri (*alpine holy-grass*)	2	2	4	..	3	..	2	..	Possibly equal as feed to *H. redolens*.
Echinopogon ovatus ..	3	1	0	0	..	..	..	0	..
Agrostis antarctica ..	..	..	..	..	..	..	..	..	..
—— muscosa ..	..	..	..	..	..	..	..	..	Small cushion-plant.
—— subulata ..	..	..	..	..	..	..	..	..	..
—— Dyeri	2	3	4	4	4	..	2	..	..
—— Petriei	..	..	..	..	..	..	..	..	..
—— tenella	..	..	..	..	..	..	..	..	..
Deyeuxia filiformis ..	3	3	4	3	3	2	..	..	..
—— pilosa	3	4	4	..	3	..	..	..	..
—— setifolia	..	..	..	..	..	..	..	..	..
—— avenoides ..	4	4	4	..	3	3	..	1	..
—— Youngii	..	4	4?	..	3	..	..	..	..
—— quadriseta ..	4	4	1	3	1	..	..	..	..
—— Petriei	..	..	..	..	..	..	..	..	..
Dichelachne crinita (*plume-grass*)	4	3	4	1	4	2	..	1	This may be a good grass. It usually grows in the fescue or poa tussocks, so sheep cannot get at it.

Name of Species.	Buchanan.	J. C. and J. B. Armstrong.	T. Kirk.	J. B. Armstrong.	Petrie.	Cheeseman.	Cockayne.	Remarks.
Deschampsia caespitosa	3	1	0	..	0	..	..	..
—— pusilla	..	..	..	..	..	..	..	Very rare alpine species.
—— novae-zelandiae ..	..	..	..	..	..	..	..	..
—— antarctica ..	..	..	..	..	..	..	..	..
—— tenella	..	..	..	..	..	..	..	..
Trisetum antarcticum ..	4	3	4	4	4	2	..	..	Usually in no great quantity.
—— Youngii	..	..	4?	..	4	..	..	..	A rather rare grass and so of little moment.
—— subspicatum ..	4	..	2	..	4	..	..	..	Usually a rock-plant.
—— Cheesemanii ..	..	..	..	..	..	..	..	..	Only recorded from one or two places; probably always a rock-plant.
Danthonia Cunninghamii	3	2	1	..	..	..	..	..	..
—— Raoulia, var. rubra (*red-tussock*)	3	..	1	..	..	..	2	1	..
—— flavescens (*snow-grass*)	3	..	1	..	..	..	2	2	Has a great reputation amongst shepherds as a stand-by in winter.
—— crassiuscula ..	..	..	..	..	..	..	..	..	..
—— australis (*carpet-grass*)	..	1	..	..	..	..	..	1	Or perhaps not eaten at all.
—— oreophila ..	..	..	..	..	..	..	..	..	A rare and local grass.
—— pilosa (*danthonia*)	..	4	..	..	4	..	..	4	There are many varieties of this grass.
—— semiannularis (*tufted danthonia*)	..	4	4	3	4	..	..	3	There are many varieties of this grass.
—— Buchanani (*Otago danthonia*)	..	..	..	..	..	4	..	3	Doubtful. A grass of limited and local distribution.
Triodia Thomsoni (*Otago triodia*)	..	2	..	..	..	5	..	3	An important grass in Central Otago and the Mackenzie country.
—— exigua (*mountain-twitch*)	..	..	..	..	..	1	..	0	Forms a close, very short turf.
—— pumila	..	..	..	..	3	..	..	..	..
—— australis	..	..	..	..	..	3	..	..	A grass of limited distribution.
Arundo conspicua (*toetoe*)	1	3	..	..	..	..	..	1	..
—— fulvida	..	3	..	..	..	..	..	1	..
Koeleria novo-zelandica	4	1	4	..	..	3	3	1	Usually in no quantity.
Poa novae-zelandiae ..	..	3	..	..	4	..	..	..	Usually a plant of wet rocks.
—— anceps	..	1	..	4	..	..	..	..	This may be a fair grass.
—— pusilla	..	..	..	..	..	..	..	..	..
—— dipsacea ..	..	..	..	..	..	..	..	..	Generally a rock-plant.
—— Cheesemanii ..	..	..	..	..	..	..	..	..	Only recorded from one locality.
—— caespitosa ..	..	3	4	..	1	2	..	1	But the leaves after burning, 4.
—— Cockayniana ..	..	..	..	..	..	..	..	..	..
—— Colensoi (*blue-tussock*)	2	5	3	..	..	4	..	3	Perhaps my estimate too high.
—— intermedia (*tall blue-tussock*)	..	4	..	..	3	..	..	3	..
—— acicularifolia ..	..	0	..	..	..	..	..	..	Only recorded from one or two localities.
—— pygmaea ..	..	..	..	..	..	..	..	..	A minute, very rare alpine plant.

Name of Species.	Buchanan.		J. C. and J. B. Armstrong.	T. Kirk.	J. B. Armstrong.	Petrie.	Cheeseman.	Cockayne.	Remarks.
Poa Kirkii	..	..	..	..	3	..	3	..	..
—— Lindsayi ..	2	4	..	..	..	..	..	1	At best could only give a small amount of feed.
—— exigua	2	..	..	..	..	..	..	..	A small, rare alpine plant.
—— maniototo ..	..	..	..	..	..	..	..	..	A very small grass of limited distribution except in Central Otago.
—— sclerophylla ..	..	0	..	..	..	..	..	..	..
—— imbecilla ..	..	..	4	4	..	3	..	..	..
Festuca novae-zelandiae (*fescue-tussock*)	2	4	..	..	4	4	..	1	But 4 after burning.
—— species	..	..	..	..	..	..	..	..	..
Agropyron scabrum (*blue-grass*)	2	2	..	3	4	5	..	1	This may be a palatable grass. It usually grows amongst tussock where sheep cannot reach it.
—— aristata	..	..	..	..	4	..	..	..	..
—— Youngii	..	..	..	..	..	..	..	..	A large form of *Agropyron scabrum*.
Asperella gracilis ..	..	..	..	..	..	..	..	..	..

TESTING OF SOILS: NOTICE TO FARMERS.

IN view of the great importance of lime on New Zealand soils, the present shortage of phosphates, and the fact that the use of phosphates may be economized by the application of lime, it has been decided to examine any soils which are properly collected by a Fields officer of the Department, for the purpose of determining the amount of lime which such soils actually require.

For this purpose it is desirable that groups of farmers, such as those forming the local branches of the Farmers' Union, or other farmers' organizations, should approach any one of the following Fields officers, and get him to appoint a date for visiting their district and for collecting typical soils for testing: Mr. R. Rowan, Fields Instructor, Auckland; Mr. J. W. Deem, Fields Instructor, Wanganui; the Fields Instructor, Hawke's Bay (position vacant); Mr. A. Macpherson, Fields Instructor, Christchurch; Mr. J. W. McCulloch, Fields Instructor, Invercargill; Mr. C. S. Dalgliesh, Fields Instructor, Hokitika.

Farmers will note that—

(1.) It is essential that the samples should be collected by an officer who has been specially instructed in the correct methods of soil-sampling, in order that the results of the test may be dependable.

(2.) The testing of these samples, in order that it may be expeditiously performed, must be limited to the question of what amounts of lime are required per acre.

LIMITING FACTORS IN FARMING.

THEIR MINIMIZATION OR ELIMINATION.

By A. McTAGGART, M.Sc.Ag., Agriculturist.

IN the pursuit of successful farming there are encountered various limiting factors or drawbacks, some of which, however, may be more or less minimized, while others, fortunately, may under certain conditions be eliminated entirely.

Limited or insufficient capital is perhaps the chief obstacle to modern farming, and particularly to successful farming. To point out ways and means for improving rural finance does not, however, come directly within the function of the scientific agriculturist. Nevertheless, it may be noted that several countries have found a partial solution of this world-wide problem through the medium of rural credit associations of various types.

Land-tenure, too, has an important bearing upon the degree of success attained in farming efforts. This subject, likewise, hardly comes within the sphere of the agricultural specialist. Therefore all that need be here stated under this heading is that for successful farming operations and for productive agriculture generally land-tenure, whether local or national, must of necessity be based upon at least a reasonable degree of permanency, and be of such a general character as to enable the holder of the land to take full advantage of its natural resources without unduly interfering with the rights of posterity with respect to those resources. In other words, fixity and conditions of tenure should be such as to permit of maximum agricultural production, if need be, without encouraging undue exploitation of the natural fertility or resources of the soil.

LABOUR, MACHINERY, AND POWER.

Scarcity of labour, especially of a satisfactory type for farming operations, presents one of the most formidable obstacles with which successful farming to-day has to contend. This scarcity is unfortunately causing many good farmers to give up farming and to sell out, thus augmenting non-permanent agriculture, which is not conducive to the welfare of the State. So important is this question of a constant supply of satisfactory labour to the success of the agricultural industries that it should continuously command the best thought and concentrated action on the part of those concerned with the highest interests of these industries.

Unsatisfactory as is the farm-labour position at the present time, much might be done by all connected with agriculture toward solving, or at least partially solving, this problem. Apart from the return to the country from military service of large numbers of men who will settle on the land, and the possible encouragement of immigration of prospective farmers and farm workers, much may be accomplished by fostering the principles of co-operation, by improving the living-conditions of farm hands, and by the extension of the use of labour-

saving machinery and of improved farm-power. Much may be done by the farmers themselves to overcome their individual labour difficulties by co-operating, neighbour with neighbour, as far as possible, particularly during the course of such operations as haymaking, shearing, harvesting, threshing, ensilage-making, liming, &c. Indeed, the spirit of co-operation among farmers will afford them the means of solving many rural problems and of making life on the land much more congenial for all concerned. The community spirit, as distinguished from the individualistic, is what is wanted, and in time this spirit will doubtless come to be recognized as the main solution of many rural difficulties, industrial and social.

The provision of comfortable quarters for farm workers—proper housing of married men and satisfactory accommodation of single farm hands—will materially contribute towards promoting reasonable permanency as regards the personnel of workers on a particular farm. Men are human the world over, and if the primary wants of employees, whether on farms or elsewhere, are properly satisfied, contentment, and consequently a much lessened disposition to change, generally results.

The universal adoption of the use of labour-saving farm machinery and the application of improved farm-power, wherever possible—particularly of hydro-electric power—have vast possibilities. Labour-saving machinery mostly in use elsewhere, and to some extent in New Zealand, could be more widely used, with greater relief to the farming industries and with greater benefit to the State. The following embrace some of the farming machinery to which allusion has just been made: Farm tractors and agrimotors; self-adjusting ploughs; improved cultivators for turnips, maize, &c.; special-purpose drills; lime-sowers; manure-distributors; turnip-thinners; drainage machinery, including the traction ditcher and the mole plough; stump and tree haulers; improved harvesting machinery, including harvesters and maize-binders; tedders; side-delivery rakes; hay-sweeps; stackers; potato planters and diggers; improved threshing-machines and seed-cleaners; grain-elevating machinery; bag-lifters; motor-lorries; chaffers and blowers for silos; power sprayers; and the numerous handy devices continuously being designed that all play a part in saving labour. New Zealand, perhaps, leads in the use of milking-machines, and is well advanced as regards shearing-machines, but even in these lines there is room for extension here. Much as has been accomplished in the field of agricultural engineering as regards the invention of labour-saving machinery, there yet remains vast scope for improvement and achievement in this desired direction.

The application of improved farm power, as already indicated, has enormous possibilities. The internal-combustion engine has done, and is doing, a vast amount of work in saving labour on farms to-day, but the harnessing of the water-power of the country, the generating of electricity, and the distribution of it to factory and farm will effect in years to come untold saving in this respect. In parts of Canada and the United States electricity to-day is driving almost every piece of machinery on many farms and hauling the products of those farms to markets or centres of distribution. Farm lighting, heating, and cooking are also performed by electricity. It is even claimed that such operations as ploughing and cultivating generally will be undertaken eventually by means of electric power. Possibly this will be effected by the application of improved storage batteries to these

particular implements. Doubtless, as the result of the more general harnessing of this country's abundant water-power, we shall in due course see similar developments here. The varied use made of the Lake Coleridge electric service in certain rural districts of Canterbury is an indication of what may be expected throughout the Dominion in greater degree.

SOIL-MOISTURE.

Of the various limiting factors connected with the soil itself moisture is perhaps the most influential. Within certain limits, determined by the physiology or nature of the plant and the natural physical condition of the soil and subsoil, the more moisture supplied to and retained by a productive soil the bigger the crop. This holds good even in light or ordinarily none-too-productive soils, from which during a moist season good crops can usually be harvested — a significant fact pointing to the possibility in ordinary farm practice of materially minimizing this potent limiting factor. This may be done by either of two means, or by both—namely, by irrigation or by conservation of soil-moisture. In the prevailing drier sections of the country irrigation could be undertaken with far-reaching results. Water reticulated over dry plains or valleys, and intelligently made use of in the raising of various farm crops, will greatly minimize, if not eliminate entirely, this limiting factor. In Central Otago, the soils of which are pronounced by our agricultural chemists to be among the richest in New Zealand, wherever irrigation water is provided there is a marked growth of clovers, of lucerne—in fact, of almost any farm crop, when sown. Moisture is clearly the limiting factor, and so it is periodically over the greater part of Canterbury. These parts of the Dominion, and other sections where irrigation would be feasible and advantageous, possess untold possibilities per medium of irrigation widely and intelligently applied.

As regards conservation of soil-moisture, whether used alone during the course of ordinary farming or supplemental to irrigation operations, cultural methods employed with the object mainly of conserving moisture for use by a crop are economically desirable. Moisture is conserved by making use of every possible means of checking evaporation, especially in dry climates or during dry seasons. Frequent stirring of the surface of the soil by such implements as cultivators and harrows forms a mulch or blanket by intercepting the natural upwards flow of water of capillarity. Hence evaporation from the surface of the soil is materially reduced. The operation of packing or rolling the soil previous to this shallow cultivation accelerates the rise of water by capillarity, and this, together with the subsequent surface-stirring, concentrates the soil-moisture at a point at which the growing seed or young crop can best make use of it. This point is usually determined by the depth of the mulch—generally about 3 in. from the surface. Whether or not rolling has been carried out, evaporation can be considerably checked by frequent surface cultivation. Where crops are sown in drills periodic intercultivation stimulates the crop wonderfully as a rule, the conserved moisture being directed into the crop rather than allowed to evaporate through want of soil-mulching.

Where soils are bare during the period of preparation — through cultural operations — frequent stirring of the surface by harrowing,

especially under dry climatic or seasonal conditions, materially conserves moisture for use by the crop intended subsequently to be sown. Under these conditions mulching of the surface by such means after a shower of rain is highly desirable. The light harrowing tends to restore the mulch destroyed by the rain-shower, and, if the mulch is re-established, conserves the extra moisture that has fallen. Indeed, the practice of harrowing the land during dry weather conditions, even if carrying a young crop, is decidedly beneficial. Such harrowing of wheat, turnips, or other crop at the right time, when the growth seems to "hang" for want of rain, may mean the difference between failure and success with respect to that crop. Timely intercultivation of a drilled crop may have a similar desired result. In semi-arid regions, such as Central Otago, special cultural implements, such as surface and sub-surface packers (as used in Western North America, where "dry farming" is practised), should prove an acquisition to farmers of arable land. Systematic use of these packers and the practice of the "dust mulch," by timely and frequent surface cultivation, should materially conserve moisture in these regions and promote increased crop-production. Autumn ploughing and subsoiling, where this latter is necessary, are also important factors in conserving and supplying the crop with soil-moisture calculated to benefit plant-life.

The incorporation of organic matter with the soil, wherever this can be effected without undue loss of season and without "drying out" the soil, conserves moisture to an appreciable degree and causes its better distribution. Stubble land may be worked up for the growth of green-manuring crops, such as white mustard, crimson clover, peas, &c., and these can be ploughed in when satisfactory growth is reached. Legumes, such as cow-grass and red clover, may also be sown with cereal crops, and the aftermath ploughed under some time following harvest, to provide humus. When ploughing-under these crops in soils requiring humus a point should be made of so doing during a more or less moist period, otherwise the incorporated organic matter will attract and thus concentrate the available soil-moisture, and during dry-weather conditions this will prove more detrimental to crop-growth than were the humus not so provided. Where farmyard manure is available this should be spread upon the land, and, while moist, ploughed under, this valuable form of humus-incorporation also materially assisting in the conservation of soil-moisture.

The provision of shelter-belts, at right angles to the prevailing winds, will afford an additional means of reducing evaporation and of so conserving soil-moisture. This is particularly desirable on windy plains and other areas that are periodically wind-swept, for the quantity of soil-moisture lifted and borne away by high winds is enormous, and the farther the farmed area is removed from a shelter-belt the greater the evaporation.

WEATHER CONDITIONS.

The general weather conditions constitute a factor not capable of being eliminated or minimized. Nevertheless, much may be accomplished in the direction of minimizing the effects of adverse weather conditions. The Dominion Weather Bureau furnishes daily forecasts of weather likely to prevail after so-many hours. If these forecasts as published in the daily papers are heeded, the operations on farms can to some extent be arranged so as to provide safeguards against

loss of crops or stock. Then, again, meteorologists of wide and long experience tell us that the seasons in New Zealand come in cycles, occupying approximately seven years from one extreme in the cycle to the other extreme. Thus we have series of more or less dry years at the one extreme and series of more or less wet years at the other extreme, with gradations of good years, not too wet nor too dry, in between. Recognition of this phenomenon, and close observation of seasonal variation extending over at least fourteen years, should enable the farmer, especially in certain situations, to guard against loss by shaping his farming methods and systems in accordance therewith. Crop rotations, cultural methods, and crop-storage operations could be adopted to meet effectively the requirements necessitated by meteorological changes — one period compared with another period within the cycle.

KNOWLEDGE AND ITS APPLICATION.

