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WELLINGTON, 20TH MARCH, 1919.

SEED-TESTING.

THE NEW ZEALAND OFFICIAL SYSTEM.

By E. BRUCE LEVY, Biological Laboratory.

OFFICIAL seed-testing is by no means an innovation in the history of agricultural progress. Over forty years ago official seed-testing stations were in operation on the Continent of Europe. Ireland has been testing seeds for sixteen years, Scotland for six years, and in 1917 Great Britain, as a war measure, established a station and issued an Order for the compulsory testing of the main agricultural seeds used within its borders.

The seed-testing station of the New Zealand Department of Agriculture has now been established for ten years, but so far no enactment has been passed making seed-testing compulsory in the Dominion. The necessity for compulsory testing has been obviated to a large extent by the seed-merchants themselves recognizing the necessity of knowing the quality of the goods they are offering. In the main it is the high-grade or larger merchant who forwards seeds for test, and it seems feasible to conclude that if these merchants are unable to satisfactorily fix the quality of their seeds the smaller merchant with

White clover - N.Z. "D2" H2849

A. S. Paterson & Co.,
Box 384, Dunedin 6/12/18

Dec 10th	12	14	17	20
2849				
A				

White clover - N.Z. "D2" H2849

A. S. Paterson & Co.,
Box 384, Dunedin 6/12/18

Dec 10th	12	14	17	20
2849	51	38 89 } 90		
A	49	41 90 }		

INTERIM REPORT
16 DEC 1918
DESPATCHED

White clover - N.Z. "D2" H2849

A. S. Paterson & Co.,
Box 384, Dunedin 6/12/18

Dec 10th	12	14	17	20
2849	51	38 89 } 90	1	0·10H·5 95 } 95½
A	49	41 90 }	1	1·5H·3 95 }

INTERIM REPORT
16 DEC 1918
DESPATCHED

REPORT
21 DEC 1918
WRITTEN

White clover - N.Z. "D2" H2849

No.

Sender A. S. Paterson & Co.,
Box 384, Dunedin 6/12/18

Weight Analysis	9·8	P.S.	2	E.S.	2 P.C.
Number Analysis	14,412	P.S.	290	E.S.	1·9 P.C.
1,000 Seeds weigh	·68	Grams. Germination:			95 P.C.

E.S. comprise Selfheal: Suckling Clover: Sorrel: Catchfly: Ribgrass: Scarlet Pimpernel: Chamaecrista Chickweed: Mayweed.

INTERIM REPORT
16 DEC 1918
DESPATCHED

REPORT
21 DEC 1918
WRITTEN

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SPECIMEN RECORD-CARDS IN THE NEW ZEALAND SYSTEM, SHOWING PROGRESSIVE STAGES THROUGHOUT TEST.

his less skilled assistance must needs be trading in an article the value of which he is not able correctly to assess.

As indicated, general seed-testing by the Department was inaugurated in 1909. Before that period a great deal of seed-testing work of a more or less experimental nature had been carried out, and many preliminary expedients were adopted before the Department announced that a seed-testing station had been established. Seeds were tested free, the test including a statement of the average germination capacity and the percentage and kinds of extraneous seeds. In 1916, however, in order to place the system on a businesslike basis, fees were fixed for merchants' samples, the amounts being 1s. per sample for germination tests, 2s. for germination and purity, and for seed-mixtures 1s. for each constituent of the mixture. Testing is still carried out free of charge for farmers.

During the year of inception 180 samples were tested. The following table indicates the growth of the work from its inception to the present time:—

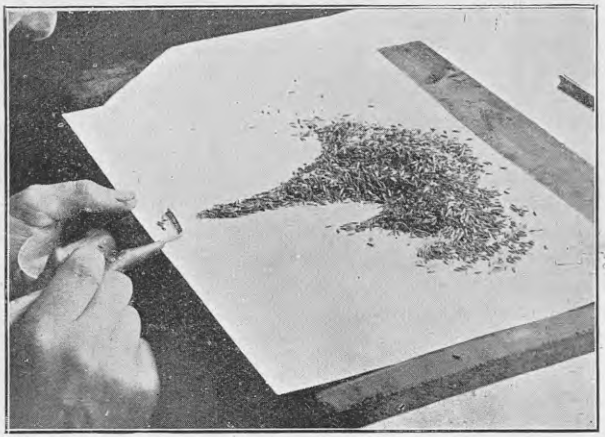
Year ended March,	Samples.	Year ended March,	Samples.
1910	180	1915	2,646
1911	400	1916	3,200
1912	400	1917	2,700
1913	650	1918	3,859
1914	1,863		

For the eleven months ended February, 1919, 4,417 samples have been tested, thus making an aggregate of 20,315 samples dealt with since the establishment of the system.

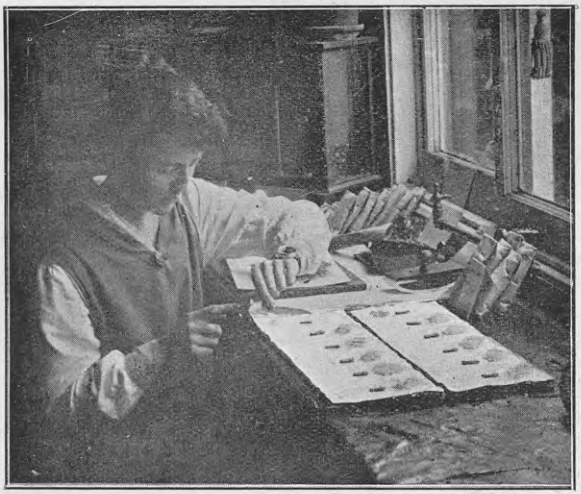
PREPARING A GERMINATING-TRAY.

It is gratifying to note that by far the greatest proportion of the samples are sent in by seed-merchants, the farmer as a general rule accepting the statement of his seedsman that the seed is reliable and of good value. The farmer, after his crop has failed to establish, sometimes sends in samples for test — perhaps with the hope that he may be able to claim compensation from his seedsman if the test proves that the seed was of low vitality. There should be no need, however, for the farmer to have to bother getting his seeds tested. Too long a time must elapse between his procuring the samples and his receipt of the result of the test. If the test is unsatisfactory he must procure fresh samples and again wait for results. Testing for farmers is practically useless as far as their actual sowings are concerned. What the farmer requires is to have the germination supplied

him by the seller at the time he makes his purchase. The only satisfactory way in which this can be done is by obligating the seller to supply this information—and not only to supply it, but to be directly responsible if his information is misleading.



COUNTING OUT THE SEEDS FOR GERMINATION.



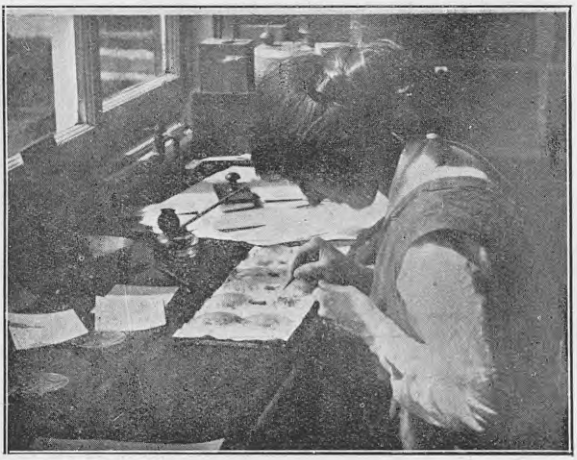
PLACING SEEDS TO GERMINATE.

These notes, however, are not written to discuss possible or prospective legislation, but aim at setting out what has been accomplished already in the direction of seed-testing, and making more fully known the methods adopted by the Department. It may be mentioned that all the photographs here reproduced illustrate the New Zealand system, having been taken by the writer at the Biological Laboratory.