Lack of knowledge is a limiting factor of some importance associated with profitable farming. Every business demands knowledge and careful training if the individual is to make a success of that business. Yet for the intricate business of successful farming, demanding as it does wide knowledge and proper training, some people think that any one — whether schooled or unschooled, trained or untrained— is fitted to successfully engage in it. Modern farming demands some knowledge of a number of sciences, some knowledge of business, and actual experience with the various operations carried out on farms. Indeed, it has been said that a 200-acre farm provides satisfactory scope for the exercise of every faculty man possesses. It is therefore incumbent upon all connected with present-day farming, or those contemplating a farming career, to avail themselves of every possible means of obtaining reliable knowledge connected with the business. They cannot obtain too much learning in this most intricate and widest of all businesses, and, no matter how extensive their knowledge and experience in it, there is always something for them to learn. Just as knowledge is at the foundation of a successful commercial undertaking, so it is the basis of successful farming. A mind well supplied with detailed information connected with its business is equipped to intelligently engage in that business—be it farming, commerce, or manufacturing—and to better command success therein. With the spread of up-to-date knowledge of agriculture will come better farming, and consequently an ever-increasing agricultural production.

Highly important as is the possession of up-to-date knowledge of agriculture, it is more important that those connected with farming should possess the capacity for making practical application of useful knowledge when they acquire it. The two are so interdependent that success can be obtained only when they are both possessed to a degree by the farmer; and the individual possession of this power of application removes a limiting factor of considerable importance.

BUSINESS TRAINING.

Lack of business methods constitutes an obstacle of some magnitude in the path of successful agriculture. The management of farming operations, especially if of a diversified nature, calls for a good deal of business aptitude. In Britain young men who intend eventually

to farm—that is, to assume the full management of a farm—often spend a period in some bank or commercial firm, so as to fit them from a business standpoint for farming. While this is not possible generally in New Zealand, yet the practice emphasizes the importance of training in business methods in some measure to fit present-day and future farmers for successfully handling the intricacies connected with their calling. In the American agricultural colleges are departments of farm-management, the commercial, as distinguished from the productive, aspect of farming being given due prominence there in the agricultural education system of the country. The farmer of to-day has to be continuously looking ahead if success is to attend his efforts. Among the various provisions he must make is that of supplemental feed—to effectively feed his stock during periods of comparative scarcity; while one of the many economies he must exercise is that of the elimination of animals from his herds or flocks that are not worth at least more to him than the cost of the food they consume. Successful farm-management is based upon knowledge of up-to-date methods of production, augmented by some experience in affairs connected with business, particularly in book-keeping and general matters of finance.

SOIL-TREATMENT.

An obstacle of some magnitude in the path of modern successful farming, but one which, happily, may be removed, is the tendency on the part of many connected with arable farming to rely more upon the chemical treatment of the soil and less upon the physical treatment of land—by systematic drainage, liming, green-manuring, and proper cultivation, where each or any is necessary. By treating soils first physically as fully as possible, in the order just mentioned, the farmer is in a position to effectively treat them chemically—that is, to use fertilizers to the best advantage and economically. These aspects of the subject have been enlarged upon recently in the *Journal* by the writer.

WEEDS.

The prevalence of weeds on arable land presents a limiting factor of considerable magnitude. But even this formidable foe of the farmer can be materially reduced in strength, if not entirely subdued. The adoption of proper farming methods, involving the practice of a satisfactory rotation of crops and thorough and timely cultural methods, will contribute materially towards the reduction of the weed pest. In coping with the worst weeds (Californian thistle, ox-eye daisy, &c.) the practice of summer fallowing (frequent cultivation during the hotter and drier months), followed immediately by the sowing of heavily seeded smother-crops (rape, &c.), will have a decided eliminating effect, if not kill these weeds entirely. This method of treatment, if persisted in each year for two or three years, should, however, have the desired result. If it fails the land should be sown down with lucerne where the soil is specially suitable for this crop, or elsewhere with grass. The quick growth and the frequent cutting of the lucerne, also the constant grazing of the pasture with sheep and cattle, keep the thistles, and indeed most bad weeds, materially in check. It is by such good-farming methods, and not by any so-called weed specific or eradicator, that this most prevalent limiting factor can be effectively minimized and in many cases eliminated altogether.

PESTS AND DISEASES.

Another drawback to successful agriculture is the prevalence of insect pests and fungus diseases. But even this potent factor can be minimized by the adoption of farming systems that embody suitable crop rotations, thereby changing the host-plant and promoting vigour of growth fortified to resist attack. Sound cultural methods, effective soil-treatment, and the growing of crop varieties that present immunity, or partial immunity, to disease, also afford a degree of defence against the ravages of these pests. Where applicable to field conditions, spraying with suitable fungicides or insecticides presents a further means of successful combat.

CO-OPERATION.

Lack of co-operation in handling and marketing farm-produce presents a most potent limiting factor in the attainment of complete success in farming pursuits. Through the absence of this co-operation the farmer obtains less for the product of his labour and skill and the consumer pays more for the products of the farm. Advanced agricultural countries like Denmark, California, and Ireland in recent years saw the great advantages of co-operation, and have materially reaped the benefit. It is well known how Denmark (a country indifferently favoured from the points of view of climate and soil), particularly, took up co-operative production, handling, and marketing of farm-products, together with the systematic education of its producers, with the result that the country has risen from comparative agricultural obscurity to a most prominent position in the farming world. Co-operation, indeed, was Denmark's salvation. This matter need not be discussed further here, for the great advantages of widespread co-operation have been well recognized by New Zealand producers. Co-operation, particularly in connection with the dairying and fruit industries, and by farmers' associations in the matter of general trading, has been successfully carried on for years in the Dominion. But the question may well be asked, Cannot New Zealand become, co-operatively, another Denmark?

MIGRATORY FARMING.

The last but not least limiting factor to really successful farming to which the writer will refer is what may be termed "migratory farming." Not until New Zealand possesses a more or less permanent husbandry will she produce to the full, for it must be recognized by every one that land which is awaiting a purchaser is not going to be fully developed and systematically farmed. Older countries famed for their farming methods and agricultural output, and less favoured in climate and soil than New Zealand, present numerous cases of farms that have been worked by the same families for generations. Therein lies the real source of the agricultural wealth of these countries. It is to be hoped that in the course of time New Zealand will possess in greater measure that permanent husbandry upon which depends satisfactory and continuous production and the maintenance of soil-productivity.

REARING OF QUEEN-BEES.

By A. B. TRYTHALL, Apiarist, Ruakura Farm of Instruction.

THE most vital point in successful beekeeping is to ensure that each colony is headed by a good queen. The traits in a queen-bee's character are just as hereditary and the degrees between good and bad just as great as in any other kind of stock. A queen-bee should be prolific, of good size, colour, and shape, and keep her brood-nest compact and solid. Her progeny should be good honey-gatherers, disease-resisters, reluctant swarmers, good-tempered, robber-resisting, of good colour, and not given to building too much brace-comb or collecting too much propolis.

The only way to secure queens with as many of these traits as possible is to persistently breed from stock showing these qualities. If in the apiary there is a colony which stands out pre-eminently above all others, that is the one to breed from. If there are none that are satisfactory it is advisable to send to a reputable queen-breeder for as many as one can afford, and after testing them in one's own apiary breed from the best. It is not necessary to be constantly buying breeding-queens, as each importation may alter one's standard, nor is it always advisable to breed from a queen before fully testing her, as it is quite possible the beekeeper may have a better one among his own stock.

It is best to breed only from pure Italian queens whose correct mating has been assured. Novices can judge the mating by noting the uniformity of the hatching brood as regards colour. Should the young bees show diversity of colour—some being yellow-banded and others quite black—the mating has not been correct.

The question of mating is always a difficult one, as queens mate on the wing, and therefore it is impossible for the apiarist to select the sires. But as purebred queens, even though mismated, throw pure drones, it only takes a comparatively short time to eliminate crossbred drones from an apiary. There is, however, still the chance of contamination from other drones in the neighbourhood.

To sum up the matter: By persistently breeding from the best it is possible to achieve wonderful results, while under careless management, or, as is often the case, no management at all, bees are sure to deteriorate.

Methods of queen-rearing are legion, but may be roughly divided into two classes—namely, those which use the naturally built queen-cells, and those which necessitate the provision of artificial queen-cups into which young larvæ are transferred. The former method is most suitable for beginners, or for use early in the season, as it minimizes the risk of chill to young larvæ; while the second method is used largely by beekeepers who want to rear queens in greater numbers. As an example of the first method I will briefly describe what is known as the "Stewart method" (after the noted queen-breeder, Mr. R. Stewart, of Crookston, Otago), and how to carry it out.

THE STEWART METHOD.

In autumn or very early spring place a comb containing a fair number of drone-cells in the centre of the brood-nest of one or more of your best Italian colonies, other than that headed by the choice queen it is desired to breed from, so as to get very early unrelated drones. By getting pure Italian drones flying before Black drones in a district it is possible to get a larger percentage of pure matings than would otherwise be possible. If in going through Black or inferior colonies at this time drone-brood is found to be in existence, it is best to either remove it or to place a drone-trap at the entrance of such hives.

Weight of evidence goes to prove that Black drones are either more alert or active or less susceptible to cold than Italians, and therefore it is necessary, if we wish to Italianize, to eliminate Black drones as much as possible. My experience is that early batches of queens are the most likely to show the highest percentage of mismatings, and an Italian apiary left to its own devices is almost sure to revert to the Black type in time.

By judicious feeding or otherwise work one of your strongest colonies—which will be called No. 1—in early spring until it has bees in two hive-bodies for preference. As soon as drone-brood is beginning to hatch out of the combs inserted for the purpose, as mentioned, go through the hive, find the queen, and place her in the top story with two frames of young brood and stores, leaving the remainder of the brood below, and place a queen-excluder between the bodies.

In three days' time go to the hive—which will be called No. 2—containing the choice queen which it is desired to breed from, taking with you a nice clean comb that has not been used for brood-rearing more than once or twice, and insert it right into the middle of the brood-nest for the queen to lay in.

In a further five days' time return to No. 1 and remove the top body with queen and bees to a new stand—No. 3—where they can remain permanently to build up to full strength again. Return to No. 1 and examine very carefully every brood-frame to see if any queen-cells have been started; if so, remove every one without exception.

Now exchange an empty frame from this hive with the special frame from No. 2 which was placed there five days previously. This frame, which should now contain eggs and probably very young larvæ, is treated as follows: With a sharp knife cut a strip off the bottom of the comb right through the cells containing eggs and larvæ, and another strip or two vertically down the comb as shown in Fig. 1, thus leaving plenty of room for the building of queen-cells. The cutting of the comb should be done as quickly as possible, in order to avoid any possibility of chill to the young larvæ. If the day is at all chilly it would be best to do it in a warm room.

The prepared frame of eggs and larvæ is now placed in the centre of the brood-nest of No. 1 hive. Prior to the giving of this comb the bees in No. 1 were hopelessly queenless, having not only had their queen removed, but a hive containing no brood under eight days old. They will therefore be just in the condition to go to work to form queen-cells on the edges of the prepared comb, where marked by the crosses in the sketch.

In ten days' time the queen-cells should be nearly ready to hatch. Examine the comb to see how many good cells are available, and after preparing the requisite number of nucleus hives, less one, or destroying the queen in hives it is wished to requeen, come back to No. 1 and cut out carefully with a sharp thin-bladed penknife all the cells but one. Then, after putting each in a "West" cell-protector, insert in the centre of each nucleus or queenless hive and leave to hatch out. Examine in two or three days' time to see if young queens are hatched. If so, leave for a week or ten days, according to weather, and examine again to see if they are mated and laying.

If it is very early in the season or the weather is doubtful, it is advisable to introduce the cells into nucleus hives rather than dequeen hives for the purpose, as it entails less loss of time and bees in case the queens failed to mate, which is often the case in early spring.

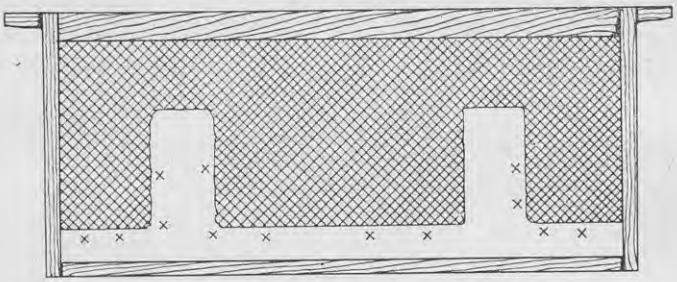


FIG. 1. COMB PREPARED FOR THE STEWART METHOD.

THE DOOLITTLE METHOD.

As indicated, if queens are required in large numbers it is advisable to adopt the "Doolittle" principle of artificial queen-cups, shown in Fig. 2. These cups may be purchased ready-made from the appliance-dealers, or can be made in the following manner: Procure a round blunt-pointed stick (Doolittle used a hay-rake tooth for the purpose); the point should be about $\frac{1}{3}\frac{3}{2}$ in. in diameter and quite smooth. After soaking the point in water for some hours dip it gently to a depth of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. into hot melted wax for about one second or less, and after withdrawing it allow the coating of wax to cool. Repeat this process four or five times, after which the wax cup so formed can be removed from the stick (see Fig. 3). The wax cups can now be waxed into wooden cell-cups fitted with a short spike as shown, or on to small squares of wood similarly spiked by driving a small nail through them, to protrude about $\frac{3}{16}$ in., or they may be simply waxed on to the cell-bar without any wood foundation at all (see Fig. 4). This drawing also shows how the cell-bars are held in position in an ordinary Langstroth frame.

The only other tools required are a transferring-needle and a jelly-spoon (see Fig. 5), which also can be procured from the appliance-dealers, or may be made out of knitting-needles by slightly flattening the ends as shown in the illustration.

Having made sufficient cell-cups and placed them on bars the beekeeper is ready to commence rearing operations. Hive No. 1 is

prepared in the same manner as stated for the Stewart system, and after removing the top box with queen, &c., to new stand No. 3, return to No. 1 and place a frame containing one or more cell-bars with cells right into the middle of the brood-nest, and leave for a few hours for the bees to discover their queenlessness and to warm and polish up the cell-cups given.

A supply is now needed of royal jelly—the term given to the food supplied by the worker-bees to the young queen larvæ, and resembling thick cream in appearance and consistency. This can be

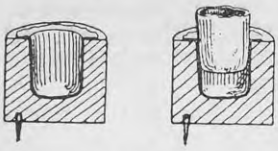


FIG. 2.

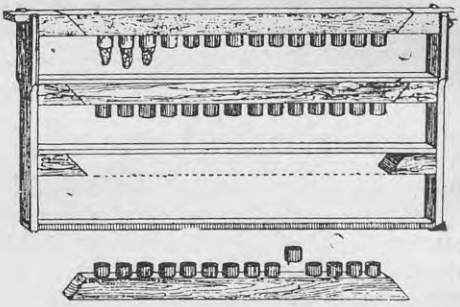


FIG. 4.

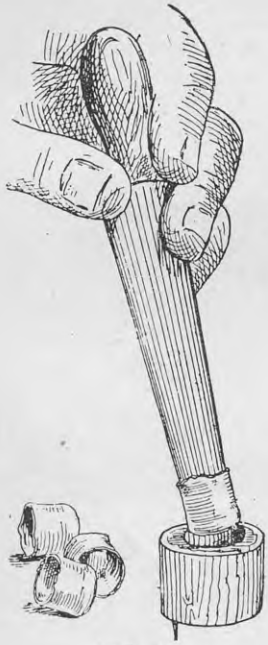


FIG. 3.

FIG. 5.

APPARATUS FOR THE DOOLITTLE METHOD (SEE TEXT).

procured from a previously built queen-cell. The thin jelly from a queen-cell in its early stages is the best for the purpose. If no natural queen-cells are available a hive should have been made queenless a few days previously so that a supply would be assured. Go to hive No. 2—the choice breeding-queen hive—and procure a frame containing newly hatched larvæ not more than twenty-four to thirty-six hours old, and take it into a warm room together with one or more cells of royal jelly and the bars of queen-cups which were placed in

hive No. 1 a few hours previously. With one's back to the window, so that the light may shine directly into the cells of the brood-frame, remove the royal jelly from one of the queen-cells with the jelly-spoon and divide it among the queen-cups, placing a portion about the size of a pinhead into the bottom of each cup.

One queen-cell usually provides about enough jelly for a bar of cups—say, twelve to fourteen. With the transferring-needle now very carefully remove a tiny larva from a worker brood-cell, place it on the spot of royal jelly, and continue until you have tenanted all the cups, when the bar should be quickly taken out and placed in the holding-frame of hive No. 1 from which it was taken. Leave it there for the bees to carry on the work. Return the original frame of brood to hive No. 2 from which you borrowed it. Next day look into No. 1 and see how many cells have been accepted. In ten days' time these cells should be almost ready to hatch, when it will be necessary to prepare nucleus hives, as stated in connection with the Stewart plan, and to give to each a West cell-protector containing one of these ripe cells.

If many young queens are needed it is advisable to prepare a succession of No. 1 hives, and as some bees are better at accepting queen-cells than others it is a good plan to pick hives for the purpose whose bees show a tendency to build a number of natural queen-cups, as they usually accept grafted cells readily.

The day after the grafts are given to No. 1 the queen-cells started may be removed and given to any other queenless hive, or placed in a well-populated super above the excluder on a queen-right colony, providing care is taken to see that the queen is kept below the excluder. The bees of this hive will carry on the work and finish the cells. It is advisable, however, to place a frame containing brood on each side of the cell-bars in the super.

No. 1 hive can now be given fresh bars of grafted cells, and the process kept up daily until the bees tire of the work. Usually the second bars given are the most successful as regards the number of grafts accepted.

Some queen-breeders graft the larvæ without using a supply of royal jelly at all; but the larvæ leave the needle best if placed in the jelly at the bottom of the cell, and, personally, I always have the best results when jelly is used.

It is very necessary to avoid chill in all manipulations, as the larvæ are very delicate and easily killed. Speed is therefore very desirable, but it can be attained only with practice.

GENERAL.