GENERAL METHODS OF SEED-TESTING.

There are two methods of seed-testing—the Continental method and the Irish method. The essential difference between these is that in the Continental method only those seeds and caryopses that are fully matured are tested for germination, the immature ones being

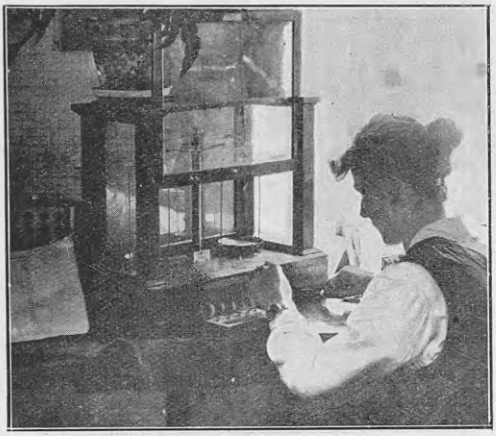
GERMINATOR: INTERIOR VIEW.



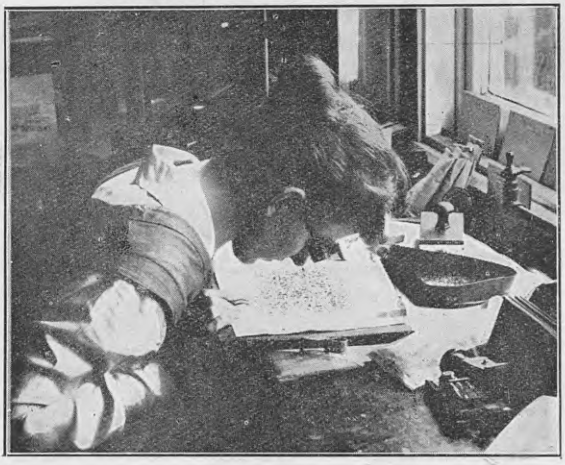
COUNTING OUT THE SEEDS THAT HAVE GERMINATED.

counted as impurities. In the Irish method the immature seeds are included in the germination tests. Neither method is entirely satisfactory. In the Continental method no value can be attached to the germination alone, the real value, Germination × Purity ÷ 100, being

the only real guide to the value of the line of seed. In the Irish method, each immature seed incapable of germination lowers the real value by 1 per cent., whereas it may weigh less than a mature seed; consequently the real value of the line is to a small extent underestimated.



WEIGHING OUT QUANTITY FOR PURITY ANALYSIS.



SEARCHING FOR IMPURITIES.

The method adopted by the Department here, as in Great Britain, is the Irish method. In some cases, however, this method is departed from, and the case of Waipu brown-top (*Agrostis canina*) seed may be cited as an example. This seed usually contains a large percentage of empty glumes, &c., and of these samples mature seeds only are germinated. The percentage by weight of kernel and the percentage

by weight of husk and extraneous seeds are given thus—Empty glumes, &c., 45 per cent.; kernel, 50 per cent.; extraneous seed, 5 per cent.; germination, 85 per cent.

The Continental method offers advantages over the Irish method so far as the actual sale of seeds is concerned, while the Irish method provides the farmer a better and more readily understandable conception of the worth of a line. It is much better for the farmer to know that in a certain line 70 per cent. of the apparent seeds will germinate rather than to know that 30 per cent. of the seeds are immature. When they have the Continental germination test merchants almost invariably quote this test and let the farmer examine the line. He sees that it is well dressed, and concludes that if the germination is 90 per cent., then ninety seeds out of every hundred seeds he sees will germinate. This is not so, as there may be up to 30 per cent. of the seeds counted as immature and which are not included in the germination

PICKING OUT IMPURITIES (MAGNIFIED).

test. Thus our germination tests are often lower than the Continental ones; but the purity is higher, as we count as impurities only extraneous seeds, making a special note when husk, dirt, &c., are excessive, as is the case of Waipu brown-top just cited. What the farmer really wants to know as far as purity is concerned is what foreign seeds are contained in the sample, and when immature seeds of the species sold are included as impurities he receives quite a wrong impression of the line.

Theoretically the Continental method is the more correct, the only trouble being the laborious and exact method of execution of tests—so much so that for all practical purposes this method defeats its own end.

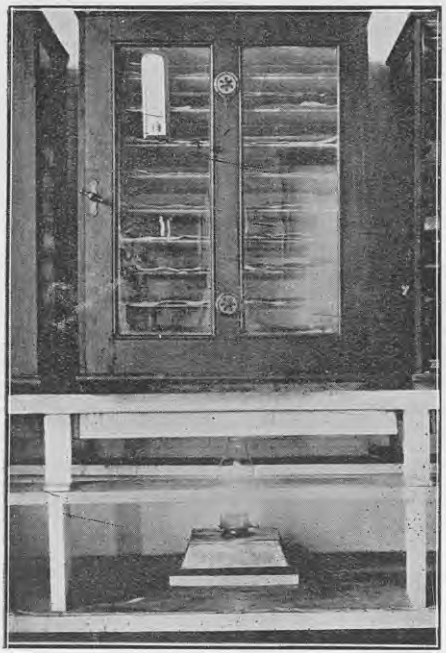
THE NEW ZEALAND SYSTEM IN DETAIL.

The detailed methods of germination and purity tests adopted in this Laboratory will now be described. In passing, it may be mentioned that in consulting reports, &c., of European and other seed-testing stations practically no information can be gleaned as to the exact method of conducting the tests. This is to be regretted, as an exchange of ideas should lead to a more perfect system and hence greater efficiency.

When received the samples are given a distinguishing laboratory number. The name of the seed, distinguishing-mark, name of sender, &c., are entered on special record-cards. The date on which the sample is placed to germinate is entered, also the various days on which counts are to be made. The card is then placed in an index of days of the month, so that all cards of a certain date are together, which constitutes the day's counting. The card system of recording is advantageous not only in ensuring uniformity in periods of counting, but also as forming a permanent record of results.

Process of Germination.

The germinating medium is provided by coarse felt—the under-felt—which is placed on asbestos trays, each tray holding twelve samples. The felt is well sterilized by boiling before being used, and is surmounted by two plies of blotting-paper.



ONE OF THE GERMINATORS.

The sample is well mixed and poured out on a sheet of plain paper, which is laid on a counting-board. From a portion of the sample a hundred seeds are counted (as they come) and spread out on the germinating-tray alongside the corresponding sample number. From a further portion of the sample a similar hundred seeds are counted and placed beside a corresponding duplicate number on a separate tray. Each sample is covered by a 3 in. watch-glass, which is raised on one side by a strip of cork to admit of free ventilation. The trays are then placed in the germinator. It will be noted that each test is conducted in duplicate, the duplicate being taken from a different portion of the sample, placed on a separate tray, and each tray placed in a separate germinator.

Germination of all seeds, with the exception of paspalum, cereals, and prairie-grass, are conducted at a temperature alternating from 85° F. to 65° F.: 85° for eight hours and then let fall to 65° for the remaining period of sixteen hours. Paspalum is germinated in a special oven between temperatures alternating from 75° to 95°. Cereals and prairie-grass are germinated at ordinary room temperatures. Peas, tares, &c., are soaked in water for sixteen hours before being placed on felts to germinate.

It will be noted that the essentials of germination tests are (1) an alternating temperature, (2) free ventilation, and (3) a moist atmosphere surrounding seed on all sides.

Purity Analysis.

For purity analysis the percentage by weight is the most important, and only under special conditions is the purity by numbers given.

The purity is worked on a 10-gram basis. The sample is thoroughly mixed and a definite amount accurately weighed by means of a chemical-balance. The amount taken varies for different seeds, thus: For larger seeds, such as rye-grass, $2\frac{1}{2}$ grams; for smaller seeds, such as crested dogstail, 1 gram; for seeds such as rape, 5 grams; for oats, prairie-grass, &c., 10 grams.

This weight is spread out evenly over a squared surface, and gone through carefully square by square with an eyeglass. All extraneous seeds are picked out and weighed, and the percentage of extraneous seeds calculated thus:—

Weight of extraneous seed ÷ Weight of sample examined × 100 = Percentage by weight.

The remainder of the sample is then gone through for additional impurities, other than those noted in the weight dissected. A list of all the impurities is made on the purity-card.

The percentage by numbers is estimated as follows:—

(1.) Weigh out definite amount of sample.
(2.) Pick out extraneous seeds, weigh and count.
(3.) Estimate number in 10 grams.
(4.) Calculate per cent. by weight.
(5.) Calculate weight of extraneous seeds in 10 grams.
(6.) Calculate weight of pure seeds in 10 grams.
(7.) Estimate weight of 1,000 pure seeds.
(8.) Estimate number of pure seeds in weight of pure seeds in 10 grams of sample:
Weight of pure seeds in 10 grams of sample ÷ Weight of 1,000 pure seeds × 1,000 = Number of pure seeds in 10 grams of sample.
(9.) Estimate total number of seeds in 10 grams of sample.
(10.) Then,
Number of extraneous seeds ÷ Total number of seeds × $\frac{100}{1}$ = Percentage by numbers of extraneous seeds.

Recording of Progressive Germination.

Four counts are made of each sample, but the interval between each count varies according to class of seed under test. Thus—

	Days.	Days.	Days.	Days.
Crucifers, clovers.. ..	2	4	7	10
Rye-grasses	3	6	10	14
Crested dogstail	4	8	12	18
Cocksfoot	5	10	16	22

The seeds that have germinated are counted out and discarded, and an entry made on the card under the date on which the count was made.

Ag. H. 72.

NEW ZEALAND.

Department of Agriculture, Industries, and Commerce,

BIOLOGICAL LABORATORY,
CENTRAL DEVELOPMENT FARM,

Messrs Wright Stephenson & Co. Ltd.,
Wellington.

Weraroa, 16th January 1919

Dear Sir(s),—

The following is my **INTERIM** report on undermentioned seed sample(s) received from you for test:—

Sample and Mark		Date of your Advice.	Average Germination.	Number of Days in Test.	Purity: Extraneous Seeds.
White Clover	"4226"	7/1/19	86%	4	1%
Red Clover	"1675"	"	86%	4	UO.1%
Cowgrass	"G1666"	"	84%	4	0.2%
Chewings Fescue		3/1/19	79%	8	0.8%
Italian Ryegrass	"C777"	4/1/19	88%	6	0.2%
Perennial Ryegrass	"C1000"	"	92%	6	0.5%

Final germination results, together with the purity analysis (if purity analysis is desired), will be forwarded in due course.

Yours truly,

E Bruce Levy for Biologist.

2,030/11/18—17434]

Ag. H. 85.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE, INDUSTRIES, AND COMMERCE.

BIOLOGICAL LABORATORY,
CENTRAL DEVELOPMENT FARM.

Lab. No. H2849

Messrs A. S. Paterson & Co.,
Box 384, Dunedin

WERAROA, 21st December 1918

Dear Sir(s),—

FURTHER TO MY INTERIM REPORT OF THE 16th December

The following are the final results of undermentioned seed-sample advised by your letter of the 6/12/18

Sample and Mark	Average Germination-capacity. Interim Report: 4 Days.	Final Results.	Purity Extraneous Seeds.
White Clover - NX "D2"	90 per cent.	95 per cent.	2 per cent.

Kinds of extraneous seeds noted: Selfheal: Suckling Clover: Sorrel: Ribgrass: Mouseared Chickweed: Scarlet Pimpernel: Ragweed.

Yours truly,

E Bruce Levy for Biologist

2,000/7/18—19274]

Ag. H. 84.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE, INDUSTRIES, AND COMMERCE.

BIOLOGICAL LABORATORY,
CENTRAL DEVELOPMENT FARM.

Lab. No. H3295

Messrs J. Cooper Ltd.,
Box 499, Wellington

WERAROA, 25th January 1919

Dear Sir(s),—

FURTHER TO MY INTERIM REPORT OF THE 15th January

The following are the final germination-results of undermentioned seed-sample advised by your letter of the 4/1/19

Sample and Mark	Average Germination-capacity. Interim Report 6 Days.	Final Results.
Onion "1088"	93 per cent.	96 per cent.

Yours truly,

E Bruce Levy for Biologist.

2,000/7/18—19275]

SPECIMEN REPORT FORMS.

Top—Interim Report; Middle—Germination and Purity Certificate; Bottom—Germination Certificate.

Reporting.

In each case after the second count an interim report is furnished to the sender. This gives the average germination after a certain specified number of days, and the percentage of impurities (if a purity test is desired). From the interim report it is expected that a merchant will be able to judge whether or not the line under consideration is fit for his trade. A very fair idea of what the final germination result will be is afforded by the use of our progressive germination tables supplied to each merchant. Thus, for instance, a rye-grass germinating, say, 75 per cent. in six days will finish up with a test of approximately 80 per cent. This final result can be judged from the table.*

The interim report is an extremely valuable report, as it is so expressive of the vitality of the line. The rapidity with which germination takes place is a very important factor in determining the value of that line. Rapid germination means great vitality, and this is shown by the interim report. A good viable swede, for instance, will germinate over 90 per cent. of its maximum capacity in four days, whereas a poor germinating line may germinate less than 50 per cent. of its maximum capacity in the same period. It is highly probable that of those seeds which germinate after the interim report in such a line very few will come up when sown in the field.

Final reports on germination are sent out at the expiration of the testing period, and in the case of purity tests the percentage and a complete list of the impurities.

In order that the sender of the seed may decide the nature of the impurities present a list of extraneous seeds, some 226 in number, has been compiled,† and is supplied to those concerned. The English and the botanical name is given, and a key by which the relative harmfulness or otherwise can be judged.

Each sample is reported on individually, and the certificate is issued immediately the test of this particular sample is complete, irrespective of the number and kinds of other samples that may be included under any one advice of the sender.

In the case of clover-seeds, after the testing-period has expired there frequently remain few or many seeds that have neither rotted nor germinated. Such seeds are termed "hard" seeds. This "hardness" is very common in freshly harvested lines of clover-seed. Heavy machine-dressing should reduce the number of hard seeds for immediate purposes, but in the course of time natural "softening" will take place. Hardness in clovers is due to the impermeability of the seed-coats to water, and unless such coats are scratched by going through the dressing-machine or through special scratching-machines no water can enter, and consequently no growth can take place, the seed remaining hard as when first put to test. In making up our final germination results half of the "hard" seeds are allowed as viable.

Accounts.

At the end of each month the record-cards are forwarded to the Department's Accountant, who renders the accounts and receives the fees.

* A description of this method, together with the full tables, was published under the title of "A Seed-testing Key," in the *Journal* for August, 1916.

† For list see "Seed Impurities," in September, 1916, *Journal*.

MEANS FOR INCREASING AGRICULTURAL PRODUCTION IN NEW ZEALAND.

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

APART from the highly important questions of increased population, closer settlement, and supply of capital, with which it is not my function to deal, there are numerous purely agricultural considerations which, if given widespread, practical, and concentrated attention by our farmers, would increase the production of New Zealand to a vast extent. It is such details of agricultural economy that count most in raising the output of a country whose prosperity is mainly dependent upon what is produced from its soil. The following embrace the more important of these factors:—

DRAINAGE.