In either system of queen-rearing, when preparing No. 1 hive by placing the queen above the excluder, it often happens that the bees form queen-cells on the brood-frames in the bottom body box. When, therefore, the top box with the queen is removed on the eighth day to a new stand it is necessary to search carefully and remove any such queen-cells that may have been formed, or one's queen-rearing efforts will be a failure.

It only remains to be said that the best results are obtained during a good honey-flow. If no honey is coming in it is advisable to feed heavily.

CONTROL OF RED MITE AND BLACK-SPOT.

SPECIAL CLUSTER-BUD SPRAYING.

By T. E. RODDA, Manager of the Arataki Horticultural Station.

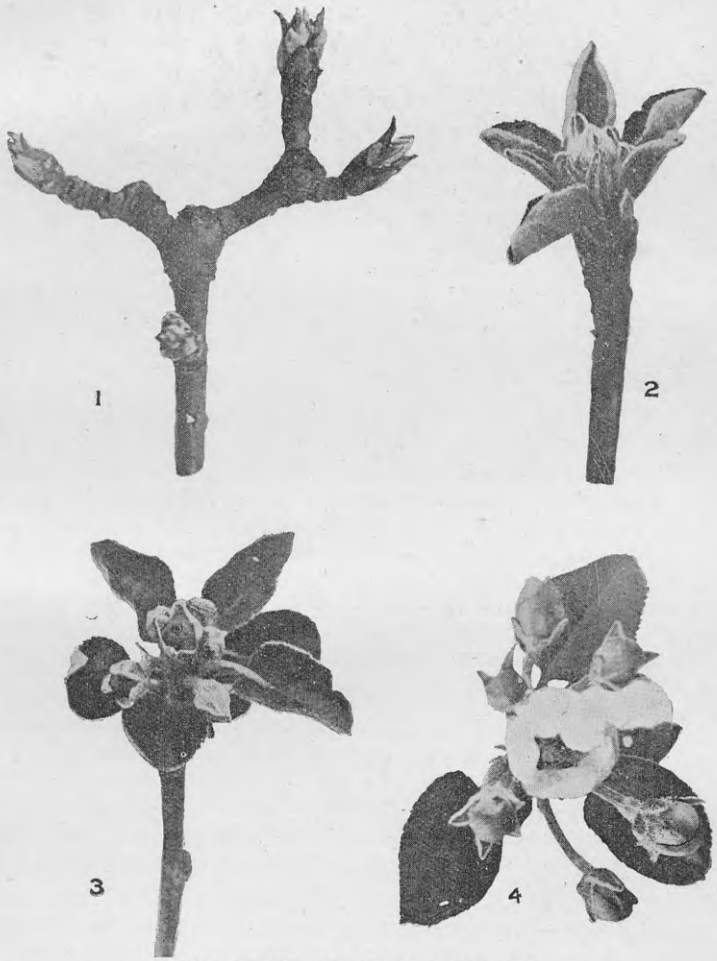
FURTHER series of experiments were conducted at the Arataki Horticultural Station during the past season to ascertain the value of oil and lime-sulphur sprays for the control of red mite on apple-trees, when applied at reduced strengths late in the season, commencing from the period of pronounced bud-movement up to the time that the buds were in the advanced-pink stage. Bordeaux was also applied prior to the oil as a check against lime-sulphur for the control of black-spot.

The bordeaux was in each instance followed the same day by oil. The main purpose of this was to ascertain whether bordeaux was by this means made more efficacious and lasting in its effects, and at the same time to ascertain how late the combined spray could be applied with safety. Lime-sulphur was used on the sister trees at the same strength as the oil. Particulars are indicated in the following outline of the experiments :—

	Treatment.	Period applied.
Plot 1—		
Row 1.	Bordeaux, 6–4–50, and oil, 1–15	Just after bud-movement.
,, 2.	Lime-sulphur, 1–15	,,
,, 3.	Bordeaux, 6–4–50, and oil, 1–20	,,
,, 4.	Lime-sulphur, 1–20	,,
Plot 2—		
Row 5.	Bordeaux, 6–4–50, and oil, 1–25	Tight cluster.
,, 6.	Lime-sulphur, 1–20	,,
,, 7.	Bordeaux, 6–4–50, and oil, 1–25	,,
,, 8.	Lime-sulphur, 1–25	,,
Plot 3—		
Row 9.	Bordeaux, 6–4–50, and oil, 1–30	Pink.
,, 10.	Lime-sulphur, 1–30	,,
,, 11.	Bordeaux, 6–4–50, and oil, 1–40	,,
,, 12.	Lime-sulphur, 1–40	,,
,, 13.	Bordeaux, 6–4–50, and oil, 1–45	,,
,, 14.	Lime-sulphur, 1–45	,,
Plot 4—		
Row 15.	Bordeaux, 6–4–50, and oil, 1–50	Advanced pink.
,, 16.	Lime-sulphur, 1–50	,,
,, 17.	Bordeaux, 6–4–50, and oil, 1–60	,,
,, 18.	Lime-sulphur, 1–60	,,
Plot 5—		
Row 19.	Bordeaux, 6–4–50, and oil, 1–30	,,
,, 20.	Oil, 1–30	,,
Plot 6—		
Row 21.	Bordeaux, 6–4–50, and oil, 1–25	Open cluster.
,, 22.	,, 6–4–50, ,, 1–25	Advanced pink.
Plot 7—		
Row 23.	,, 6–4–50, ,, 1–30	Open cluster.
,, 24.	,, 6–4–50, ,, 1–30	Advanced pink.
Plot 8—		
Row 25.	Oil, 1–30	Open cluster.
,, 26.	,, 1–30	Advanced pink.

There would be about twenty-eight days' difference between the applications on plots 1 and 4, with a difference between each plot of eight to ten days.

On plots 1 and 2 no summer insecticide was used for mite. Woolly aphis was hand-painted with oil. Trees showing signs of black-spot were sprayed with bordeaux, 3–4–50. Arsenate of lead was applied regularly.



SOME STAGES OF BUD-DEVELOPMENT.

(1) Pronounced bud-movement; (2) tight cluster; (3) pink; (4) advanced pink.

NOTES ON THE PLOTS.

Plot 1.—An examination made on 14th November revealed a fair number of mites present. These rapidly increased as the season advanced, being especially noticeable on trees treated with lime-sulphur. At the time of a later inspection, on 23rd April, all the trees were badly

infested with winter eggs. At the first examination black-spot was showing rather pronounced on some trees treated with lime-sulphur, and to a much less extent on a few trees treated with bordeaux and oil. The affected trees were then sprayed with bordeaux, 3–4–50, after the fruit was well formed. No further development of black-spot took place throughout the block. There was no spray russeting on the fruit.

Plot 2.—No live mites on 14th November, and only one fruit infected with spot. Live mites developed as the season advanced. It was very noticeable that the mites increased at a very much greater rate on the trees treated with lime-sulphur. All rows were free from spray russeting.

Plot 3.—There were very few live mites on 14th November, but they were fairly plentiful by 12th December, and towards the end of April were very numerous on all trees, more especially on the lime-sulphur rows. Oil, 1–30, was more effective than the weaker strengths. Black-spot development was pronounced on the lime-sulphur treatment, while it developed to a much less extent on those trees treated with bordeaux and oil. The fruit on the trees sprayed with the latter was very badly russeted, but was very bright and of fine appearance on all trees treated with lime-sulphur. No arsenate of lead was applied until 23rd December. No other summer insecticide was used.

Plot 4.—Live mites were showing on 14th November, and became very numerous as the season advanced. The bordeaux and oil, 1–60, did not appear to russet the fruit quite so badly as bordeaux and oil, 1–40 and 1–45, in plot 3. Black-spot appeared on fruit treated with lime-sulphur, but there was no sign of the disease on the rows treated with bordeaux. Again, the fruit on those rows treated with lime-sulphur was of bright appearance. As in plot 3, no arsenate of lead was applied until 23rd December. No other summer insecticide was used.

Plot 5.—Where oil was applied without bordeaux red-mite control was very satisfactory, but where used after the bordeaux, oil, 1–30, gave only slightly better results than bordeaux and oil, 1–60, in plot 4. Black-spot developed on those trees treated with oil alone, while those that had bordeaux in addition were clean. Bordeaux and oil, 1–30, russeted the fruit very badly, while the oil alone did almost as much injury.

Plots 6 and 7.—These plots were used to ascertain whether delaying the spraying for eight to ten days from one stage to the other would increase the amount of russeting. It will be noticed that the same strength was used both in the open-cluster and advanced-pink stages. Sister trees were used for the purpose. There was an average of 55 per cent. of fruit russeted in open cluster and 70 per cent. in advanced pink.

Plot 8.—This plot was to demonstrate whether oil alone would blemish the fruit. There was similar russeting to plots 6 and 7 where bordeaux was used in addition.

CONCLUSIONS.

The results derived from the past season's work confirm the previous year's experiments. Although the oil used at the bud-movement and tight-cluster periods did not injure the buds or retard growth, it was demonstrated that the applications were not of sufficient strength to be of any material advantage in controlling red mite. It may be that oil alone at this stage would be efficacious, but this would need to be tested. Oil, 1–30, used alone in advanced pink gave very satisfactory results. At all stages of bud-development one application of lime-sulphur at any of the strengths used was of no practical value in controlling red mite. The writer is of the opinion that the buds will stand lime-sulphur a good deal stronger in all stages of development, and possibly something may be gained by using it at increased strengths.

In regard to black-spot control the qualities of bordeaux were outstanding, while on the other hand there can be no question that lime-sulphur produces the brightest and cleanest-skinned fruit.

There is nothing to be gained by using bordeaux and oil on the same day, or even oil alone, when growth is beyond the tight-cluster stage. To apply oil after this period of development is decidedly too dangerous and has nothing to recommend it. Although the bordeaux and oil controlled black-spot fairly well in the pink, it russeted the fruit to such an extent as to render it very unsightly for market, and as a result makes this combination when applied at that stage or later of little or no practical value.

Expeditionary Force Scholarships.—Among the recipients of scholarships awarded in England to members of the New Zealand Expeditionary Force is Captain W. S. Hill, B.Sc.Ag., formerly Plant-breeder in the Department of Agriculture, who will study agriculture at the Imperial College of Science, London, and Wye Agricultural College, Kent. A scholarship has also been awarded to Sergeant W. H. Udy, of the Chemistry Section of the Department, to study agricultural science at King's College, London.

Farm-manure Experiment with Onions.—In the horticultural section at Ruakura Farm of Instruction during the past season an experiment was conducted on various kinds of farm manure with onions. Four plots, each 14 yards by 8 yards, were dressed in April, 1918, as follows: (1) Horse-manure, (2) fowl-manure, (3) pig-manure, (4) cow-manure—each at the rate of 15 tons per acre. The plots were immediately dug under and left until the middle of July, when they were lightly forked over. In the middle of August the onions (Straw-coloured Spanish) were transplanted into the plots, basic super at the rate of 2 cwt. per acre being applied in each case at the same time. The crop was harvested in the middle of February, when the following yields were recorded: Pig-manure plot, 832 lb.; fowl-manure plot, 742 lb.; horse-manure plot, 647 lb.; cow-manure plot, 588 lb. The manure was from animals fed under good average New Zealand conditions.

WEATHER FORECASTING IN NEW ZEALAND.

By B. V. PEMBERTON, F.R.Met.Soc., Assistant Meteorologist, Dominion Meteorological Office, Wellington.

[Reprinted from the *New Zealand Journal of Science and Technology.*]

INTRODUCTION.

ALTHOUGH the barometer was invented as long ago as 1643 its use as a means of foretelling the weather was recognized only about the beginning of last century. The method then adopted was to take an average of the readings of the barometer and thermometer, and the direction and force of the wind. These results were then charted to show the means of the elements over the earth. This method was a great advance, and gave an impetus to the scientists of those days to further the study of weather prognostics.

It was found, however, that these general means were certainly not sufficient to give an idea of what weather to expect from day to day, or even of the average climatic conditions from month to month, that could be depended on. For instance, with regard to temperature, the mean monthly temperatures, taking the average of many years, may prove very different in any particular year. Napoleon discovered this to his cost, for he assumed, on the judgment of Laplace, that the cold of Russia would not set in until January, but in that year the great cold came a month earlier, and his army was lost in consequence.

During the Crimean War a violent storm was experienced on the 14th November, 1854, and the French and English fleets in the Black Sea narrowly escaped destruction, while the French man-of-war "Henri IV" was lost. It was known that a storm raged some days previously in western Europe, and this fact influenced the French Minister of War, Valliant, to order an investigation by the astronomer Leverrier. From the data collected it was shown that the Crimean storm was identical with that experienced some days previously to the westward, and this occurrence caused a greater interest to develop in the study of storms and their progression over the earth's surface, and a revision of the science of forecasting weather-changes generally.

About the year 1861 the first attempt of forecasting by means of synoptic charts was undertaken by Admiral Fitzroy, who was afterwards in charge of the London Meteorological Office as its first Director.

The whole system of weather forecasting is primarily dependent on telegraphic communication, and the development of radio-telegraphy, by an extension of the observation area, has also been a further practical aid to the forecaster.

METHOD OF FORECASTING.

The history of the development of this branch of meteorology having thus been briefly touched on, an attempt can now be made to explain the principles of forecasting as adopted by weather bureaux throughout the world; and, as our own local weather is naturally of more particular

interest, it will be more easily followed if the conditions in New Zealand are used to illustrate these remarks.

The particulars necessary for the construction of a weather chart are telegraphed to the central office from places distributed over the country, and also, if available, from places farther afield. These observations of wind direction and force, barometric pressure, temperature, weather—and, from coastal stations, state of sea and tide—are all taken simultaneously. The most important of these reports is the barometer-reading, and in order that the observations from this instrument may be intercomparable they must be corrected and reduced to sea-level. This is necessary because the pressure of the atmosphere diminishes with height, and so the reading of the barometer decreases approximately one-tenth of an inch for every 100 ft. increase in altitude. The corrected readings are entered by signs and figures on a plain map, and lines are then drawn connecting all those stations having the same barometric pressure. These lines of equal pressure are called *isobars*, and are drawn for every tenth of an inch: thus a line would join all places representing a pressure of 29·9 in., 30·0 in., 30·1 in., and so on.

The wind is indicated by arrows, the head of the arrow pointing in the direction in which the wind is blowing, and the force being shown by arrows of different types. An arrow with a barb on one side only indicates light wind (see Fig. 1), a barb on each side indicates a breeze, while one, two, and three "feathers" on one side of the shaft indicate progressively stronger winds, the last representing a gale. There are also numerous signs representing different conditions of weather, state of sea, &c.

Ballot's Law.

If the different synoptic charts which follow are examined definite principles will be perceived in regard to the direction of the wind with relation to the isobars. Professor Buys Ballot, of Utrecht, was the first to formulate a general rule with reference to the direction of the wind and its relation to barometric pressure. This was in 1850, the law in simple language being: "Stand with your back to the wind and the barometer will be lower on your right hand than on your left." This is applicable in the Southern Hemisphere, while in the Northern left must be substituted for right, and right for left. For example, suppose at Wellington a northerly wind is blowing, then if we face south our right will be the side where the barometer is lower; if the wind be westerly, then the barometer should be lower to the south and higher to the north of us. The wind does not assume a direction strictly parallel with the isobars, but it is nearly always found that the direction is inclined at an angle of about 35° to the isobar and towards the position of low barometric pressure.

Mountain-ranges, steep coast-lines, or other topographical features often cause a marked deflection in the wind-direction, in some cases to such an extent that the very opposite wind may be experienced to what would be anticipated according to the isobaric trend.

Baric Gradient and Wind-velocity.

From the consideration of the direction we now pass on to that of the velocity or rate of the wind, which is likewise related to the distribution of atmospheric pressure. If we take a line at right angles joining two isobars, the measure of this line is called a "gradient." The shorter the

distance between the isobars the greater or steeper is the baric gradient, just in the same way that the varying distances between contours on a military map denote varying steepness of the hills. It is the practice to compute the gradient in hundredths of an inch per 15 nautical miles, or the quarter of a geographical degree ; but when one becomes accustomed to the drawing of isobars over a certain defined area one very quickly becomes experienced in estimating the amount of gradient approximately enough for practical purposes. The barometric gradient enables one to anticipate the velocity of the wind, the law applying to this being that the strength of the wind depends upon the amount of the baric gradient : the steeper the gradient the greater will be the velocity of the wind.

The air being extremely mobile, it follows that when there is an inequality of level between different places the tendency is for a flow to set in from the higher level to the lower, in an endeavour to restore equilibrium. Consequently the greater the difference in level, as shown by the closeness of the isobars, the more rapid will be the flow.

Tables have sometimes been set out for different places showing the gradient and the corresponding mean wind-velocities, but these can be taken as only approximate. There are many factors, such as local configuration and conditions, which also govern the wind-velocity, and therefore the highest winds are not always found where the gradient is steepest. For instance, when the gradients are steeper either over the North Island or the South than they are about Cook Strait the strongest winds are invariably experienced in the Strait, and this is naturally accounted for by the indraft through the Strait. As the widest portion of the Strait is to the north-west, with a westerly wind the volume of air becomes more confined when it reaches the narrower limits about Wellington, and consequently the horizontal pressure exerted must be greater and the velocity increased. Thus it is found that a steep gradient over the South Island causes a stronger wind in Wellington than would a similar gradient over the North Island.

It will therefore be seen that the actual reading of the barometer at a single station can give one but little indication as to the direction and force of the wind, or the kind of weather to expect. For the purpose of anticipating the character of the weather the larger one's field of vision the greater is the probability of the forecast being verified. On this account it is evident that large tracts of country, such as continents, should present less difficulty in forecasting weather than does, for instance, New Zealand, whose greatest width from the west to the east coast is only 280 miles in the North Island, and 180 miles in the South.

Cyclones and Anticyclones.