As one traverses almost any district in New Zealand he is convinced of the great need there exists for systematic drainage of not only agricultural but also pastoral lands. An extensive carrying-out of adequate drainage will of itself vastly increase production from the pastures and cultivated areas of the country. How many of our pastures are growing plenteously rushes, sedge grasses, and other inferior and worthless vegetation; whereas these could be replaced by superior profit-producing grasses and clovers. True it is that the capital involved in carrying out adequate drainage in many instances is a barrier, but this is not always the trouble. It has been demonstrated over and over again that within a reasonable time drainage pays for itself in the increased carrying-capacity of, or enlarged crop returns from, the land. Apart from the question of lack of capital, it may be asserted that vast areas of country could be better drained, and so have their productiveness greatly increased, were landowners to give more thought and attention to this important subject. They would find that there has already been designed and successfully used labour-saving machinery that could materially assist them. The drain or mole plough, for instance, has done extensive valuable drainage-work for Southland, and to a lesser degree for other districts. Its use, particularly on pasture lands of stiffish subsoil, is of very great economic importance. In North America the traction ditcher has been used extensively, its function being to dig daily long stretches of ditching and place pipes along the ditch-bank ready for subsequent placing in proper position. This labour-saving machine is of much importance for certain types of country, especially where extensive under-drainage is badly needed owing to the stiff nature of the subsoil, where the land is otherwise of high value, and where no stumps or buried timber exist. Again, where labour is fairly abundant, how much more drainage of land could in many instances be effected by using ordinary farm implements, such as the single-furrow plough and the subsoil plough,

and employing manuka, stones, or rough timber for placing in these ditches when completely excavated! Further, as a last resource, the system of providing good surface-drainage, particularly for land to be laid down to pasture, could be employed. This method consists of ploughing the paddock in comparatively narrow lands, high in the centre and low at the sides, running with the natural slope of the land. Under-drainage in addition makes, of course, for greater soil-efficiency, and is of permanent benefit to the pasture and other crops. As a final emphasis of the importance of this subject, let it be stated that drainage is the first essential in the treatment of any soil, and without adequate draining the land cannot respond to any extent to any subsequent treatment it may receive. It cannot grow crops—pasture or otherwise—successfully. It may, then, well be asked, Are New Zealand soils as a whole growing as they should the staple crop of the country—pasture?

LIMING.

Next in importance to drainage in the rendering of soils fully productive is attention to the lime-requirement. Liming is almost unexceptionally required in New Zealand. The plenteous rainfall experienced; the abundance of decayed or decaying vegetable matter with which most soils of the country are supplied; the prevalence of large areas of swamp soils, stiff clays or clay loams, and porous non-retentive soils such as pumice; the preponderance of fern and manuka scrub, whose roots render the soil sour, over large areas of the country—these factors all account for the soils of the Dominion as a whole being acid. Lime is universally required to neutralize this acidity, and to replace the natural stores of calcium that, through the course of centuries, have been neutralized by the organic acids evolved as the result of the process of vegetable decay, and the bases that have leached from the soil owing to the copious rainfall of the past.

Of agricultural lime there are two forms—burnt lime and carbonate of lime (ground limestone). In general the former is more suited for soils well supplied with humus than for light sour soils deficient in humus, and, being more concentrated than the carbonate form, is better adapted for long haulage from the railway. Carbonate of lime, while highly suitable for all soils reasonably supplied with moisture, is specially adapted for sour soils deficient in humus, for, being a mild lime, it does not attack the small humus-supply, and does not therefore cause loss of nitrogen. As in 100 tons of carbonate of lime there is only 56 tons of calcium oxide (burnt lime), ground limestone would require to be applied to the soil in practically double the quantity of the burnt form to satisfy the lime-requirement of a soil; moreover, owing to this lesser degree of concentration, it cannot be hauled by road profitably to the distance that burnt lime can. When haulage is a negligible quantity, however, finely ground limestone of satisfactory price is more to be desired, all things considered, than burnt lime—due principally to its greater ease of handling, its greater safety in transit, and its non-caustic action on plant-food constituents of the soil. Increased quantity required per acre has nevertheless to be kept in mind. As to the quantity of lime required per acre, this depends upon the lime-requirement of a particular soil, gauged by means of a modified system of soil-analysis.

As an initial lime dressing for soils that have never been limed or that have not been dressed for some years, however, 1 to 2 tons per acre of burnt lime (according to the extent to which the soil is supplied with organic matter and to the sourness displayed), or its approximate calcium-carbonate equivalent, 2 to 4 tons per acre of ground limestone, are usually applied to soils in general. Nevertheless, obtaining the lime-requirement, either by soil-analysis or by carefully conducted plot experiments, is the only accurate means of guiding the farmer in the matter of liming, not only as regards the initial supply required for a particular type of land, but also as regards the quantity required annually to maintain the supply under a definite system of rotation farming adopted. In the absence of this knowledge—and the requirement will vary with type of soil, climate, and system of farming—advice as to maintaining the lime-supply of soils in general, after initial liming has been attended to, can only be given in the nature of supplying ground limestone in small quantity (2 cwt. to 5 cwt. per acre) with the manures when used for manuring the turnip or other crop with which fertilizer is supplied. Carbonate of lime is fairly suitable for mixing with manures, especially those containing nitrogen among their constituent parts. Failing this convenient method of keeping up the lime-supply, the system of applying a definite quantity every five or six years—as, for instance, the quantities previously mentioned for soils in general—will require to be resorted to. This latter method is not an economical one for soils inclined to be porous, from which soils lime is leached considerably by a copious rainfall. For stiffish retentive soils it is, however, adaptive. But, as indicated, the ascertaining of the annual lime-requirement for definite types of soil, climate, and systems of rotation farming, by soil-analysis or by plot experiment, or by the two combined, is the only reliable guide in this question of liming.

Apart from these considerations, however, there exists the known fact that lime is required by New Zealand soils, and any legitimate means that can meantime be adopted for encouraging its universal use is justifiable, for there can be no doubt but that lime, used extensively and judiciously, will enormously increase the production of the country.

SOIL-RENOVATION AND MAINTENANCE OF FERTILITY.

Throughout the sections of the Dominion where cereal cropping has been practised persistently for a number of years, and in soils of the lighter nature, humus is required. Exhausting the virgin fertility, mainly through depletion of humus by continuous cropping, cannot always prevail if a soil is to remain productive. Commercial fertilizers are being used in large quantities throughout the country, and lime is being applied more generally than formerly; but what steps, if any, are being taken to systematically replenish the humus-supply of our soils, particularly of the soils above mentioned? To my knowledge, practically no farm system of regular humus-supply has as yet been taken up seriously, and in the cropping districts it is time that some consideration was given to this important matter. Traversing the older cereal-growing districts of the Dominion, it is evident, by the appearance of the soil in many instances, that humus is badly needed to restore the fertility of these areas. Lime and commercial fertilizers alone will not restore this fertility, however intelligently they are used.

Indeed, proper humus-supply to these and other soils will render lime and manures fully effective—will make them go further.

The practice of colder countries of annually treating a portion of the farm with dung is practically out of the question in this climatically more-favoured land. Even if farmyard manure were produced in quantity here, soil-fertility could not be fully maintained thereby, for it has been ascertained by scientific investigations that even when stored under the best of conditions there is a loss of 40 per cent. to 50 per cent. of plant-food constituents in the manure. On the other hand, green-manuring with leguminous crops will maintain the fertility of the soil. As to the most economical method of supplying green manure to the soil, the practice of sowing red clover or cow-grass with a cereal crop, and after harvest ploughing-under the dense subsequent growth, has much to recommend it. The purpose for which the clover is sown is one of soil-renovation, and one should not be tempted to feed it off with sheep, no matter how good a crop it looks. Deliberately plough it under, and rest assured this action will have a most marked effect upon the crop—indeed, crops—that follow. It has been shown by experiments in North America that the ploughing-under of a good crop of red clover is equivalent to applying 15 tons to 20 tons per acre of farmyard manure to the soil. By the method just described of providing humus the season is not lost, for on the same area a cereal crop is still grown. Indeed, a better grain crop is produced, for the leguminous crop—red clover or cow-grass—stimulates the non-leguminous crop, and *vice versa* (another scientific fact).