When a set of weather maps is examined an endless variety of isobaric shapes may be discovered. In fact, it would be almost impossible to find two maps presenting identical characteristics in this respect. There are, however, really only seven fundamental types of pressure represented by these isobars, and of these the two principal ones are the *cyclone* and the *anticyclone.*

Both these systems are approximately circular or oval. In the cyclone the central or inner isobar represents the lowest reading of the barometer. Around the centre the wind rotates in a similar direction to the hands of a clock, so that, should the cyclone be moving in an easterly direction, in

front of the centre the winds would be northerly, and in the rear southerly; directly north of the centre the winds would be westerly; while to the south, easterly winds would prevail. These directions hold good everywhere in the Southern Hemisphere, while north of the Equator exactly opposite directions are experienced, a law which is governed by the effect of the rotation of the earth on all moving bodies on its surface.

Usually the isobars in a cyclone are very numerous, and this accounts for the strong winds experienced. Besides the cyclone there are other types of pressure which cause high winds and heavy rains, and it is a mistake to refer to every storm of exceptional severity as a cyclonic storm, without having the knowledge that the conditions were really due to a cyclone.

An anticyclone, as its name suggests, is the reverse of a cyclone, for the pressure is highest in the centre, and gradually diminishes outwards. The winds are more variable, particularly in the central region, while in the Southern Hemisphere their general direction is opposite to the motion of the hands of a clock, the front of the centre, when it is moving due east, having southerly winds, and the rear northerly. The winds generally have but little force, since the isobars are not so closely bunched together as in a cyclone.

The most important conditions relating to these two systems are the association of unsettled weather with cyclones, or low barometric pressure, and fair weather with anticyclones, or high barometric pressure.

Areas of high and low pressure entirely control our weather, and the changes due to both are brought about by their translation across the Dominion, for the whole system of isobars moves forward from west to east, and when any distinct type in the system is passing over the country the winds and weather usually associated with such a type are experienced. Our knowledge of the direction and rate of their movements makes the forecasting of weather possible.

Circumpolar Pressures.

There are two theories with regard to the arrangement of the Antarctic circumpolar system of isobars. The one which seems the more likely in the light of the observations made by explorers in recent years is attributed to Lockyer, and is as follows: The polar region is covered by relatively high pressure, while on its outer or northern perimeter are a succession of cyclones, which are constantly travelling from west to east at the rate of about 400 miles per day. Such a distribution of pressure would account for the strong westerly winds between the 40th and 50th degrees of latitude; from the 50th to the 60th we then expect to find easterly and southerly winds, and beyond the 70th degree there would be a continual outflowing of southerly winds from the Pole.

The other theory is that the whole of the polar area is covered by an immense cyclone which is centred at the Pole. If this were correct we should invariably expect westerly winds in the higher latitudes; but Sir Douglas Mawson at Adelie Land experienced mostly southerly and south-easterly gales. The lowest pressure, also, would nearly always be found nearer the polar region; but according to both Sir Douglas Mawson's and Captain Amundsen's observations this is not so, for pressure is invariably lowest farther north.

The Macquarie Island* reports have been extremely valuable in helping to elucidate this matter, and from these it would seem that the centres of the cyclones above referred to pass usually somewhat to the south of that island.

The mean number of intense "lows" passing Macquarie Island during the three years 1913 to 1915 was as follows: January, 6·3; February, 5·7; March, 3·0; April, 4·0; May, 5·0; June, 4·3; July, 5·7; August, 4·3; September, 6·0; October, 9·3; November, 6·5; December, 4·0.

There are therefore sixty-four cyclones passing during the year, and, taking the average rate at 400 miles per day, there would appear to be at least eight or nine primary cyclones circling the subantarctic regions at the same time.

Westerly Areas of Low Pressure.

Farther north than the latitudes in possession of the cyclonic systems we come to the region of anticyclones. The latter move somewhat irregularly from west to east, accompanied on their southern extremities by the before-mentioned Antarctic cyclones. Between adjacent anticyclones the northern portions of these cyclones tend to wedge themselves, with the result that in each case a $\wedge$-shaped depression is formed. This is the commonest of all the "lows" which pass over the Dominion, and is frequently referred to in the weather reports as a *westerly area of low pressure*, particularly when the isobars assume a wider sweep than in an actual Antarctic $\wedge$.

TYPICAL EXAMPLES.

The above descriptions distinguish briefly the chief weather controls, and show the principles on which the forecasts are based. It will make the matter more explicit if the statements made are now illustrated by means of examples of atmospheric systems that have actually existed.

A Typical Anticyclone.

Fig. 1 shows a typical anticyclone or high-pressure system which overspread the Dominion on the 13th August, 1912. Its centre, or inner isobar, circled the whole extent of New Zealand, and when such is the case fine and clear weather results, and in winter, late autumn, and early spring sharp frosts occur in places subject to them. The large arrows denote the approximate direction of the wind in relation to the isobaric trend.

The actual direction of the wind at each reporting station is denoted by an arrow, and a glance will show how variable it is in the central area, which is about Cook Strait. At Wellington the wind is north-east, while at Farewell Spit it is south-west. North of the path of the centre the tendency is all for easterly winds, while in the south the predominating direction is westerly. Along the east coast of the North Island—that is, in front of the central isobar of 30·3 in.—southerlies prevail.

* The Macquarie Island wireless station was established in connection with Sir Douglas Mawson's Australian Antarctic Expedition. It was closed down about the beginning of December, 1915. Discussing the matter publicly at the time, Mr. D. C. Bates, Director of the Dominion Meteorological Office, said, "It is a distinct loss to science. . . . The importance of Macquarie Island is very great, since it is so far south and yet has relationships so closely affecting our conditions."

As the whole system moves forward to the east the winds over the North Island will " back "* (or change in an opposite direction to the motion of the pointers of a clock)—*i.e.*, from easterly to northerly ; while in the South they will " veer " (or change in the same direction to the motion of the pointers of a clock)—*i.e.*, from west to northerly.

Such an anticyclone, in summer, would account for high temperature in the daytime, and the nights would be cool ; frosts might even occur at some of the high inland places.

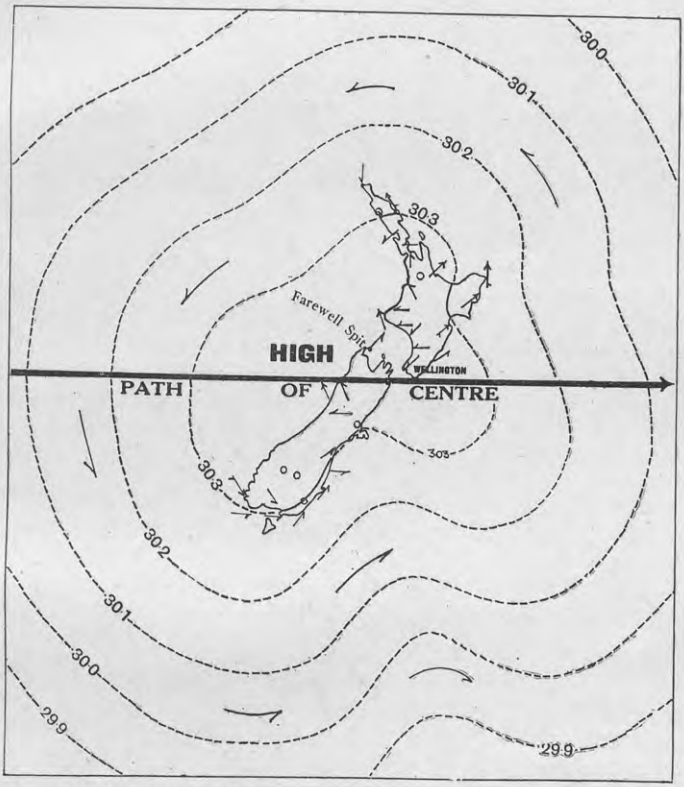


FIG. 1.—Weather chart, 13th August, 1912. Typical anticyclone, or " high."

Anticyclone centred North of New Zealand.

Fig. 2 is a case where an anticyclone is centred in more northern latitudes, and pressure shows a gradual decrease southwards, in which quarter is the steepest baric gradient. The trend of the isobars is approximately due

* The terms " veering " and " backing " were originally used to express the change of wind-direction with and against the sun's apparent movement. The International Meteorological Committee, however, in 1905, adopted the following resolution : " Meteorologists in either hemisphere are requested to denote by the word ' backing ' a change of wind-direction at the place of observation (or on board ship) in the direction west-south-east-north (counter-clockwise)—irrespective of accompanying changes of weather—and to use the word ' veering ' to denote a change in the opposite direction—west-north-east-south (clockwise)." (*Rep. Internat. Met. Conf. at Innsbruck, Sept., 1905*, p. 41, item 47.) In the Southern Hemisphere the terms are, therefore, now used in the reverse sense to that in which they were originally employed.

west and east over New Zealand, and favourable to strong westerly winds, especially over the South Island and in Cook Strait. With this distribution of pressure showery weather is experienced on the western coast, extending as far north as Cape Egmont at least, and also often passing through Cook Strait.

This is a type of pressure which is rather prevalent in the spring, and to which the continued dry weather so often experienced at this season of the year in the eastern provinces is accountable.

The normal track of our anticyclones varies according to the seasons, being located in higher latitudes in the summer than in the winter. In the spring months the position, then, would be midway, as shown in Fig. 2, and this would therefore appear to be the critical period for the east-coast districts, especially as precipitation then is more urgently required for growing crops.

Anticyclone centred South of New Zealand.

Fig. 3, the chart of 23rd June, 1913, proves an exception to the above rule, for instead of being in lower latitudes in this case the " high " centre is considerably to the south of the Dominion, while relatively low pressure exists to the northward.

This synoptic chart, as will be readily seen, is the reverse of the preceding one (Fig. 2) ; as the latter was representative of westerly type of weather, Fig. 3 may be taken as a high-pressure system in which easterly and south-easterly winds are dominant. It was responsible for a spell of intensely cold weather in the east-coast districts, with heavy passing showers, particularly northward of Kaikoura. In the western districts clear skies ruled, with frosty nights.

The centre, shown in the chart south of New Zealand, was only one of several existing in this anticyclone, which proved to be an exceptionally extensive one and reached over almost the whole of Australia. After the front had moved farther eastward conditions improved in the eastern districts, the centre following taking apparently a more northerly track over the Dominion.

Variation in Annual Rainfall.

When referring to Fig. 2 it was pointed out that the normal position of the east–west axis of anticyclones is different in summer and winter. In summer the mean track is a little south of Auckland, while in winter it is along the latitude of the Kermadec Islands. In some years, however, the movement of these " highs " is much farther north or south of the normal path, and this extreme migration has an important bearing on the climate of certain portions of New Zealand, especially with regard to the annual amount of rainfall. The effect is particularly noticeable in the case of the North Auckland district, and the annual rainfall records of the City of Auckland present some interesting features in years when the anticyclonic track has been abnormal. For instance, in 1914, which was a year when the high-pressure belt was in more northern latitudes than usual, the fall was only 28·42 in. (— 35 per cent. of mean), while in 1916 and 1917, when the belt had receded south of its normal track, the total falls were 66·36 in. (+52 per cent. of mean) and 74·15 in. (+70 per cent. of mean) respectively.

The District of Canterbury is affected chiefly by the more northern position of the belt, and the rainfall does not show any marked effect from the southern extension. In 1914 the total year's fall at Christchurch was

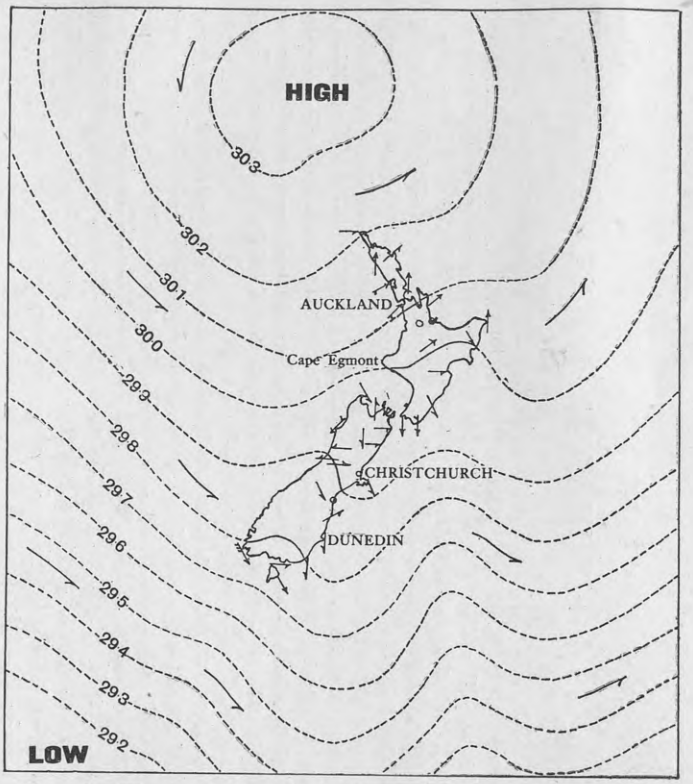


FIG. 2.—Weather chart, 2nd October, 1915. Anticyclone in north; low pressure southwards.

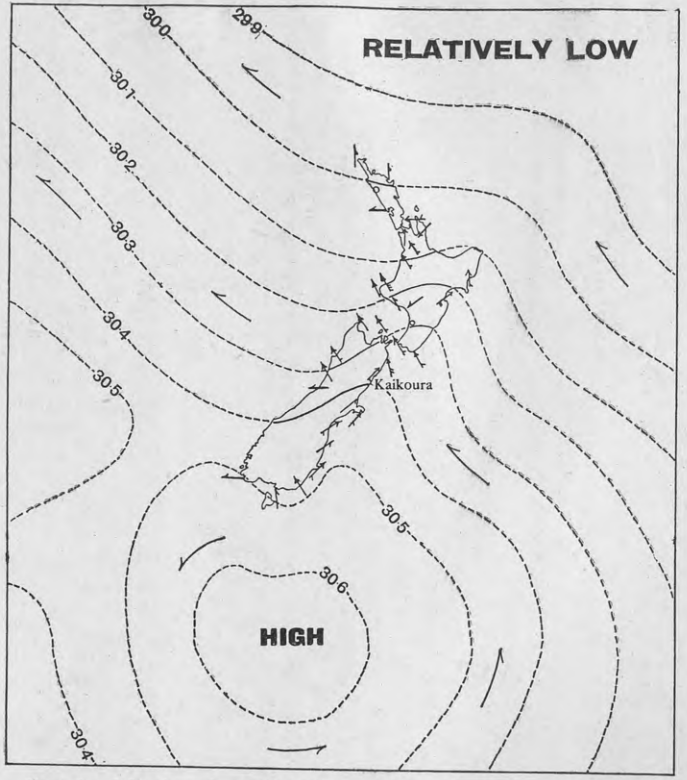


FIG. 3.—Weather chart, 23rd June, 1913. Extensive anticyclone centred south of New Zealand; relatively low pressure northwards.

19·90 in. (—21 per cent. of mean). In 1916 and 1917, however, the rainfall was about the average, but slightly above it in the latter year. The rainfall returns for Dunedin, which may be taken as representative of the southern districts, in some cases show a fall below the average when that at Auckland in the same year of abnormal anticyclonic movement is above it; but this rule is by no means consistent in the records, and so it would appear that the extreme south is not greatly affected by the variation from the normal of the anticyclonic track in any year.

The excessive rainfall in the northern districts when the high-pressure systems move in higher latitudes is brought about by the greater number of extra-tropical cyclones, which are then able to approach within effective range of the northernmost portion of New Zealand. On the other hand, when the high-pressure areas are in lower latitudes, Antarctic or westerly depressions extend farther north, and the west-coast and southern districts of the South Island receive heavy rains. The conclusion to be drawn is that in years when extra-tropical cyclones are more numerous Antarctic or westerly areas of low pressure are less in evidence, and *vice versa*, and this the records have generally proved.

Since the annual rainfall at Auckland shows a marked relationship to the abnormal positions of these anticyclonic belts, it might be expected to show evidences of any cyclical movement if any such existed, but from records which extend back to 1864 no definite periods in the intervals of maximum or minimum swings of the anticyclonic belts can be deducted. The periods between the years of maximum rainfall, and also between the years of minimum rainfall, appear to be altogether irregular, ranging from one to ten years for the former and one to eight years for the latter. The mean period in both cases is 4·4 years.

(To be continued.)

SUNFLOWER NOTES.

By J. BEVERLEY, Assistant Agriculturist, Central Development Farm, Weraroa.

THE sunflower deserves to be grown more than it is at present in New Zealand, especially on small holdings and in gardens. In the early districts of New Zealand I should advise taking a crop of peas or potatoes first, and letting the sunflower be the second crop off the land in the one season. As regards the cultivation of the crop, sowing in rows 28 in. apart with the plants spaced to about 15 in. apart is recommended. The seed should not be covered with more than 1 in. of soil. When the plants are from 12 in. to 15 in. high they should be earthed up like potatoes, and no more cultivation is necessary. A good average crop will yield 50 bushels to the acre.

In Europe the annual sunflower is cultivated for its oil as well as a food for cattle and poultry. *Helianthus annuus* is, however, not the only variety cultivated, as the dwarf species, *Helianthus indicus*, is preferred by some cultivators in France, who assert that, owing to its dwarf habit of growth admitting of a greater number of plants being grown on a given space, it is not so much inferior to the other variety in quantity of produce as one might be led to expect from its appearance.

The produce of sunflower-grain varies considerably according to the state of the soil, climate, method of cultivation, and the purity of the seed used. At Weraroa this season an experimental plot of $\frac{1}{10}$ acre was sown on 9th November, 1918, with the Large Russian black-seeded variety, and the crop was harvested on 23rd April, 1919. Australian seed was sown at the rate of 7 lb. per acre, in 30 in. rows, and the plants spaced 18 in. apart in the rows. The crop was a mixture of good and bad. Some plants came into flower in twelve weeks, whilst the latest ones to bloom arrived at the flowering-stage in sixteen weeks. Some were 10 ft. high, others under 5 ft. It is only by the selection of single plants that one may look for a crop flowering evenly and ripening evenly. Uniformity as regards height is also important, and may be arrived at by selection.

Some plants in this test plot gave from ten to twenty small flowers instead of one large head, which is a disadvantage, owing to the time it takes handling so many small heads when knocking the seed out. Topping the plants to encourage them to send out several flowers is sometimes advised, but my own experience indicates that this is a mistake in more ways than one. Besides making the harvesting more expensive, it delays the harvest; consequently the plants are longer growing, and the crop is more exhausting to the soil than it would otherwise be.

The heaviest plant weighed in the Weraroa crop referred to gave a total weight of 9 lb. 7 oz., made up of root, 1 lb. 5 oz.; stem, 4 lb. 2 oz.; head 4 lb.; 1,500 seeds from this head weighed 12 oz.

There is a considerable difference in the percentage of husk and kernel in individual sunflower-plants. I have found it vary from 61·4 per cent. husk to 53·8 per cent. husk. To increase the percentage of kernel, from which the oil is extracted, should be the first aim of the plant-breeder. The bushel weight of dry seed from selected plants has ranged from 25 lb. to 32·5 lb. for the variety under test at Weraroa this season.

As regards the disposal of the stems of a sunflower crop, a sample from Rhodesia analysed by the Imperial Institute, London, contained 10·3 per cent. of moisture and 10·7 per cent. of ash, the latter containing 49 per cent. of potash, 2·3 per cent. of soda, and 1·5 per cent. of phosphoric acid. According to the Institute, the best use to which the stems can be put is to chop them up finely and spread them as manure, since they contain about 5 per cent. of potash, or else to burn them and use the ash as a potassic fertilizer or for the extraction of potash, as is done in Russia.

Opossums.—At the last meeting of the Board of Agriculture a report from the Crown Lands Ranger, Dunedin, on a proposal of the Otago Farmers' Union that opossums might be liberated in some of the forests of the great alpine range was carefully considered. It was finally agreed that this might prove a considerable source of revenue to the country (as black skins were said to be worth £1 each) if the black or brown ones were introduced, and if every care was taken to prevent their introduction into districts where they might become a menace to the fruitgrowing industry.

IMPORTATION OF FERTILIZERS.

ANNUAL RETURNS AND REVIEW.

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

THE returns of artificial fertilizers imported into New Zealand during the year ended 31st March, 1919, are now, by the courtesy of the Comptroller of Customs, available for the accompanying tables. These, as usual, are designed to show the returns of the twelvemonth compared with those of the previous corresponding period.

The following is a summary of the kinds, quantities, and values of the various fertilizers imported during the years ended 31st March, 1918 and 1919:—

Fertilizer.	Weight.		Value.	
	Year 1918-19.	Year 1917-18.	Year 1918-19.	Year 1917-18.
	Tons.	Tons.	£	£
Bonedust	3,468	6,363	31,054	41,898
Bone char	200	676	1,149	3,403
Bone and blood	79	26	1,175	360
Basic slag	..	10	..	43
Egyptian basic phosphate	..	11,225	..	43,217
Superphosphate	21,400	37,157	114,999	185,515
Guano and rock phosphate	31,351	37,037	61,240	66,882
Sulphate of potash	30	25	1,028	825
Gypsum	342	564	828	902
Sulphate of ammonia	10	65	349	1,731
Nitrate of soda	204	34	3,435	602
Sulphate of iron	64	54	826	380
Manures unspecified	202	..	1,668	..
Totals	57,350	93,236	217,751	345,758

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

The declared import values per ton of the chief phosphatic and soluble nitrogenous fertilizers for the two years under review work out as follows:—

	Year ended 31st March, 1919.	Year ended 31st March, 1918.
	£ s. d.	£ s. d.
Bonedust	9 0 0	6 12 0
Basic slag	Nil.	4 6 0
Egyptian phosphate	Nil.	3 17 0
Superphosphate	5 7 6	4 19 6
Guano and rock phosphate	1 19 0	1 17 0
Nitrate of soda	16 17 0	17 15 0
Sulphate of ammonia	34 18 0	26 12 6

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS TO NEW ZEALAND FOR YEARS ENDED 31ST MARCH, 1919 AND 1918, SHOWING COUNTRIES OF DEPARTURE.

New Zealand Port of Entry.			Australia.					Chile.	India.		Japan.	Pacific and Indian Ocean Islands.		United Kingdom.						United States.		Egypt.
			Nitrogenous Manures.	Bonedust and Blood-and-bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Gypsum.	Nitrogenous Manures.	Potash Manures.	Bonedust.	Superphosphate.	Name of Islands.	Rock Phosphate.	Nitrogenous Manures.	Superphosphate.	Gypsum.	Potash Manures.	Phosphate unspecified.	Iron Sulphate.	Nitrate of Soda.	Iron Sulphate.	Basic Phosphate.
Auckland	.. 1919		14	1,843	5,519	27	..	50	..	1,750	..	Makatea Island	14,166	..	..	..	..	..	..	..	1	..
												New Caledonia	3,257									
„	.. *1918*		*10*	*997*	*1,250*	*359*	*50*	..	..	*3,344*	*554*	*Makatea Island*	*18,112*	..	..	..	..	..	..	..	..	*2,750*
												New Caledonia	*1,543*									
												Society Islands	*250*									
New Plymouth	.. 1919		..	..	480	150	..	..	..	..	..	New Caledonia	1,600	..	..	..	..	..	..	..	..	..
„	.. *1918*		..	..	*1,907*	*335*	..	..	..	*40*	..	..	..	..	..	..	..	..	..	..	..	..	..
Patea	.. 1919		..	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	.. *1918*		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wanganui	.. 1919		..	..	1,357	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	.. *1918*		..	..	*2,268*	..	*414*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellington	.. 1919		20	60	6,080	375	339	..	30	50	..	New Caledonia	956	..	..	2	..	..	..	..	..	..
„	.. *1918*		*22*	*244*	*6,992*	*17*	*16*	..	..	*350*	..	*New Caledonia*	*2,925*	..	..	..	..	..	*2*	..	..	*3,475*
Napier	.. 1919		..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
„	.. *1918*		..	..	*280*	*102*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton	.. 1919		40	..	2,827	974	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..
„	.. *1918*		..	..	*7,848*	*688*	*77*	..	..	..	*2,499*	..	..	..	..	..	..	..	..	..	*46*	..
Timaru	.. 1919		..	..	1,650	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	.. *1918*		..	..	*3,569*	*645*	..	..	..	*80*	..	..	..	..	..	..	..	..	..	..	..	..
Dunedin	.. 1919		..	..	944	..	..	150	..	..	..	Makatea Island	4,145	..	..	..	..	..	..	..	..	..
												New Caledonia	1,389									
„	.. *1918*		*30*	..	*2,941*	*982*	..	..	..	*500*	..	*Makatea Island*	*4,050*	..	..	..	..	..	..	..	..	*2,500*
Invercargill	.. 1919		..	44	2,463	388	..	..	..	..	..	Makatea Island	4,000	..	..	..	..	..	..	..	..	..
												New Caledonia	37									
„	.. *1918*		*25*	*492*	*7,049*	..	..	..	..	*1,025*	..	*New Caledonia*	*3,039*	..	..	..	..	..	..	..	..	*2,500*
												Makatea Island	*4,000*									

Reviewing the statistics, it will be seen that the importation of phosphatic fertilizers for the past year shows a great falling-off, particularly in bonedust, superphosphate, and Egyptian phosphate, of which three fertilizers in the aggregate there are shortages totalling some 36,000 tons. Compared with the previous year's figures, those for guano and rock phosphate have not shown such a falling-off, there being a decrease equal to only one-sixth ; no Egyptian phosphate was imported, however, as against 11,000 tons during the previous period ; and only half the quantity of bonedust and three-fifths of the quantity of superphosphate was received in comparison with the previous year's importation. This shortage may be put down almost entirely to the lack of shipping facilities, which it is hoped will be considerably improved now that the conditions are returning to normal.

Potash manures, as might have been expected, show no change. There seems to be very little demand for this class of fertilizer in New Zealand. The writer still has occasional offers from sawmill-owners of wood-ashes having a potash-content of about 5 per cent. (soluble K_2O) and 10 per cent. total (soluble in acid), but has difficulty in placing them with farmers or fertilizer-mixers.

Nitrate of soda, which for the last year or so has shown a downward tendency, has increased from 24 tons to 204 tons. In the past a few hundred tons of sulphate of ammonia and nitrate of soda have been imported every year, but the amount used for fertilizers does not raise hopes that the soluble nitrogenous class of fertilizer will be required in amounts which will necessitate the establishment of factories for manufacturing nitrogen compounds from the air.

Elephant-grass.—The Department received some seed of elephant-grass (*Pennisetum purpureum*) from Rhodesia in 1915, which was sent to Moumahaki Experimental Farm to test its forage value. A plot was sown in November and the grass reached 5 ft. in height by the middle of the following April. It came into flower but did not seed. Horses seemed fond of it, and in spite of the stems being an inch in diameter they ate it all. The plants died down in June, and there was no further growth until after Christmas. The period of growth here seems to be from January to the middle of April. Elephant-grass is a perennial plant, and at Moumahaki it did best the first season. It requires hot dry weather to be of real value, and as a good crop of maize would give the farmer three times more forage, elephant-grass seems to have only limited recommendations for New Zealand conditions.—*J. Beverley, Assistant Agriculturist.*

Mr. W. Dempster, of the Dairy Division, who has been officially deputed to investigate milk-product industries in the United States and Canada, left for San Francisco early this month. Delegates of the National Dairy Association, and of the co-operative dairy factories of the Taranaki and Wellington Districts, left by the same boat on similar missions, the itinerary of the last-mentioned delegation also including Britain and the Continent of Europe.

THE FRUIT INDUSTRY OF BRITISH COLUMBIA.

AN INTERIM REPORT.*

By J. A. CAMPBELL, Assistant Director of the Horticulture Division.

THE system under which the fruit industry is conducted in British Columbia, both on the cultural and marketing sides, differs considerably from that followed in New Zealand.

THE TREES.—STOCKS, PRUNING, ETC.

Practically all varieties are raised on seedling stock. Woolly aphis, although more or less noticeable on the coastal area around Vancouver, causes little or no trouble in the dry-belt areas of the Okanagan Valley, where nine-tenths of the fruit of the province is grown. The permanent trees of an orchard when planted are set out at 30 ft. apart, and fillers are planted at the central point between each set of four trees. These fillers are removed when they reach approximately ten years of age.

The trees themselves are, from our standards, practically unpruned. This applies to young trees as well as old. The pyramid style of training is general, and all that is done with the young tree is to see that about six limbs are well started from the central leader. This may take two or more years to accomplish, utilizing 3 ft. or 4 ft. of the central leader, with the first branch some 3 ft. 6 in. to 3 ft. from the ground. The central leader is usually retained, but its removal after the main branches have been started is considered to be the correct course. Even when such is done, however, nothing resembling an open-centred tree results. The main limbs are allowed to branch at their own free will, the most that is done being to prevent excessive crowding. In some instances moderate shortening-back of leaders is continued after the tree reaches the age of five or six years, but the usual practice is to cut back nothing after the tree reaches that age unless under special circumstances. Stranger still from our point of view is the fact that hard cutting, as we understand it, is never practised even with young trees. Despite this, however, very large heavy-bearing trees are raised. This may be largely accounted for by the stock used and the amount of space allowed to each tree. This course of treatment applies pretty well to all trees excepting peaches. As to the latter I am unable to say at present, not having yet had an opportunity of seeing a peach-orchard, although such trees are fairly largely grown.

* This is the first report received by the Department from Mr. Campbell, who is investigating the fruit industry of Canada and the United States. It is dated Vancouver, 29th April, 1919.

PESTS AND DISEASES.—SPRAYING-COMPOUNDS.

British Columbia is fortunate in not having any codlin-moth or San Jose scale to contend with, and, as might be expected, the inspection of imported fruit and plants is extremely rigid. Red mite, mussel scale, powdery mildew, apple and pear scab, and brown-rot are present. The fungus diseases are not very serious in the dry belt, but are much more troublesome in the coastal areas. Fire-blight, however, is very prevalent within the dry belt, and where at all neglected results in the loss of a large number of trees. Remedial measures are sufficiently reliable to keep the disease within bounds if properly carried out. Within this area also very serious damage to trees is liable to follow heavy frosts when such occur early in the fall before the sap is down. I saw evidence of this damage over practically the whole of the Vernon and Kelowna orchards visited. In the low-lying parts of the valley many acres of trees have been killed right out, but the damage becomes less apparent towards the higher levels.

The principal spraying ingredients used are commercial lime-sulphur, bordeaux, Blackleaf 40, and whale-oil soap. Nine-tenths of the spraying, however, is done with lime-sulphur, at a strength 1–8 in winter and 1–50 in summer. This mixture can be used without damage to foliage at a strength of 1–20 and even 1–15. If these strengths applied only to the dry-belt areas the matter could be more readily appreciated, but it is not so. In the coastal areas, where the rainfall reaches 60 in. and the summer weather is equal to that of Nelson or Hawke's Bay, the standard summer strength of lime-sulphur is 1–50, whilst a strength of 1–35 is frequently used. Many different brands are used, but I understand that the "Niagara"—at 30 cents per gallon by the barrel (war price)—is the most popular.

THE OKANAGAN VALLEY.

The Okanagan Valley, as previously stated, is by far the most important fruitgrowing area in British Columbia. The valley extends well over 100 miles, or at least that portion referred to. The actual valley, I understand, runs right through the southern portion of British Columbia, and on through the west of the United States of America, taking in many well-known fruit districts, such as Yakima and Wenatchee. The banks of Okanagan Lake, which lie in the valley, are in the main rough and rugged, but occasionally give way to very beautiful undulating valleys, ranging from a few acres to several thousands of acres in extent. It is in these valleys that the fruit is grown. The rainfall ranges from 8 in. to 18 in. annually, necessitating irrigation. The soil is very irregular, ranging from very poor to good. The minimum temperature is some 20° below zero F., and a maximum of 110° in the shade is recorded.

Irrigation is carried out in a more or less haphazard manner, owing to the water being privately controlled and an insufficient supply having been originally provided to meet the requirements of fully grown trees. Although pruning and training has been carried out on the lines previously referred to, there are many fine large heavy-bearing trees, but, as might be expected, quite a considerable percentage of inferior ones. How they would compare with New Zealand

trees of similar age, allowing for the greater number of trees per acre in New Zealand, could best be judged in the fruit season.

MARKETING.

The sale of fruit in British Columbia is carried out on altogether different lines to those followed in New Zealand. In the first place, there are no fruit-auctioneers. Instead there are fruit-brokers, wholesale merchants—commonly called fruit-jobbers—and, of course, the retail shopkeeper. The broker has no warehouse, nor does he actually handle fruit, but merely solicits orders from jobbers and passes them on to the packing-houses or individual growers, for which he charges 10 to 20 per cent. according to the size of the consignment for other than car lots; for car lots of 720 cases of apples the charge is $30. The retailer receives practically the whole of his supplies from the jobber.

The "direct to the consumer" trade has been attempted in British Columbia much on New Zealand lines, but the results, through the lack of a really good system, have not been satisfactory. In fact, the position regarding this class of trade is identical with that applying in our country. Growers and co-operative organizations fully appreciate the possibilities of such a system, but do not know exactly how to tackle it owing to the danger of antagonizing the proprietary trade. The manager of the Okanagan United Growers, an organization referred to later, assured me, however, that his concern fully intended taking the matter up to some extent during the coming season.

CO-OPERATION.—THE OKANAGAN UNITED GROWERS.

For some considerable time prior to 1912 the growers of the Okanagan were dissatisfied as a result of treatment received at the hands of the proprietary fruit-traders, so much so that Mr. Robertson, owner of considerable orchard property in that locality and partner in the firm of Robertson and Morris (Limited), wholesale provision-merchants, of Vancouver, undertook to organize the growers of the valley on co-operative lines. In this he received the assistance and sympathy of the Provincial Government and its officers, as well as that of many of the leading fruitgrowers. Mr. Robertson, in 1912, succeeded in forming eight local associations, one each in the following districts: Vernon, Kelowna, Penticton, Peachland, Summerland, Enderby, Armstrong, and another since defunct.

The work of these associations was to assemble, grade, and pack according to standard rules all fruit and vegetables grown by the respective shareholders, and to otherwise prepare the same for market. The Government advanced 80 per cent. of the capital required to build and equip the necessary central packing-sheds to enable this to be done. At the same time a united selling organization was set up called the Okanagan United Growers. This company was formed of the growers who constituted the several local associations, but was registered as an independent concern with a share capital of $10,000, and a paid-up capital of $28 only. No further calls have since been made. The functions of this organization were to find a market for all the fruit and vegetables packed by the different local associations.

This it did and has continued to do very satisfactorily, so much so that it is now fully recognized to be the controlling selling organization of British Columbia. The local associations have been equally successful in handling their end of the business.

The joint organizations go to show what can be done by co-operation when intelligently conducted along economic lines, even in the face of serious difficulties. The difficulties in this case lay in the fact that only 50 per cent. or less of the growers supported the movement, and that progress had to be made against the very firmly established footing of some half-dozen proprietary firms. The Okanagan United Growers was further handicapped by the loss of a lawsuit during the second year of its existence, involving the payment of $30,000.

The charge to growers by the local associations for providing cases and other material, and for grading and packing, varies according to the size of the package, but in the case of the boxed apples this charge is 42 cents. To this is added an overhead charge of 6 cents. The Okanagan United Growers' selling-charge varies in the same way, but with the box of apples it is 9½ cents. Therefore the grower pays 57½ cents for having his fruit graded, packed, and sold, plus commission, which at $30 per car-load is 4⅙ cents, a total of 61⅔ cents, or approximately 2s. 7d. per case. For financing purposes the selling organization, apart from the direct case-charge referred to, withholds 2 per cent. of all accounts handled. Amounts so deducted bear interest at 5 per cent. and are repayable in five years.

If circumstances permit, the writer will return to the Okanagan during the fruit season in order to study the whole scheme in active operation.