Failing the growing of clover with the cereal whenever and wherever grown, the system of setting aside each year a small fresh area and growing on it a legume for ploughing under may be resorted to. Eventually the whole farm, or the portion requiring renovating, could be so treated. This, of course, entails partial loss of season. Again, stubble areas might be disked and harrowed in the autumn, and white mustard, rape, or crimson clover broadcasted. Later, the crop selected (all three grow quickly) could be ploughed under—a chain attached to the beam of the plough dragging under all green material. Here again the temptation to feed off with sheep should be resisted, for on a soil lacking in humus greater production can eventually be obtained from the land by the deliberate ploughing-under of this crop. Crimson clover is to be preferred to the other crops mentioned, for it is a legume, hence a nitrogen-gatherer.

Should any one doubt the economic value of green-manuring to a soil known to be through various causes not too well supplied with humus, let him sow a small patch of red clover and plough this under in a paddock intended for oats. Later, when the oats grow and mature, let him note the difference between the green-manured and untreated areas. He can, if he desires, cut the oats on treated and untreated areas of the same size, and so estimate the difference per acre, either in chaff or grain, produced by green-manuring. Seeing is believing, and this simple and easily handled experiment, if properly carried out, will in all probability astonish by its results many people, especially on cropped soils and on the lighter soils of the country.

This phase of profitable farming and maintaining a permanent fertility is of great importance, and one which is by no means receiving the attention it deserves.

RIGHT CULTIVATION AND IMPLEMENTS.

Wherever cultivation is carried out it is essential to increased production that it be as thorough as the season, labour, and facilities available permit. Thorough and timely cultivation makes available plant-food and conserves soil-moisture, the two most important factors in promoting abundant crop-growth. In adverse seasons attention to thoroughness and timeliness as regards cultivation frequently means the difference between success and failure in crop-production. A fine firm seed-bed is important in giving a crop a good start—a highly important factor; and the rule to follow in the seeding of crops is, the finer the seed the finer the seed-bed. Elimination, as far as possible, of rough-and-ready cultivation will go a long way toward materially increasing production from our soils.

The adoption of methods of cultivation and the use of implements suited to varying conditions of soil, climate, and labour-supply will, where possible, contribute a great deal toward increased output. Labour-saving machinery can materially assist in this direction. The farm tractor, on land suitable for its use, can play an important part.

In parts of the country where the rainfall is prevailingly somewhat limited, or where in seasons the weather conditions are dry during the growing-period, implements designed for "dry-land" farming could be used to advantage. In preparing a seed-bed under such conditions use could be made of the subsurface and surface packers, as used in the western States and provinces of North America. These implements pack the soil, both lower and upper portions, and thereby encourage moisture to travel upwards by capillarity. The thin dust mulch that, in addition to packing, is produced by the subsurface packer tends to check evaporation from the soil. Thus moisture is both conveniently concentrated and conserved, and so made the most of by the crop subsequently sown. Disk drills, especially the double disk, also pack the soil around the grain as it is sown, thereby causing the young plant to have the benefit of a maximum of the moisture available in this comparatively dry soil.

Failing the use of these special-purpose implements, the roller, of as heavy a type as made, should be made plenteous use of in preparing "dry-land" seed-beds, and their use should always be followed by a final stroke of a chain or brush harrow to promote a dust mulch, and so prevent evaporation. After every shower of rain in such climates or seasons a stroke of the harrows (light tine), where possible, will conserve this extra moisture to a marked extent. Indeed, during a dry spell when a cereal or turnip crop seems to "stand still" a stroke of the harrows (crosswise) often works like magic in promoting growth. This, again, is due to evaporation of moisture being checked and concentrated at the roots of the crop.

In like manner the intercultivation of drilled crops during a dry season often means the difference between success and failure with respect to such crops. This being so, the expenditure on labour for such purpose where at all available or procurable is thoroughly justifiable. In other words, it pays.

INTELLIGENT USE OF FERTILIZERS.

A better understanding of the chemistry and use of commercial fertilizers on the part of a greater number of our settlers would be

a highly important factor in promoting an increased agricultural output. These valuable crop-stimulants are not as well understood by farmers generally as they might be. An understanding by the farming community of their use from the standpoints of soil, crop, climate, and economics is of first importance. A good deal has been accomplished in this educational matter, but much remains to be done. Official experts are at the service of producers, and it behoves any settler who is in doubt as to the manures to use for his particular soil, crop, and climate to obtain advice on the subject from a scientific source.

USE OF GOOD SEED.—CEREAL-SEED IMPROVEMENT.

The sowing of none but clean seed of good vitality is of great importance to our agricultural industries. Unclean seed is dear at the cheapest price, on account of the waste of time, money, and labour, and of the far-reaching effects of polluted land involved in the sowing of impure and weak seed. The significance of this subject must be well enough known to any settler without further enlargement here.

In the cereal-growing sections of the Dominion the improvement of grain used for seed purposes presents an important phase of more productive agriculture. Much can be done by farmers themselves in this direction, and, when considered collectively, with most marked effect upon grain-growing in the Dominion. Much improvement of grain crops can be effected on the farm itself by a simple form of selection. This consists of making provision each year on new ground for a seed-plot. A standard local variety of wheat or oats, or of both, is chosen, and previous to cutting the crop a number of the best plants, judged from all standpoints, are selected and harvested by hand. The best seed from these is sown next year on the seed-plot, varying in size according to the extent of that cereal usually sown. Previous to the next harvest selection from the seed-plot is made, and the surplus seed therefrom is reserved for the seeding of the general crop. The process is continued for a few years, and eventually valuable high-yielding strains are produced. Apart from this valuable cereal-selection work much good to grain-growing may accrue by the trial of varieties and the eventual adoption of those that best suit local soils and climatic conditions.

SUITABLE GRASS-MIXTURES AND PASTURE-FORMATION.

The laying-down of pastures with grass-mixtures suited to both soil and climate is an economic factor which, if more or less universally adopted, is also calculated to materially assist in increasing the production of the country. For moist climates and areas grass-mixtures suited to such conditions should be employed, and should include such grasses as timothy, meadow-foxtail, meadow-fescue, and Italian rye, and clovers such as alsike and cow-grass. For very wet more or less undrainable soils glyceria fluitans is very suitable. Rich soils, such as those of alluvial formation, are better fitted to hold rye-grass, and hence for such this grass should be the dominant mixture-constituent. Red and white clover are also most adapted to these richer soils. For the lighter, more porous, and drier soils grasses and legumes of the deep-rooting type, including crested dogstail, sheep's fescue, tall oat-grass, yellow oat-grass, poa trivialis, sheep's burnet, lucerne, suckling-clover, and

lotus corniculatus should be employed. For stiff clay and clay-loam soils grass-mixtures should include crested dogstail, cocksfoot, timothy, poa trivialis, white clover, alsike, and cow-grass; also lotus angustissimus for northern soils. Cocksfoot is a most adaptable grass, being of special value for broadcasting on hilly and rough land generally. The foregoing embrace the more important elements in computing pasture mixtures suited to varying soil and climatic conditions.

Under this important consideration pertaining to the premier crop of the country, there arises the question of breaking up land and laying down to grass afresh. The best system, all things considered, is to adopt, where possible, a rotation of crops suited to the conditions and kind of farming carried on, and to lay the land down to grass periodically under this rotation. The period during which a particular area is pastured will be determined principally by its ability to carry a profitable grass lea and by its suitability for growing and the market prices prevailing for other farm crops. There is in parts of the country land that has been in pasture continuously for twenty-five years—in many instances land that has never been broken up. Where land can be ploughed and cultivated it is decidedly in the interests of greater production to break it up periodically (this does not necessarily mean at short intervals) and to renew the pasture, preferably under a suitable rotation system in which grass is the dominant crop. Periodic renewing of the pasture crop, where at all possible, is of very great importance to increased agricultural production in New Zealand.

PROVISION OF WINTER FEED AND SUMMER FORAGE.

The provision of winter feed in quantity sufficient to carry live-stock satisfactorily through that period of the year is a matter that should, particularly in certain districts, be given more consideration. In some parts the condition in which dairy cattle, for instance, struggle through to the spring is deplorable; and this is due to neglect on the part of their owners to provide the all-necessary winter feed. The climate of certain of these districts is highly suitable for the growing of suitable forage crops, and this is so to some extent even in the winter period itself. Apart from the provision of such feed in the form of hay, ensilage, or roots (mangolds, swedes, and turnips), in most parts of the country arrangements may be made for the growing in winter of certain forage crops, and their possession during this period by any farmer can be turned to profitable use, whether for feeding dairy cattle, beef cattle, or sheep. Among such crops may be mentioned Buda kale, thousand-headed kale, emerald rye, and winter vetches, prairie-grass (*Bromus unioloides*) and crimson clover, Western Wolths rye-grass (for strong lands), oats and vetches, oats and field-peas, and dun oats. The last-named and emerald rye and winter vetches are perhaps the only crops that will grow during the winter experienced in the southern districts of the Dominion, whereas all grow elsewhere during this period. With the climatic and soil-fertility conditions possessed by New Zealand there should be no excuse for live-stock to any extent wanting food. Most districts grow roots well, and where hay cannot be made ensilage can be provided. Where, owing to unforeseen circumstances or other causes, all three cannot be produced, winter feed, embracing certain of the crops mentioned, may still be grown.

Ensilage-making affords an economical means of conserving surplus feed produced in seasons of good rainfall, for use during winter or during dry seasons that follow. In Australia ensilage has been kept for a period of ten years, and at the end of that period was still palatable and otherwise satisfying to stock. Such conserved fodder is of special value to prevailingly or seasonally dry sections of the country. The extensive practice of this principle of surplus-feed conservation and the adoption of ensilage-making generally in districts unsuited for haymaking thus present further means of increasing the country's agricultural output.

Summer forage—in the form of maize, millets, sorghums, oats and vetches, or oats and peas — serves to materially supplement the pasture when dried up somewhat in late summer and early autumn. This provision of abundance of succulent green feed for cutting and carting out to dairy cattle tends to keep up the milk-yield, and hence, if generally carried out, will considerably augment the output of dairy products throughout the Dominion. Lucerne produces the same stimulating effect, and is of great value in feeding in any form to all live-stock, summer or winter. The growing of this fodder wherever possible throughout the country will vastly increase agricultural production, so palatable and nutritious is it to all kinds of farm animals. Its perennial supply of the most nourishing of animal-foods, when once the crop is established, and its suitability for providing feed in form of pasture, green feed, hay, and ensilage, render it easily the most valuable forage crop in the agricultural world. Where lucerne cannot be grown successfully red clover can be substituted, also with excellent results.

IMPROVEMENT OF DAIRY HERDS.

The culling-out of the poor producers of milk—low in quantity and quality—in our dairy herds by means of systematic testing will, if generally adopted by dairy-farmers, enormously increase the output of dairy-products. The breeding from none but good sires of recognized milk-producing strains, and mated with dairy herds from whence the poor producers had been culled, would also have very far-reaching effects upon the future of the industry. This phase of agricultural improvement is, however, so consistently presented in the *Journal* that no more than a passing allusion to it is here necessary.

CONCLUSION.

The field for agricultural education is vast. Improved methods, based on scientific principles, are needed even in this land favoured so much by the gifts of nature. Indeed, these very gifts to some extent stand in the way of the ready adoption of modern methods of proven value in the scientific and agricultural worlds. Time will assuredly see the general adoption in New Zealand of principles and practice known to be raising the standard of agriculture of other countries. Knowing, however, from the experience of older countries what agricultural losses intervene when constructive methods are deferred for adoption during the later stages of development of a new country, all concerned may be urged to bend their energies towards an earlier attainment of the desired end.

RECLAMATION OF SAND-DUNES.

By E. PHILLIPS TURNER, Officer in Charge of Forestry Branch, Lands Department.

IN the reclamation of sand-dunes it is essential that operations be started where the sand-drift has its source, which in the case of coastal dunes is high-water mark. The area under treatment should be fenced off from stock, and rabbits exterminated.

It is best not to plant trees until a protective littoral dune has been raised, or a belt along the coast planted with marram-grass.

THE LITTORAL DUNE.

In France the first operation is to build up a littoral dune or artificial bank or foredune immediately behind high-water mark. This is done by erecting two parallel sand-catching fences 6 ft. or 7 ft. apart and some distance to the landward of high-water mark. This distance should be so selected that advantage can be taken of the highest parts of the banks of sand that have accumulated naturally along the shore. If there is no kind of natural littoral dune the sand-catching fences will be continuous, but where the former already exists it should be utilized as much as possible, and the sand-catching fences need be erected only in the top ends of the hollows (on the seaward slope) in order to gather enough sand to fill them up to the level of the existing mounds. When the top ends of the hollows have been filled up another similar fence should be erected lower down on the seaward side of each hollow, repeating the work till the whole hollow is filled. An ideal foredune should have a height of from 30 ft. to 35 ft., with a long easy slope to the seaward and a steep slope to the landward. It should be as straight as the coast-line will allow, and the slopes as uniform as possible.

When a foredune has been raised to the desired height it may then be planted with marram-grass. The seaward side of the foredune is always kept under marram; and should the grass fail at any places or be blown out by storms the gaps made must be at once repaired and replanted.

SAND-CATCHING FENCES.

For their sand-catching fences the French use sawn pickets, which are driven into the sand and afterwards raised when they are nearly covered up. Where, however, there is an abundance of manuka in New Zealand a cheaper fence can be made by using thin manuka sticks about 4 ft. or 5 ft. long and inserting them firmly in the sand, leaving a space between each equal to the diameter of the stick. Another method is to use light manuka scrub and lace it between wires or thin rails fixed to posts. Care must be taken, however, not to have the scrub too dense, as if the wind cannot pass through it hollows will be blown out at its base and no accumulation of sand will take place. The object of the fences is not to stop the wind, but merely to so lessen its force that the sand it is carrying will be deposited on the lee side of the fence. Two fences are more effective than one, but where

two fences are made the one on the weather side may be more open; they should be about 7 ft. apart. When the accumulation of sand has covered up these fences others should be erected on top of but a little to the windward of them.

PLANTING MARRAM.

Marram for transplanting should be obtained from plants that are not more than two years old. A hole is made by simply pushing a spade into the sand and pressing it backwards and forwards until a wedge-shaped hole is made. A bunch of marram-stems is then inserted to a depth of about 8 in. and the hole filled up by pressure of the foot on the sand. There should be not fewer than five stems of marram in

A NEWLY MADE MARRAM PLANTATION ON THE NEW ZEALAND COAST.
Planted 2 ft. by 2 ft. Rows crossways to prevailing wind.

a bunch, and each stem should have two rooted joints. Near the sea the bunches of marram should be planted not more than 2 ft. apart, but inland this distance may be increased to 3 ft. Care must be taken not to have the marram in lines that are parallel with the direction of the prevailing wind. Plants should be exposed as little as possible before planting, and the best time to plant is wet weather. Autumn, winter, and spring are the only seasons in which planting may be done. On sand with an even surface the bunches of marram may be planted by using a plough.

PLANTING OF TREES.