Cereal-yields at Ruakura.—The heaviest-yielding wheat at Ruakura in the past season was Marquis, at 45 bushels per acre, and Bobs close up with 44¾ bushels. Thew and Norok gave 38¼ and 36 bushels respectively. The only oat grown was Green's Ruakura, the part of which threshed has yielded 90 bushels per acre. On measurement of stacks the crop would cut 4 tons of chaff per acre.

Saving Onion-seed.—In the horticultural section at Ruakura in July last seventy bulbs of Straw-coloured Spanish onions were planted for seed-saving. The crop was 4 lb. of excellent seed, harvested in March—a very remunerative result.

Apple-grading Machines.—Reporting on the fruit industry in British Columbia Mr. J. A. Campbell mentions that the apple-grading machines used there by the various co-operative associations are the Cutler and the Page. These are the makes adopted by the Nelson Co-operative Fruit Company.

Milking Shorthorns.—The Weraroa Milking Shorthorn herd, consisting of twenty-two cows, together with ten two-year and four yearling heifers, and four heifer calves, was transferred in April to Ruakura. About three hundred Milking Shorthorns, including young stock, are now at Ruakura.

WORK FOR THE COMING MONTH.

THE ORCHARD.

WINTER naturally suggests unsettled and wet weather. Orchardists should take full advantage of all fine days and push pruning on with all speed so as to avoid a rush of work in the spring. It very often happens that good use is not made of fine days, and as a result wet weather delays pruning, which is then done in a hurried and slipshod manner, or even abandoned altogether. This is very undesirable management. As stone-fruits are the first to break into growth in the spring these should be pruned first. Pears follow stone-fruits, and apples are usually the last to start. In mixed orchards this order of pruning could be followed with advantage, as it prolongs the pruning season. Various phases of current work are indicated in the district notes which follow.

—Gordon Esam, Acting Assistant Director of the Horticulture Division.

AUCKLAND.

During July, all fruit-trees being at their most dormant stage, oil sprayings may be applied at fullest strength. All growers who are troubled with mussel, olæ, maire, or other scales, and red spider, are advised to get their oilings on at 1–12 to 1–14 for pip-fruits, and 1–17 for stone-fruits, at the earliest opportunity.

As soon as the autumn growth has hardened on citrus trees, spraying with red oil at 1–40 should be carried out for control of scale and thrip. In cases where there is any setting of autumn fruits the oil may be preceded by bordeaux, 4–4–40, in which case three or four days should be allowed to elapse between the two applications, or leaf-scald will result.

Pruning of stone-fruits should now be put in hand with all earnestness. The attention of pruners is directed to the necessity for the removal of all diseased wood and mummified fruits from the trees at the time of pruning—remembering always to gather and burn the same when the work is completed.

Trees which are required to be replaced in the orchard should now be removed, and the sites made ready for the new trees. If such trees are removed on account of root-fungus or silver-blight a dressing of 2 lb. sulphate of iron well incorporated with the soil around where the old tree stood is recommended.

The preparation of the sites for new orchards should now be well advanced. A word of warning is here necessary for planters who have not yet obtained sufficient shelter to protect their trees from the prevailing winds and are relying on the shelter planted at the same time as the fruit-trees in the expectation that the former will grow ahead of the latter. It is imperative that the shelter-belts be well established before any idea of planting is entertained, which means that shelter-planting should be got well under way at least three seasons in advance.

Apples and pears held in store in sheds should be gone through from time to time and diseased fruits removed. Maintain sufficient ventilation in the stores, but prevent strong draughts.

Quotations for manures, spraying-materials, and cases are all slightly easier this year, and growers should take advantage of this and get their stocks in right away.

Strawberry-planting should have all been completed by the beginning of this month, but where not put through every favourable opportunity should be taken to assure completion of this work.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

At this season open drains should be cleaned out, and pipe-drain outlets examined and cleared if necessary. Low-lying parts of the orchard should receive special attention, and drains be provided where required. This is a phase of orchard work needing strict attention, as good drainage is essential for the well-being of all classes of fruit-trees.

Now is the time to trim, top, and thin out shelter-trees. Aim at providing a shelter that will break the wind yet allow a certain amount to filter through; this permits a free circulation of air in the orchard, and ensures a greater degree of health and vigour to the trees than the oversheltered, stagnant-air condition found adjacent to a dense shelter-belt.

Pruning of apples and pears will be the chief work of orchardists at this period. This branch of orchard work is too large for more than a mere mention in these notes, but the writer will be glad to visit and advise on request in the district.

The month's spraying programme consists chiefly of oil-sprayings for various insect pests as follows:—

Pip-fruits: Scale, woolly aphis, and mealy bug—oil, 1–12; red mite—oil, 1–10.

Stone-fruits: Scale and red mite—oil, 1–15.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

Planting: All planting should be completed as soon as the land is fit. Carefully consider all gaps and culls in the older orchards; the crop average is often heavily reduced by such gaps, which should now be planted up and culls replaced.

Abundant evidence has been observed recently of the advantages of shelter-trees in the orchard. Every grower, especially those on new sections, should consider this problem. Pines, acacia, and cypress (particularly Lawson's cypress) are doing good work in this respect. On a road frontage where shelter is necessary mixed evergreens look well and are effective.

Pruning: This work should now be pushed ahead. Collect all trimmings and burn them; leaving them on the headlands or in the hedges is an unsatisfactory practice. Where grafting has to be done later, select the scions now, label them carefully, and heel them in in a shady corner.

Spraying: Where little autumn spraying has been done an extra application in spring is an advantage. Towards the end of July red oil, 1–10, may be applied to apple-trees infected with red mite, aphis, or scale. Peaches infected with green aphis during the previous season should be sprayed with a weaker mixture—say, 1–25. Stone-fruit trees generally and pear-trees will require a thorough application of bordeaux, 8–6–40. Spray citrus trees affected with black scale with red oil at a strength of 1–25.

Cultivation: Towards the end of the month lighter sections may be ready for ploughing. Where trees are five years old or older a special orchard-plough should be used for ploughing near the trees; properly set, this plough will do away with any need for hoeing.

Lime: After ploughing, lime may be broadcasted and harrowed in. It should be applied over the whole area between the trees; the roots of trees five or six years old will more than meet between the rows. Stone-fruit sections specially will be greatly benefited by such an application.

—William C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

Cultivation: The land should be ploughed as early as possible after the fruit is picked, leaving it in rough furrows to be exposed to the winter frosts, which will greatly benefit the soil. Where possible plough with the lay of the land, not across the slopes; this will give much better drainage facilities and prevent the accumulation of surface water, which does enormous damage through interfering with the capillarity of the soil.

Pruning: This should now be in full swing. Where it is necessary to remove large limbs an antiseptic should be applied to the cut to prevent the incursion of bacteria and fungoid germs. Every precaution should be taken to prevent

that destructive disease, silver-blight, obtaining an entry, which it is considered to make through the wounded tissue. Immediately pruning is accomplished a good spraying with pure bluestone, used at the rate of 1 lb. to 10 gallons of water, will be beneficial as an antiseptic to prevent likely infection at pruning-cuts. This will also act as a means of destroying many of the winter forms of fungus diseases which remain on the bark of the fruit-trees.

Drainage: Where draining is required this should be done as early as possible, so as to take off all excessive moisture caused by the winter and early spring rains. This is important, because nothing tends to reduce the vitality of a tree more than "wet feet." The results of this condition are not noticeable until the spring growth commences, and then, after apparently flourishing for a short period while using up the food stored within the tree, die-back often sets in, through the root-system not being able to carry on its functions and supply further material.

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

CANTERBURY.

Very little can be added to the remarks for last month, as during July the work will in the main be a continuation of that started in June. When pruning, especially young trees, watch the cuts made and try to picture the results of such cuts. There is too much evidence of hasty pruning all through this district, with the result that trees are badly shaped. Insufficient care has been taken with the fruiting-wood; laterals have been cut indiscriminately, no thought having been given to the future. Many growers, anxious to get fruit, are inclined to let the trees bear too soon, at the expense of wood-growth. The first few years should be spent in growing trees, and if this is done successfully fruit will follow at the proper time. With older trees a good deal of attention could be given to the spurs, especially in parts of the district where fruit-spurs appear to establish themselves freely. The thinning-out of fruit-spurs may result in a slightly lighter crop, but the quality will be greatly improved. When pruning stone-fruits take care to see that all fruiting-wood is well spaced, and provide for sufficient growth for the coming season. Owing to the last month or so having been very dry it may be possible to plant fruit-trees towards the end of June or early in July, but where the land is at all wet it is advisable to hold them over until the ground is in a fit condition to receive them.

Where it is intended to regraft, scions may be selected from the best and healthiest trees, and stored in a moist shady place until required in the spring.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

The trees have carried their foliage very late this season, pruning is late in consequence, and growers will be busy at this work during July. Spray-pumps will be idle during the month, but August will see them hard at work again, and my remarks on spray mixtures will be postponed until the July *Journal*.

There is one disease that is not commanding the attention its destructiveness merits, and that is woolly aphis. Growers are too prone to neglect this pest, and it is certainly on the increase in many orchards and is still doing a lot of damage. Get on to it with red oil; a strength of 1–30 will be strong enough to check it at this time. A little Blackleaf 40 added will make it more effective. It is quite certain the longer woolly aphis is left to suck into the buds and laterals the greater the damage and the harder it will be to eradicate. The later strong application of oil will give it a further check, but this pest must be kept in control during the growing-period. When time permits, painting over all knots, cuts, &c., with red oil, 1–1, or even on old-established trees at full strength, will save a lot of future trouble.

Keep an eye on the stored fruit. Lack of ventilation or dampness may cause development of black-spot in the cases. Cleopatra is very susceptible in this respect. Watch Sturmers off the young trees for bitter-pit also. Leaf-roller caterpillar often hatches on the apples after picking and storing. Where this pest has been prevalent in the orchard it is well to look out for it in the stored fruit. One grub will sometimes damage several apples. Do not market dessert apples and pears green, but, on the other hand, do so before they begin to shrivel and go soft.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

THE BREEDING-BIRDS AND INCUBATION.

AN important fact to be remembered by those who keep the heavier breeds of fowls is that if profitable stock is to be produced, and the pullets are to lay during the next dear-egg season, the chicks should be brought out during July or August at the latest. Therefore, when there is not sufficient incubator and brooder capacity to bring out all the chicks at one time, the eggs should be placed in the incubator as soon as possible.

Care should be taken that only eggs from birds possessing outstanding laying-capacity and of sound constitutional vigour are used. The feeding of the breeding-birds is of the greatest importance, as a strong healthy germ cannot be secured from a bird which is poorly fed. Sound and liberal feeding will go a long way towards securing good hatches, healthy chicks, and robust stock. It is always a good plan to give a variation of feed to the breeders, in order to secure the best fertility of the eggs and good hatches. A mixture of equal parts of wheat, oats, and maize, fed night and morning, will usually give good results if given in a manner that will induce the maximum of exercise—namely, thrown in a deep litter. The chief advantage in feeding all grain in the litter, as compared to feeding mash from a trough, is that the hens are not encouraged to become overfat. The aim should be to keep the breeders in what might be termed an active healthy condition. Green stuff must be regularly supplied, while clean water, grit, and crushed sea-shell should be constantly before them. Undoubtedly the success or otherwise of the hatching and rearing operations largely depends on the manner in which the breeding-birds are attended to.

COLDS IN YOUNG STOCK.

At this time of the year young stock are very apt to catch colds, especially if the weather is at all changeable and the conditions under which they are kept is not favourable in every respect. Many cases of colds affecting young birds, and in an advanced stage, have been reported to me. Colds are usually the result of allowing birds to sleep in ill-ventilated and dirty quarters, whereby they become overheated by night and are susceptible to chill immediately they go out-of-doors. Probably the greatest weakness in this respect is the keeping of well-grown birds in a small confined coop which in the ordinary way would be only suitable for a hen and a small brood of young chicks. In all cases where I have recently been asked to advise regarding colds I have found that the want of sufficient air-space was solely responsible for the trouble. At one place I found no less than eight nearly matured pullets housed in a coop 3 ft. by 3 ft. In this no proper means of ventilation was provided, the only opening being a small door by which the birds entered and left the coop. True, they had a free range by day, which helped them to combat the ill effects of the unfavourable night conditions. Confined quarters, however, are not always responsible for colds. Sometimes they are due to extremes

in other respects, such as exposure to wet and cold, or by allowing the birds to sleep in a draughty house, &c.

The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dirt and dust adhere. In severe cases the discharge will usually be found on the feathers under the wing, by reason of the bird sleeping with its head thereunder. When once the trouble has reached this stage the bird rapidly loses weight, and its general appearance presents an unthrifty and feverish condition. For the latter reason it will drink to excess, and will show little inclination for food or exercise.

Colds are the forerunner of roup, and should therefore be checked at the earliest possible moment, for if roup once gets a good foothold there is no telling when it will be stamped out. The first essential is to find the cause and remove it, for, like most troubles affecting poultry, it is next to useless trying to cure the trouble if the cause is not first removed. During the early stages of colds a little Condy's fluid or crystals put into the drinking-water, sufficient to give it a rich pink colour, will generally prove effective in checking the trouble. In cases, however, where the cold is well developed a good plan is to dip the bird's beak into pure kerosene sufficiently deep only to cover the nostrils, holding the bird in this position until it breathes. This will have the effect of drawing the kerosene to the seat of the trouble. This treatment should be repeated on alternate days until a cure is effected. The beak should be wiped with a dry cloth after each operation. This will prevent the kerosene from getting on the face, &c., which might have an injurious effect.

A correspondent, acting on my advice, tried this cure with several birds which were badly affected with cold—in fact, bordering on roup. Later he advised me that it had the desired effect, but it also burnt the face and combs of the birds as well as took the feathers off from the head and neck. On making inquiries I learned that he did not read carefully the advice as to applying the cure, for instead of dipping only the bird's beak into the kerosene he plunged the head right in. It is little wonder that the birds suffered as a consequence, and a greater wonder that they survived such treatment.

THE POOR LAYERS.

This is not the time of year to cull the poor layers; it should have been done in the autumn. These birds have been probably eating their heads off during the past few months and the poultry-keeper is getting tired of them. The natural laying season for bird-life is approaching, however, and it will be a very inferior bird that will not give a profit over the cost of her keep until just before the next moult comes on. Of course, the better the feeding and the management a bird receives the sooner will she come into profit.

LEG-BANDS.

A correspondent who has experienced considerable trouble through the bands, used as a means of age-determination, coming off the legs of his fowls, asks what kind of band I would recommend for this purpose. There are many different styles of rings and bands on the market specially made for marking fowls, but in most cases these are

next to useless for the purpose intended. One of the most effective and cheapest rings that the writer has used is one like that used in a pig's nose to keep it from rooting. These are obtainable in both the round and flat forms. They may be easily put on the leg of a fowl with a pair of closing-pinchers as used for ringing a pig, and when once on there is little or no chance of the ring coming off. For pedigree breeding the flat ring may be numbered by means of a small set of steel punches numbering from one to zero. Of course, for marking chickens the best means is to punch a hole in the web of the foot. A special punch for this purpose can be purchased from most suppliers of poultry requisites at a cost of about 2s.

THE APIARY.

By G. V. WESTBROOKE, Apiary Instructor.

THE WINTER SEASON.

DURING the winter months there should be little or no manipulation of hives. In most parts of the Dominion the bees will be closely clustered on the centre combs. It is not advisable to disturb this cluster, otherwise the bees will become chilled, and any brood that might be in the hive would probably die as a result.

Should there be any doubt as to there being sufficient stores in the hive, a block of candy may be placed underneath the mat on top of the frames, or on top of the mat, having one corner turned back to allow the bees access to it. Candy can be made at any time. A good method is to take, say, 40 lb. of sugar and 10 lb. of honey—making sure the honey is from a hive free of disease. Place this in a large saucepan or, better, a fruit-preserving pan, add about 4 pints of water, place over a slow fire, and stir until all is dissolved. Then boil fairly briskly until the mixture will harden when a stick is dipped in it and placed in cold water. When it reaches this stage remove it, and if possible stand the pan in a bath of cold water. Now take a clean stick and stir vigorously until it is too stiff to stir any longer. It may then be poured into moulds of a suitable size. A frame containing four or eight sections makes a useful mould. This can, when necessary, be placed bodily in the hive. Candy is not stimulative feeding, but the bees take it slowly, and it will prevent starvation.

PREPARATIONS FOR INCREASE.

As briefly mentioned last month, now is the time to decide upon the next season's work. If increase is required get in the supply of hives, frames, wire, foundation-wax, &c. Before nailing up hives it is a good plan to give the edges a coat of red-lead or paint just previous to putting them together: this will ensure a good joint. When about four or five are nailed they may be tiered up on a bottom-board, and the lot given a coat of paint on three sides. By leaving one side they can be lifted off without smearing the paint, placed out of the way at the end of the building, and then the fourth side given its coat. This

method is easier and quicker than painting each super separately. Where many supers have to be built a hive-cramp is almost indispensable in order to ensure quick and accurate work.

In putting frames together, place the top bar upside down on the bench, then insert in it the ends, after which nail on the bottom bar. Now reverse it and nail the top bar. A 1½ in. cement-coated nail is the best for the top bar, and a 1 in. nail for the bottom. Some beekeepers prefer to nail the top bar from the ends. This is a matter for individual taste. When the required number are ready they may be wired. In wiring drive a small tack in the edge of the end bar, just opposite the top hole, and another in the edge of the other end bar opposite the bottom hole, taking care not to drive them right home. The wire can be threaded through the top holes down and through the centre ones, from there through the bottom holes; then wind the end round the bottom tack and drive it home. Now tighten the wires, wind around the top tack, and drive it home. Make a loop in the wire near the tack, when the wire can be readily broken by tightening the loop. It is not desirable to put in sheets of foundation until nearly ready for use, otherwise the wedges are apt to loosen, allowing the wax sheet to drop.

In making hives from benzine-cases it is best to use a nail-extractor, which can be purchased from any ironmonger for about 5s. 6d. Draw all nails, but save them, as they can be used again. Now cut the side pieces to the required length, and rabbet out the end pieces to the depth necessary to hold the frames, and put them together again. Make one first so as to be sure of the right measurements. These hives can be given a coating of creosote paint, and will last for years. The tops and bottom-boards can be made out of the same material, but it is not advisable to nail on the bottom-board, as so doing prevents the hive being kept clean and free from wax-moth; neither can it be supered up.

Perhaps one of the most important matters for beekeepers to consider when about to increase their colonies is that of foundation-wax. They should see that they have a plentiful supply of this, as it is not always procurable during the rush season. Those having a supply of raw wax would be well advised to arrange to have this made into foundation at once.

VITICULTURE.

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

THE COOL VINEHOUSE.

As soon as the leaves have fallen pruning may be commenced. In most houses there is one rod to each vine. In that case the pruning is a simple matter. The better the vines have been grown the clearer the buds stand out, and the better are they developed and capable of producing a strong shoot. Where the vine has been deprived of its foliage to a harmful extent in the growing season the shoots that are now to be cut away will be spindly and weak. To some extent the

same effect is produced by allowing the fruit-bearing shoot to run unchecked up among dense foliage. It will be noticed that buds at the base of the shoots are closer together than at other parts. In the vine a few years old there is a cluster of buds at this place. It will be best for the amateur pruner to leave the first well-formed bud beyond these (which we will call No. 1). The experienced vinegrower with a better knowledge of his vines can tell when a cut closer to the base can be made. Theoretically the strongest shoots are obtained from the best-formed buds; in practice, however, strong shoots also come from these scaly, inconspicuous buds. When the vines put forth their growth in spring, and a cluster of shoots appears from the base, among these being some as strong and bearing as much fruit as that put out by No. 1, then the latter may be rubbed off, together with the other superfluous shoots. This selection can be made only after a growth of 4 in. to 6 in. is put forth. This method of pruning applies to most of the strong-growing vines. For the amateur I would repeat, rather than risk the close pruning, cut just above No. 1. Prune carefully, making sure of the right spot at which to cut. Do not hurry the job. Use sharp secateurs; if they are blunt the wood is crushed by the blades, and the bud may be injured. To use the secateurs correctly, cut through the shoot with the back of the hand next to the part to be left, the nut that screws the secateurs together facing away from the part cut, severing the shoot about $\frac{1}{2}$ in. beyond the bud with a sloping cut.

Cleaning the rods: While the pruning is in progress keep a look out for mealy bug. Have some methylated spirit and a brush handy, and touch with it any that can be seen. After the pruning is completed, if the vines are a few years old, there is generally some scaly rough bark to remove. This is rubbed off with the hand or gardening-glove. There should be no scraping done. If it is a clean house, washing the rods with hot water is all that is required. The water can be fairly hot, as no harm will be done. A temperature of 150° to 170° F. will kill most insects or their eggs. If mealy bug be present after the washing the rods should be painted with the clay-and-tar mixture, prepared as described in the Department's Bulletin No. 40. Failing the right sort of clay, make a paint with 8 oz. of Gishurst's compound to a gallon of water, with clay added to give it the consistency of paint, and apply with a brush. After going over the rods after the paint has dried a careful examination may reveal some parts missed, and a little more may be required to make a thorough job.

While on the subject of treatment of vine-rods for killing insects and their eggs, I may say that cases of injury to vines by oils used in a pure state or insufficiently emulsified have come under my notice so often that a special note is called for. It should be noted that the wood of the vine is of a soft porous nature, and it thus absorbs more easily than other fruit-tree woods any substance applied to its surface. Many of the oily washes used no doubt have been effective in destroying insects and their eggs, but in some cases injury has been done to the rods. This has been caused by the mixture being badly made, and possibly the oil getting separated, but in most cases by applying pure oil. Therefore oil mixtures, if used at all, must be thoroughly emulsified. Kerosene and benzine should be avoided in any form.

Cleaning the house: The rafters of most houses are of wood, and can be scrubbed with warm water and soap, and the glass syringed clean with water. The walls, if of rough weatherboards and painted, can be whitewashed. Walls of concrete, brick, &c., are normally whitewashed. The soil of the inside borders should be well dug over. If artificial manure, such as bonedust, &c., is to be added, it can be spread over first at the rate of ½ lb. to the square yard, and the digging will turn this well under. On completion of this work, if a wire is stretched along about 1 ft. outside the centre path of the house and pegged down, the vine-rods slightly bowed can be tied down to it till growth starts in spring. The object of this is to make the vine start its growth more evenly. It checks the strong flow of sap to the end of the rod, making the growth at that place much stronger than in the lower parts of the rod, which latter condition occurs if the rod is tied up to the wires before it makes a start.

THE VINEYARD.

The vines may be pruned when the wood is ripe—that is, when it has lost its green herbaceous appearance and assumed its brown winter state. If cut at this stage no bleeding follows. Till the pruning is done no attempt should be made to remove from espalier fences the branches that are to come away, however confused a mass the growth may appear. Dragging at these branches may lead to breaking or injury to the rods that are to be retained, or to the base of those that are to be cut back to spurs.

Use great care in selection of rods that are to be retained. Whenever available these should be lower on the stem of the plant than those cut back to form spurs that are to provide new growth for the following year. If this method were not observed the stem would get higher every year. Start slowly at this work; speed will come as the eye gets accustomed to the apparent confusion of branches, and then the cuts can be quickly made. All dead spurs and useless wood should be cut away at this time.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

CAULIFLOWER and cabbage plants for early supplies should now be ready for planting. It is important that the plants be of the right age—namely, from seed sown towards the end of March or the first week in April, according to the climate of the district in which they were sown. Older plants are not suitable; they are almost certain to bolt prematurely—the cauliflowers to form heads too small to be of use, the cabbages to send up flower-stems. Early cabbages of Flower of Spring type do not require wide spacing; in really good ground 20 in. by 15 in. is ample; if the soil is not of the best the distances may be increased to 20 in. by 18 in.; if larger-growing varieties are planted space them 24 in. by 20 in. Cauliflowers of early kinds may

be spaced 20 in. each way. A larger-growing kind should be planted at the same time to succeed the early kind; space these 30 in. by 24 in.

Stable or farmyard manure is specially valuable for these crops, and should be used in liberal quantity if possible, in which case artificial manures will not be required, with the exception of nitrate of soda. If procurable, this salt should be used, as it has a forcing effect on growth, and, apart from other benefits, has the effect of preventing premature bolting, a trouble to which spring crops are liable. The best way to apply nitrate of soda is in two or three dressings, applying ½ oz. per square yard each time. The first dressing should be applied as soon as the plants begin to move after being transplanted, the other dressing at intervals of four or five weeks. A fair amount of humus is necessary in soil used for vegetable-culture, and especially so for plants that make considerable leaf-growth. Stable and farmyard manure is valuable largely because of the large amount of humus it supplies. Failing this some other source of supply is necessary. Green-manuring by working in crops grown for the purpose is the best substitute. Artificial manures then become necessary. The best fertilizer to use is a complicated question, and naturally depends on soil-deficiency in each case. Bonedust, blood-and-bone, basic slag, and superphosphate are those most used. Basic slag is advised by some authorities as the best for general use in vegetable-culture; it has the advantage of being non-acid. The continued use of stable manure renders soil acid, and the other fertilizers mentioned are acid, with the exception of basic superphosphate, which has an amount of lime in it, and, of course, nitrate of soda. An acid state of soil encourages the growth of certain weeds, assists the development of club-root disease, and locks up certain kinds of plant-food in the soil. Lime is necessary to correct acidity, and is quite indispensable for vegetable-culture.

Other routine work includes the planting of lettuces, onions, shallots, garlic, chives, rhubarb, and potato-onions; sowing cabbage, cauliflower, lettuce, peas, broad beans, radish, and carrot. Lettuces should be regarded as an important crop to plant. The first spring crop is eagerly looked for and the quality is usually exceptionally good. Potato-onions, like shallots and garlic, require a very free soil. The sets are planted by pressing them into the surface soil so as to just cover the crowns; plant the sets about 10 in. apart in rows 15 in. apart. The advantage in growing potato-onions is that they ripen about the end of the year. Chives belong to the onion family. The green tops are the part used; they are useful in salads and for flavouring purposes. The only cultivation chives require is to divide the clumps about every second year. They are best planted contiguous to the herbs, where they will not interfere with the growing of other crops. Chives are a cut-and-come-again crop, the tops being repeatedly renewed after being cut. The carrots sown should be a short horn variety, and only a small bed should be sown, being for early use only.

SMALL FRUITS.

Pruning as detailed last month should be finished by this time; if not, it should be done at once, also spraying. The soil should then be turned over and left in a thoroughly clean condition. Weeds with perennial roots should be thrown out. Regarding raspberries, deep

digging near the stools should be avoided. It is best to dispense with digging altogether, breaking the surface and cutting out weeds with a hoe. Roots are mostly near the surface, and destroying many of them weakens the plants. Provided the soil is well drained, there is no difficulty in keeping the surface open by the use of a hoe, and if a fair mulch of manure can be given in early spring it will prevent the soil being trodden too hard, serving also to feed the plants and to keep the surface open.

Stable or farmyard manure is considered almost necessary for bush-fruits in general, and should be given wherever possible. In addition to such manure apply superphosphate and sulphate of iron, 2 parts of the former to 1 part of the latter, 1 lb. of the mixture to 3 square yards, during winter. In spring, just as growth begins, give ½ lb. nitrate of soda per bush. An occasional liming is also useful for freeing potash, &c., but lime should not be applied to strawberries, these doing best on an acid soil.

The planting of currants, gooseberries, and raspberries should be put in hand at once. Bushes should be spaced 5 ft. apart each way. Raspberries are planted in rows 5 ft. to 6 ft. apart. The young plants may be planted in sets of three 4 ft. from centre to centre, or single plants 3 ft. apart.

Varieties.—The culture of red currants in New Zealand has not been attended with uniformly good results, unsuitable varieties having been planted. Some varieties that have attained celebrity in Europe and America have proved quite worthless in this country. All varieties of gooseberries do well and most raspberries. The only variety of raspberry that I personally bar is Cuthbert, which, grown under good conditions, proved a failure. The following are some of the best of each class of fruit:—

Red Currants: La Versaillaise, Fay's Prolific, Red Cherry, Chenauceau, Bertryn's No. 9.

Black Currants: Carter's Black Champion, Kentish Hero.

Gooseberries: Farmers' Glory, Broom Girl, Lion's Provider, Gregory's Perfection, Overall, Warrington (good for preserving), Crown Bob, High Sheriff, Roaring Lion, Lord Nelson, Red Champagne, Venus.

Raspberries: All-summer, Antwerp, Superlative, Fastolf, Northumberland Fillbasket, Semper Fideles, Hornet.

THE FLOWER-GARDEN.—PRUNING ROSES.

The fact that there are a number of different races of roses, that a different style of or degree in pruning is necessary for each race to give its best, and, further, that individual varieties of each race often differ greatly in habit of growth, renders rose-pruning a more complex subject than it usually is credited with being. It is no cause for wonder, therefore, that some varieties fail to give satisfaction when all are treated more or less alike. It is quite impossible in notes of this kind to do more than give general directions, which will answer for the majority of bushes but are sure to fail in a few cases to bring out the best. In the case of young bushes fresh from a nursery a uniform hard cutting-back is right for all varieties. In this case growth during the first year is nearly always in exact proportion to the extent of cutting back. The harder a young bush is pruned the stronger it is likely to be. The

growth on young bushes is always young, arising from one bud in the case of budded plants, or several buds in the case of cuttings. All young growth should be cut off, leaving but two or three buds to make the new bush. Growth will be far stronger than it would be if more buds were left. Bushes planted in autumn should be left unpruned till after mid-June. Any planted after that time should be pruned before they are planted. In after-years pruning should be mainly in accordance with strength of growth, with some reservations that will be mentioned. Among the tea roses there are some varieties that are reluctant to make thrifty growth, such plants being termed "miffy." The usual plan in such cases is to prune hard. In theory this is quite right, and is in accordance with the general happening that "wood follows the knife." In these cases, however, an anomalous condition arises. Leaving them unpruned for a year or two generally brings them into a thrifty state, but the present is not an opportune time for attempting to trace the reason for this apparent anomaly. The first step in pruning is to remove dead wood and any unripe shoots there may be. These should be cut right back to the place they started from. Directions regarding the pruning of the different races of roses will be given in next month's *Journal*.

REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT, AT 30th APRIL, 1919.

District.	Creameries (Butter).	Factories (Cheese).	Private Dairies.		Packing-houses (Milled Butter).	Totals.
			Butter.	Cheese.		
Auckland	55	51	..	..	4	110
Taranaki	29	113	16	..	3	161
Wellington ..	21	71	1	3	13	109
Hawke's Bay ..	11	24	..	..	..	35
Nelson	7	5	..	..	6	18
Marlborough ..	4	7	..	..	..	11
Westland	7	5	..	..	..	12
Canterbury ..	14	16	1	15	..	46
Otago and Southland	11	96	..	..	3	110
Totals, 1919 ..	159	388	18	18	29	612
Totals, 1918 ..	162	402	23	18	41	646

NOTE.—Five dried-milk factories and one condensed-milk factory were also operating at 30th April.

The Market for Rennet Casein.—In connection with a movement to establish a central co-operative factory in Taranaki for the manufacture of casein, the Department recently communicated with the High Commissioner in London as to the market conditions and prospects for rennet casein. A reply, dated 22nd May, states as follows: "The general opinion of the trade is that the demand for rennet casein will continue to increase, though two firms think that stock in the hands of manufacturers is heavy. Best French is at present worth £110 per ton. During the war it touched £160, but is expected to fall to about £60 in the near future. Provided the quality is right prospects are good, but manufacture of only the best quality casein is advised."

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.

WORMS AND BOTS IN HORSES.

W. H. C., Wellsford:—

What is the best remedy for removing worms and bots from horses? I think my horses are badly troubled with worms, as they will not condition, and are always rubbing themselves about the rump on posts and wires.

The Live-stock Division:—

The probability is that worms alone are the cause of the symptoms you describe. As treatment the horse should receive a generous diet. A powder made up according to the following prescription (for one powder) should be given every morning in feed for seven consecutive mornings, and should be followed on the eighth morning by 2 oz. of turpentine well mixed in 1 pint of linseed-oil: Sulphate of copper 1 drachm; sulphate of iron 2 drachms; potassium antimony tartrate 2 drachms; powdered gentian-root to make up 1 oz. This treatment should be repeated in three or four weeks' time until worms cease to come away with the dung. There is no treatment as yet which is satisfactory for the removal of bots, but these will come away in the spring-time of their own accord. They give no indication of their presence unless present in very large numbers.

TOBACCO DRYING AND CURING.

"NICOTINE," Waihemo:—

Would you kindly give me a few hints on drying and curing tobacco? We have a lot of plants growing in our flower-borders.

The Horticulture Division:—

The process of tobacco-curing varies according to the class of leaf desired, and experience is necessary to secure even moderately good results. The first steps are taken while the plants are growing, these being topped in time to prevent flowering. All suckers and side shoots should have been previously removed, as well as small or damaged leaves at the lower part of the stems. The time to cut is when yellow blotches begin to show on the leaves. The plants have to be hung up to dry. To enable this to be done the stems, before cutting, are split down the centre to within about 6 in. of the ground; the plant is then cut close to the ground. When cut the plant is to be left on the ground till thoroughly wilted; put the butt end towards the sun; wilting will take four or five hours. The plants are then placed astride sticks and taken to a well-ventilated shed. In the shed is a rack built so that each end of the stick rests on a rail; a stick 4½ ft. long will hold eight plants; a space of 10 in. should be left between the rows of plants. Drying is complete when the stems of the leaves become a brown colour and break when bent. The leaves are then stripped off one by one till the operator gets a "hand," which may be twelve or sixteen leaves; then a leaf is folded to 2 in. or 3 in. in width and bound around the base of the "hand" to keep them together, the end of the binding-leaf being tucked in to fasten it. The "hands" are packed in a pile secure from drying winds or wet, the butts being laid outward, the tips of the leaves overlapping. The "hands" are pressed down by kneeling on them while packing, and afterwards weighted with heavy planks. The pile is then covered with sacking, or some such fabric, to protect the exposed

leaves, and in this condition is left for about a month, during which time the sweating process goes on, and, with proper management, a uniform colour is secured. To complete the curing commercially, further processes are undergone in which heat is applied.

RYE-CORN FOR SHEEP-GRAZING.

M. BALL, Matakanui :—

What value has rye-corn for sheep-feed? I am sowing now for grazing in early spring, but am told there is no nourishment in it.

The Live-stock Division :—

Rye-corn is quite a good sheep-feed, but cannot be compared with rape, barley, or a mixture of rye, rape, and barley. As rye has an exhaustive effect on soil the same area should not be cropped successively.

CANKER OF APPLE-TREES.

"GENTLE ZEPHYR," Kumeu :—

Will you kindly let me know the best method of treating canker in apple-trees, and also the cause of the disease?

The Horticulture Division :—

The canker disease of apple-trees is caused by a fungus (*Nectria ditissima*) which is considered to enter the trees by means of wounds, sometimes made by insects. The recognized remedy is to carefully cut out the diseased parts and dress the wound with coal-tar.

RAUPO IN LAKE.

J. D., Wanganui :—

Please let me know the easiest method to get rid of raupo in a lake. The water could be let out or deepened if necessary.

The Biologist :—

Provided the land can be sufficiently drained so as to prevent any water lying on the surface, then the raupo will rapidly die out. If this cannot be done it is almost impossible to deal with.

LUCERNE ON FLOOD-PLAIN LAND.

MRS. D. KNOWLES, Motueka :—

We have a piece of ground—rich sandy loam—with a depth of 6 ft. or 8 ft. before you get to water, and over which the floods occasionally come. We were thinking of sowing lucerne on this land, and would like to know if the flood-waters would have any injurious effect on the plants.

The Agriculturist :—

If the flood-waters do not lie for more than a day or two and your land is otherwise suitable for growing lucerne, you are advised to give the crop a good trial.