The planting of trees is done only on the landward side of the fore-dune, and in places where the sand is bare it must be previously planted with marram. The best trees for New Zealand coastal dunes are *Pinus radiata* (*insignis*), *Cupressus macrocarpa*, *Pinus muricata*, *Pinus*

Thunbergii, and *Pinus densiflora*. If the complete afforestation of the dunes is aimed at, then the trees nearest the sea, for a breadth of about 12 chains, must always be left to serve as a protection-belt. Trees in this belt are planted from 2 ft. to 3 ft. apart, but farther inland the distance may be increased to 4 ft. or 6 ft. according to the habit of the tree to be planted.

In Belgium and Holland the erection of a foredune by means of sand-catching fences is not practised, but marram alone is relied on to hold the coastal sand. This method is cheaper than but not so efficacious as the French method. An article by Van Dissel, a translation of which is appended, gives a full description of the methods adopted in Holland. Of the trees he mentions, only *Pinus maritima* has been found successful in this country, but it is not so good as the trees quoted in the previous paragraph.

It is far the best plan for any one who wishes to reclaim by afforestation to establish a small nursery not far from the area to be planted, as the seedling trees will then be more able to withstand coastal conditions.

RECLAMATION BY LUPINS AND GRASS.

After the fixation of the coastal belt by means of marram and trees an owner of sand-dunes may prefer to reclaim the balance of his land by the comparatively inexpensive method of establishing tree-lupins on the area. Where there is a fair amount of native vegetation on the sand lupin-seed may be sown or lupin-seedlings planted in the autumn, but the safest plan is to scatter over the sand small branches of lupins bearing ripe pods. The seeds will drop out, and after the seeds have germinated the young plants will be protected by the branches.

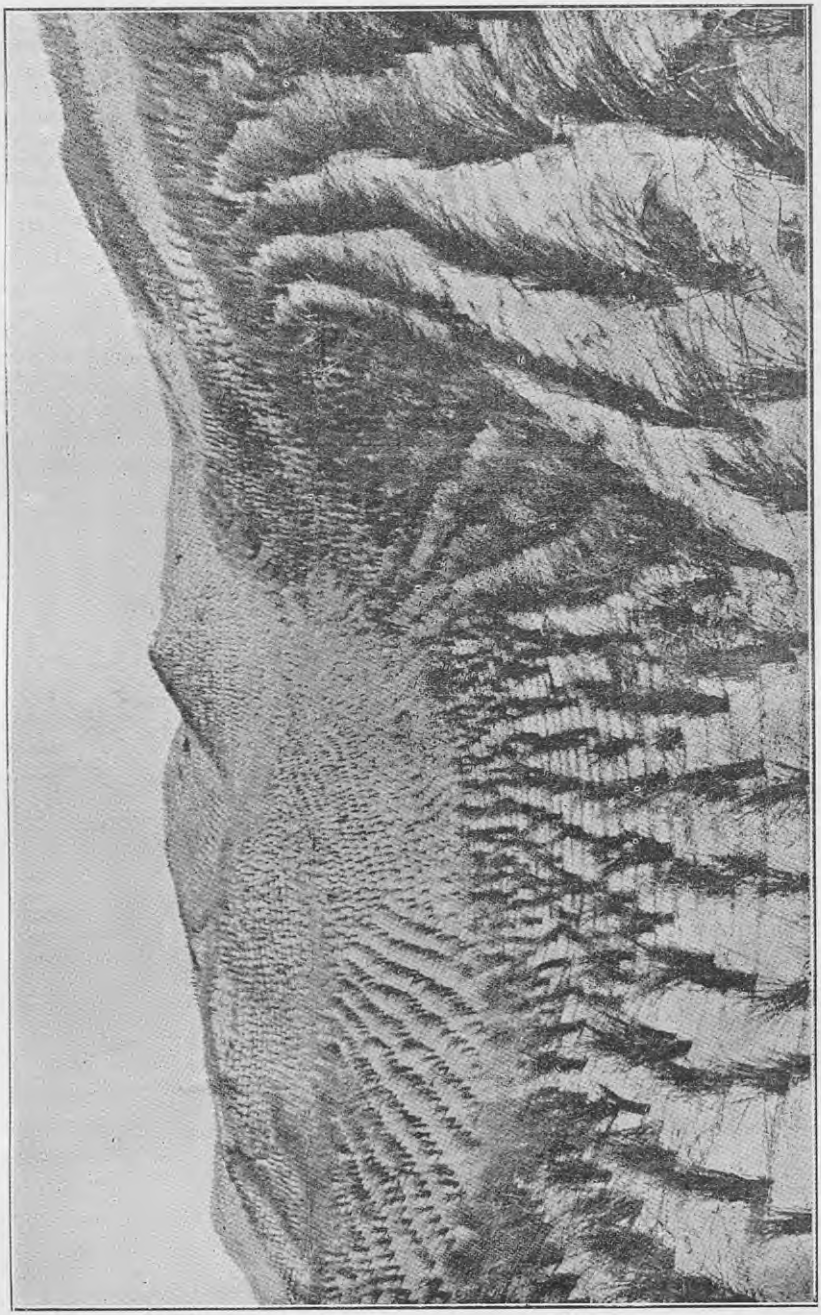
After lupin has become established, prairie-grass, clovers, trefoils, danthonia, *microlaena*, and cocksfoot may be sown in patches where the lupin is thin or where cattle have broken it down. (Cattle must never be allowed on the protection-belt.)

TREATMENT OF THE DUNES IN HOLLAND.

From *Conservation des Dunes: Plantations dans les Dunes des Pays Bas*, by E. D. Van Dissel, Inspector of State Forests and Cleared Lands, Holland.

Translated by E. Phillips Turner.

The dunes of Holland extend in a long chain along the North Sea. They occupy an area of about 92,625 acres—that is to say, nearly 1·15 per cent. of the surface of the country. They are almost entirely composed of sand with a mixture—more or less abundant—of broken shells and other material. This sand may show differences as great from the chemical as from the physical point of view. The nature of the sand exercises a great influence on its instability and on the vegetation. It is where the dunes are driest and where their soil is the poorest that the sand is most mobile; the wind raises it in places and disperses it as dust; this causes holes; at the same time the vegetation in these places is not vigorous enough to oppose the action of the wind with an effective resistance. It goes without saying that it is just there that it is important to fix the dunes by planting marram (*Ammophila arenaria*), or by making an effort to plant trees on them. One must always understand that the lands that are most in want of these remedies are also those where it is most difficult to apply them.



DUNES IN HOLLAND PLANTED WITH MARRAM-GRASS.

FIXATION OF DUNES WITH MARRAM, ETC.

The oldest plan for fixing the soil of dunes consists in planting marram on them, and it is still the means generally resorted to.

This kind of grass, which grows on almost all dunes, develops itself best in those places where the wind brings plenty of sand. That comes about from its forming stems at the joints, where new stalks and roots can be produced. In time, thus extending itself under the influence of the dust from the sand, the plant succeeds in taking possession of a considerable area.

Where the marram increases abundantly supplies are obtained to serve in the fixation of the dunes. The plants are cut in the middle with a small spade at about 4 in. beneath the surface of the soil, but naturally care is taken to have plants in sufficient number. The cut plants are tied in bundles and carried to the place where it is proposed to fix the dune.

The works decided on for this fixation are begun by rounding off the edges of the holes made by the wind, and if necessary the projecting parts of the dunes, because it is there that the wind has the most effect. Narrow holes are then made with the spade in the sand, in which are placed at regular intervals bunches of marram, which are pressed down with care. If one does not lay out with marram, straw is sometimes substituted for it. (Note: Generally marram and straw are used, as a rule planting only marram where it is found in abundance at hand and where the highest seas cannot reach it.)