PIGS ON FERN LAND.

"SUBSCRIBER," Otamatea :—

Will you kindly answer the following questions: (1.) What is the best breed or cross of pigs to use for clearing fern land? (2.) What additional food is most suitable for pigs enclosed in small fern paddocks and eating fern-root? (3.) What substitute can be used for milk for young pigs before weaning?

The Live-stock Division :—

(1.) Either Tamworth or Yorkshire, or a cross of these, would be suitable for the purpose mentioned. (2.) A mixture of milk and the different meals—pollard, pea-meal, &c.—would be suitable food for pigs enclosed on fern land and eating fern-root. (3.) There is no substitute to take the place of milk for young pigs before weaning.

APPLICATION OF TOP-DRESSING TO GRASSLAND.

J. WHITTLE, Kauwhata :—

Please inform me whether lime and superphosphate deteriorate by being sown on grassland in dry weather. Should they be sown and harrowed in just before rain ?

The Agriculturist :—

Lime and superphosphate do not deteriorate on being applied to grassland in dry weather, but it is a better plan, if convenient, to wait until rain is imminent before top-dressing, and after the rain quick results will be obtained. It must be borne in mind that dews at night provide some moisture for rendering the applied mixture partially available or soluble, but rain is required to wash it in.

"TREE-LUCERNE" AS CATTLE-FEED.

"HILLSIDE," Raglan :—

Is tree-lucerne of any feeding-value for cattle ? It is spreading over my place like a weed, and if it is no good I want to nip it at once.

The Live-stock Division :—

The term "tree-lucerne" is applied both to tagasaste (*Cytisus proliferus*), which has a white flower and is of practically no feeding-value, and also to the true tree-lucerne (*Medicago arborea*), which has a yellow flower and is a good fodder plant, but should not be grown at the expense of grassland. From the spreading nature you mention the probability is that tagasaste is the form present on your land.

BROAD-BEAN RUST.

J. E. AXEL, Auckland :—

Could you inform me of the cause of rust in broad beans, and if there is any remedy ?

The Horticulture Division :—

Broad-bean rust is a fungoid disease known as *Uromyces fabae*. Spraying has not proved an effective means of control. Massee states, "If it is grasped that the disease can only commence in spring from germinating teleutospores (winter spores) that have passed the winter on old stems and leaves, perhaps all such that are diseased will be collected and burned." Wild vetches also harbour the disease.

BROKEN-WINDED HORSE.

E. D. HOLT, Cape Runaway :—

I have a five-year-old draught horse, broken last season, and a very free worker. Towards the end of the season, however, he showed signs of being broken-winded, and was therefore turned out until last Christmas, when he was brought in and fed three weeks, then worked in a wool-wagon about three days a week. In such a case is there any reasonable prospect of his becoming right, and, if so, what is the remedy ?

The Live-stock Division :—

If the horse is broken-winded, as you say—and the characteristic symptoms cannot be mistaken—a double expiratory action seen in the flank and abdomen, and a peculiar cough more like a grunt—there is no hope of recovery. These cases invariably get worse as time goes on. Usually the trouble is caused through errors in diet, overloading the stomach with bulky food being the most common cause. Careful attention should be paid to diet. Give good food in small quantities at a time, watering the animal before feeding—never after. Never work the animal immediately after feeding, and it will be useful for slow work. An ounce of Fowler's Solution given mixed in the food twice a day has a beneficial effect in these cases.

DISEASED CUCUMBERS.

"GROWER," Te Kauwhata :—

Every year my cucumbers are cut down by a rust when the crop is about half-way through. They are grown in rich well-drained swamp. I have sprayed both with bordeaux and lime-sulphur, but it has had no effect.

The Horticulture Division :—

As your cucumbers are cut down by disease every year it seems to show that the soil or the situation is unsuitable, possibly both combined. The probability is that the humid conditions set up a soft condition of foliage, which would render the plants particularly liable to severe injury from fungoid-disease attacks. Raised beds might prove beneficial by securing a better current of air through the foliage, with consequent hardening. A good dressing of lime should also do good. With regard to spraying, this would have to be done before the disease appeared. Sprays would do no good if applied after the disease had obtained a good hold.

COW WITH SWOLLEN HOCK.

"SUBSCRIBER," Wellsford :—

I have a cow which has evidently badly ricked her hock, a soft swelling forming round the joint. Is there any way of treating this ? She has been lame for about a month.

The Live-stock Division :—

You might try painting the swelling with tincture of iodine, applying a little every other day. The application of a little of the following blister, well rubbed in, would probably act quicker : Powdered cantharides, 1 part ; vaseline, 8 parts. If this is used, however, it will be necessary to protect the cow's udder from the blister by covering over the blistered part, otherwise blistering of the udder will result.

MARE WITH BRITTLE FEET.

"WESTLAND," Hende's Ferry :—

I have a young draught mare that I have difficulty in keeping shod. The walls of her feet are black and thick, but have very little strength. Is there any method of toughening and hardening the horn ? The mare's feet break away on the slightest provocation ; there seems to be no fibre in the horn. She is fat and healthy, and a splendid worker, but the feet are a serious drawback. Will you kindly advise.

The Live-stock Division :—

Brittle feet are due to a lack of the natural moisture in the horn, and this can be remedied to a certain extent by daily applications of ointments or oils. A serviceable ointment may be prepared by thoroughly mixing tar and lard together. Linseed-oil also gives good results. Whichever preparation is used, it should be applied liberally. A blister applied round the hoof-head to stimulate the growth is also advisable.

A NEW ZEALAND AGRICULTURAL TEXTBOOK.

AGRICULTURE: A TEXTBOOK FOR NEW ZEALAND SCHOOLS AND COLLEGES. By R. P. Connell, M.A., Agricultural Instructor, Auckland Education Board, and J. W. Hadfield, Diplomé Hawkesbury Agricultural College, Agricultural Instructor, Seddon Memorial Technical College, Auckland. Whitcombe and Tombs (Limited); 421 pp.; 6s.

THIS recently published work responds to a long-felt want in connection with agricultural instruction in New Zealand. In their preface the authors state that the scope of the volume is in general similar to that of the courses in agriculture of various secondary schools with which they have been connected, and it may therefore with some justice be claimed that the book provides a practical course, for it is based on teaching experience. The main sections of the work treat of seeds and plants, soils and manures, tillage, drainage, farm crops, pastures, conservation of fodder, weed-control, plant-propagation, insect pests and fungoid diseases, pruning of fruit-trees, and other related subjects. Many practical exercises have been introduced in connection with the subject-matter, and these form an essential part of the work from the teaching standpoint. It will be noticed that the scope of the book does not include animal husbandry, dairying, &c., as in the case, for instance, of the well-known English textbook, "Fream's Elements of Agriculture." In view of the importance of the live-stock side of agriculture in New Zealand, the opportunity certainly presents itself to the enterprising publishers to bring out a companion volume to the one under review dealing with the elements of animal industry. Reverting to Messrs. Connell and Hadfield's volume, its use will be by no means confined to schools. Farmers and others will find it valuable for study and reference. This of course, will be mainly in connection with the general principles of agriculture and its practice. While a certain amount of directly New Zealand matter is introduced, and the treatment in general accords with New Zealand conditions, the work, as indicated, is in the main a general textbook. A really specialized work on New Zealand agriculture and agricultural practice proper has yet to be produced. Much of the material and data for such a work have appeared and are appearing in periodical journals, bulletins, &c. This brief notice may well conclude by an expression of congratulation to the authors on the quality of their work, and to the publishers on the excellent style and get-up of the volume, the printing, illustrations, and binding being well up to overseas standard.

THE "AGRICULTURAL INDEX."

RECOGNIZING the vital need of a guide to agricultural literature, the American agricultural colleges, in 1916, co-operated in establishing a central clearing-house of information. The result was the "Agricultural Index," a current, cumulative indexing service. During the first year fifty-three journals were indexed, and the service was issued in five numbers. Since that time there have been indexed regularly seventy-eight journals of the United States and ten foreign countries, and the publication is issued ten times a year. Acting upon the practical unanimous vote of the subscribers, the publishers (H. W. Wilson Company, 958–964 University Avenue, New York) have now brought out a three-year cumulation of the Index for 1916–18, a very significant period for agriculturists, since during that time agriculture was a matter of world concern and new achievements were born of the necessities of war. The three-year volume contains 1,056 pages with 70,752 references. It affords a permanent record, by subject, of the articles in a selected list of seventy-eight periodicals, including farm papers and technical journals, also the publications of agricultural experiment stations, State and Federal Departments and Boards, the reports of agricultural and historical associations, and the extension bulletins of colleges and universities. It may be mentioned that among the publications indexed is the *New Zealand Journal of Agriculture*.

IMPORTATION OF FROZEN MEAT INTO NORWAY.

THE importation of frozen meat into Norway from countries outside Europe has been hitherto absolutely prohibited, but in January last the Norwegian authorities made regulations authorizing, under certain conditions, such importation from Argentina until the end of 1920. A translated copy of the regulations, furnished through the British Consular Service, has been received from the New Zealand Veterinary Officer in London, Mr. A. Crabb. In a covering letter to the Director of the Live-stock Division, Wellington, Mr. Crabb states, "It will be seen that the conditions laid down in the regulations are of such a nature that they could easily be complied with in the event of it being found desirable to import New Zealand meat into Norway, the main conditions apart from certification being that the meat shall be imported in not less than quarters, and that the pleuræ, peritoneum, kidneys, and glands shall remain *in situ*. Under present conditions of Government purchase I do not expect that any trade can be done in the immediate future, but the granting of permission to import Argentine meat will undoubtedly open the way for the New Zealand product when importation is possible."

THE RABBIT NUISANCE AND THE FORMATION OF RABBIT BOARDS.

THE following useful notes are extracted from matter prepared by the well-known settler, Mr. Joseph Barugh, of Hamilton, chairman of directors of the Farmers' Co-operative Auctioneering Company, and recently issued, together with other related matter, by that concern. Mr. Barugh states,—

The Rabbit Nuisance Act, 1908, did not allow the Board to strike a high enough rate to cope with the pest, and contained other faults, many of which have been altered by amendments during the past session. There are only four Boards in New Zealand, which shows how unsuitable the Act was, or it would have been taken more advantage of.

The amendments provided that the Governor-General, by Order in Council, on petition from a majority of the ratepayers over an area of not less than 2,000 acres, providing that it contains not less than ten ratepayers, may constitute a Rabbit Board district. The Board has power to strike a rate up to 1d. in the pound on the rateable value, but in no case must the rate exceed a sum equal to 1s. per acre. The Government will pay to the Board a subsidy of £1 for £1 on the rate struck up to $\frac{3}{16}$d. in the pound, provided that the total amount of subsidy paid during each year shall not exceed £5,000.

Suppose a Rabbit Board district is valued on an average at £16 per acre, and the Board struck a rate of $\frac{3}{16}$d. in the pound, the tax would return 3d. per acre, and with the Government subsidy would make a total revenue equal to 6d. per acre. If that estimate was considered too little the Board might strike a higher rate, but the Government would not give any more than the $\frac{3}{16}$d. in the pound subsidy.

The Board has power to borrow money from the Government under the Local Bodies' Loans Act for the purpose of constructing rabbit-proof wire-netting fences. Wire netting should not be necessary where natural boundaries such as rivers are obtainable, or where one Rabbit Board is bounded by another Rabbit Board.

THE RABBIT NUISANCE AND THE FENCING ACT.

There is apparently nothing in the Rabbit Nuisance Act, 1908, and its amendments by which an individual owner or occupier of land can require or compel his neighbour to join with him in the erection of rabbit-proof fences. The Fencing Act, however, does deal with the matter. The ordinary provisions of the Fencing Act as to giving notice (in order to enable an occupier to claim from his neighbour half the cost of a boundary-fence) apply to rabbit-proof fences, and in giving a fencing notice the occupier may require and specify a rabbit-proof fence. If no objection is taken or cross-notice given within twenty-one days after the service of the notice, the giver of the notice may proceed with the erection of the fence and recover half the cost from his neighbour. If objection is taken by the neigh-

bour within twenty-one days on the ground that a rabbit-proof fence is not required, or on any other ground, or if a cross-notice is given within the time aforesaid, the question or questions in dispute must be brought before a Magistrate in the usual manner. Section 15 of the Fencing Act provides that if the questions in dispute relate to the erection of a rabbit-proof fence or the conversion of a non-rabbit-proof fence into a rabbit-proof fence, and the Magistrate decides that the receiver of the notice will not derive adequate benefit from such erection or conversion, then—(*a*) The giver of the notice may, at his own cost, erect or convert the fence, the wire netting used to remain his property; (*b*) the receiver of the notice shall be liable to contribute a sum equal to the half-cost of erecting a non-rabbit-proof fence, together with such additional sum (if any) as the Magistrate considers equitable; (*c*) the receiver of the notice shall be liable to bear the half-cost of repairing the rabbit-proof fence (as a rabbit-proof fence) until the wire netting is removed.

[NOTE.—Section 15 of the Fencing Act here quoted does not apply to the South Island of New Zealand or to any county within the North Island that the Governor-General on petition from the Council of such county exempts from its operations.]

CROWN AND NATIVE LANDS.

Rabbits on Crown and Native lands will be dealt with by the Government, except where Native lands have been individualized, in which case the Native is liable in the same manner as a European.

STARTING A BOARD.

Procure the Rabbit Nuisance Act of 1908, No. 161, and its Amendment of 1918. The Act provides for the establishment of three classes of Boards—(1) A Rabbit Board elected by stockowners; (2) a Rabbit Board elected by ratepayers; (3) a Rabbit-proof Fencing Board elected by ratepayers. The recent amendment to the Act applies chiefly to the Rabbit Board elected by ratepayers and makes it the Board most suitable to small farmers.

If any farmers think that their district would be better under a Board, they should make their views known—say, through the local branch of the Farmers' Union, or by calling special meetings within the proposed Board district. A committee should be formed to define boundaries, which should be shown on a plan. A large district is better than a small one, especially where boundaries such as rivers can be taken advantage of.

Having decided on the boundaries, a temporary clerk should be engaged—a man experienced in local-body work for preference—to prepare the necessary petition and secure the signatures of a majority of the ratepayers within the proposed district. After the proposal is carried the approval of the Governor-General in Council must be obtained before the members of the Board can be elected by the ratepayers. All that is necessary is a simple form of petition to the Governor-General setting out the facts and praying for the constitution of the district. The petition should be sent through the Minister of Agriculture. A Board shall consist of not less than six nor more than eight members. One member, who will be appointed by the Government, shall be the Inspector of Stock in charge of the district. This Board carries out all necessary work, such as striking rates, borrowing money for wire-netting purposes, deciding on the method of destroying rabbits, and the employment of men to carry out the work.

Do not wait till your district becomes a rabbit-warren before starting a Board. It is cheaper and easier to keep a district clear than to eradicate rabbits after your country is full of holes.

FORM OF PETITION.

To His Excellency the Governor-General of the Dominion of New Zealand. This humble petition of the undersigned ratepayers of the lands hereinafter described showeth:—

1. That the lands hereinafter described are not less than 2,000 acres in area, and that there are not less than ten ratepayers within the said area.

2. That your petitioners form a majority of the ratepayers within the said area.

3. That the said area comprises all that parcel of land bounded, &c. [Here follows description of boundaries, which should be prepared by a solicitor], the same being delineated on the plan attached hereto.

4. That your petitioners are desirous that within the said area a Board be constituted and declared within the meaning of Part III of the Rabbit Nuisance Act, 1908, and its amendments.

Wherefore your petitioners humbly pray that Your Excellency will be pleased to constitute and declare a Board within the meaning of the above Acts. And your petitioners will ever pray, &c.

Ratepayer's Signature.	Initials of Witness.

The above petition must be accompanied by the following declarations:—

Declaration of Witness.

I, John Smith, do solemnly and sincerely declare that the signatures to the above initialled by me (J.S.) are the genuine signatures of the persons whose signatures they purport to be; and I make this solemn declaration conscientiously believing the same to be true, and by virtue of the Justices of the Peace Act, 1908.

(Signed) JOHN SMITH.
Witness: ....., J.P.

Declaration of County Clerk.

I, ..., do solemnly and sincerely declare—

1. I am Clerk to the County of .....

2. The persons whose signatures are appended to the within-written petition comprise a majority [minority] of the ratepayers of the area mentioned in the petition (so far as such area is within the county), and I certify that within such portion of the said area as is contained in the said county there are ..... ratepayers, of whom ..... have signed the said petition.

(Signed) .....
Witness: ....., J.P.

BRITISH COLUMBIA AS A MARKET FOR NEW ZEALAND FRUIT.

WRITING from Vancouver to the Director of the Horticulture Division on this subject, Mr. J. A. Campbell says,—

So far as brokers, merchants, and growers are concerned our fruit would be most welcome. Everybody to whom I mentioned the matter was of the opinion that there was no reason in the world why we should not ship our fruit to Vancouver—in preference during the months of March, April, and May. The Okanagan United Growers (O.U.G.), also known as the Central Selling Agency, who do their own brokerage and have their agents established throughout the prairie country as far east as Winnipeg, are prepared to handle our shipments, and have undertaken to give me a written statement as to the terms and conditions before I return to New Zealand. They state that if the first two shipments are satisfactory they would be prepared to deal f.o.b., New Zealand, if we preferred it. There is, however, another side of this question. The inspection for codlin-moth is thorough and strict. The finding of one codlin-moth would mean the condemnation of the consignment. If we undertake to ship fruit to Vancouver at any time in the future we shall have to have a strong staff of Inspectors engaged at the time of packing, and shall no doubt also have to select the orchards from which the fruit is taken. The British Columbia business people, officials, and private individuals I have met all assured me that they are prepared to give our fruit a very kind and favourable reception.

Exportation of Veal.—The prohibition of the export of veal from New Zealand has been revoked by Order in Council dated 21st May.

Unidentified Subscription.—A postal note for 2s. 6d. (No. 253770) bearing the Ashburton post-mark dated 19/5/19 has been received without the sender's name. The person concerned should communicate with the Publisher.