The bunches of marram are spaced on the slopes at about 12 in. by 12 in., and in the more level places about 20 in. by 20 in. Provided one does not use too old plants (for example, plants not more than two years old), and that the stems have joints, the marram will put forth roots and spread. If that has not taken place it will be necessary to maintain the ordinary repair—to fix the dune afresh—and that generally at the end of three years, because then the stems of the marram are rotten. Where, however, the soil of the dunes is better there will have grown during this time, besides the marram, other plants which will help to fix the dune.

Where sufficient heather grows in the hollows (*pannes*) it is cut and used for the fixation of the dune. The heather is spread in thin layers on the ground and weighted down in the middle with shovelfuls of sand. This is more expensive than the use of the marram. In return, this kind of covering turns out to be more effective in the very dry parts where the marram does not take, and the maintenance of it is not onerous.

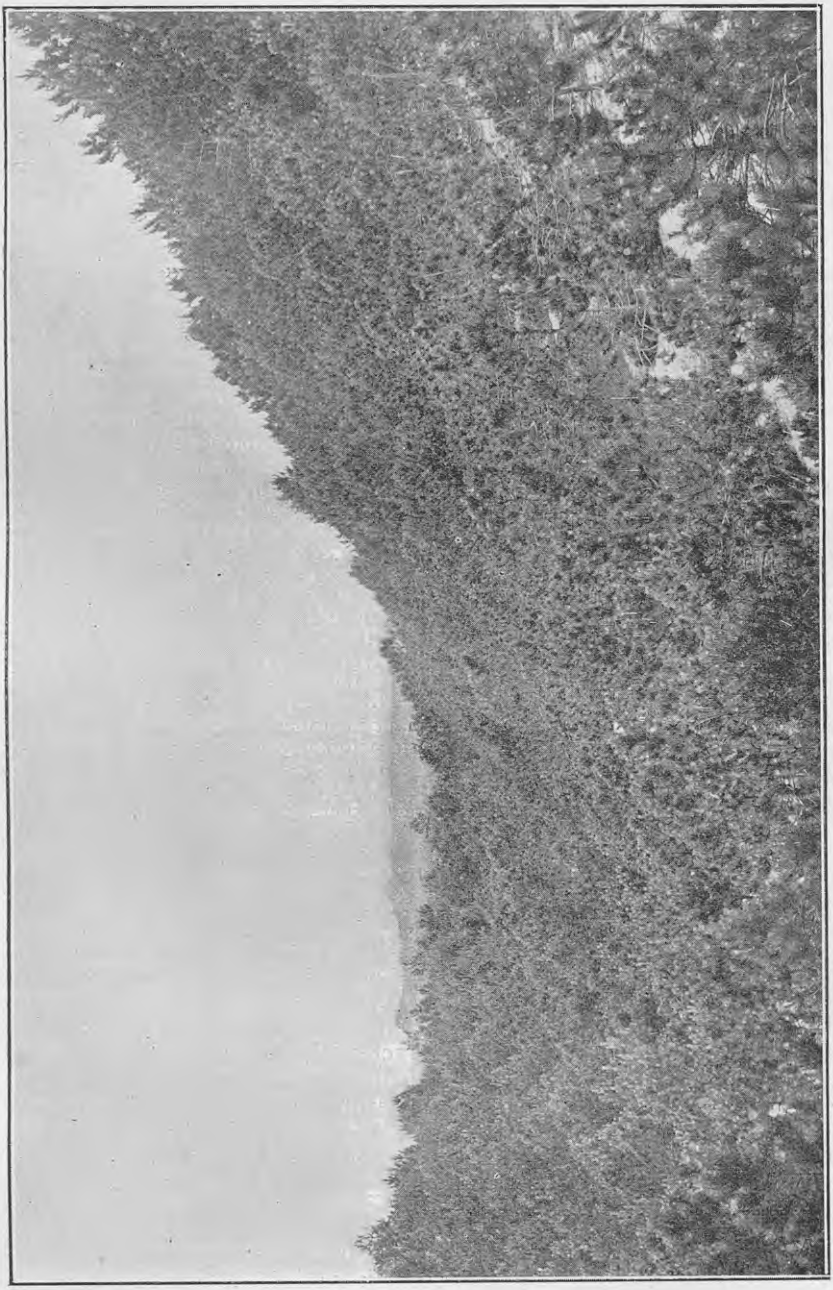
The results of the methods described here are relatively of little durability, and necessitate considerable expense in maintenance and renewal. Afforestation, on the contrary, is capable of fixing the dunes in a permanent manner.

AFFORESTATION OF THE DUNES.

The experiments in afforestation not only of the dunes belonging to private persons but also those of the State date from a long way back. Well known is the trial made by the State in 1865 and the two following years on the dunes of Schoorl. There were then used the following species of trees: *Pinus Laricio* var. *austriaca*, *P. montana*, *P. silvestris*, *P. maritima*, and *Picea excelsa*. Unfortunately the planters had no experience; many of the young plantations perished from want of care, and the results obtained with the others were only partly successful. This attempt has at least not only shown particularly that the three first species named above can give excellent results, and that *Pinus silvestris* succeeds very well in sheltered places, but that *Picea excelsa* and above all *Pinus maritima* are unfitted for this use.

New trials have been made since the year 1893 on the dunes in the neighbourhood of Schoorl. At first, following the example of Denmark and Jutland, they planted chiefly *Picea alba*. This species, however, has been found unsuited for the afforesting of the Dutch dunes. They have therefore had recourse particularly to the species used at the trials of 1865 and 1867. The young plants are raised in nurseries situated near or on the dunes. They endeavour to obtain young spruces from two to three years old, not too big, but with fibrous and long roots very important conditions, seeing the dryness of the dunes.

As a rule, preparation of the soil can be dispensed with in situations where the sand is mostly dust, the soil being there generally sufficiently mellow and containing enough moisture.



DUNES PLANTED WITH MIXED PINES, AT SCHOORL, HOLLAND.

It is necessary before afforesting dunes to suitably fix them, in order to preserve the plantations against the dust from the sand. They use for that (after having rounded off the sharp ridges) heather, marram, or straw in the manner that we have described.

If, however, the dune harbours much vegetation it is necessary to prepare the soil, because in this case it is generally not sufficiently moist for spruces to thrive in it. At times this is done by means of a special shovel, with which are made holes from about 12 in. to 20 in. deep in which to put the young trees. For some years, however, more care has been taken with this work; with an ordinary shovel are made trenches from 10 in. to 12 in. deep, even making this digging as deep as 20 in. in places much covered with plants and in those where the soil is poor and sterile. After this operation the soil ought to be naturally fixed afresh. In the dune-hollows the soil is fairly firm and humid; there are dug trenches about 20 in. deep, and, if required, they are provided with borders to ensure them from an excess of water. Among the species enumerated those which succeed the best are (1) *P. Laricio austriaca*, (2) *P. montana*, (3) *P. Laricio corsicana*, and in sheltered places *P. silvestris* raised from Scotch seed. The plants are put in at a distance of from about 23 in. to 31 in. apart. In places most exposed to the wind they space at a less distance, and plant principally *P. montana*, which stands the violent winds and quickly covers the soil. Besides the conifers, broad-leaved trees are planted in the better places where the soil is sufficiently moist and sheltered, but it is necessary to prepare the soil carefully. Those concerned have expressed themselves as particularly satisfied with alder and oak; they have besides made trials on a small scale with other broad-leaved trees.

The afforestation of dunes in Holland is met with considerable difficulties. Not only do the winds, but also numerous parasites, hinder vegetation, and as much damage is done by the prevalence of animals as by the vegetable pests. Among the pests may be mentioned different species of *Retinia*, *Pissodes notatus*, *Cneorrhinus geminatus*, *Hylesinus piniperda*, *Lophyrus pini*, *Polyphylla fullo*, *Agaricus melleus*, *Coeoma pinitorquum*, and *Hysterium pinastri*. One is obliged to be always on the lookout to fight these enemies at the right time. It happens also that the soil is very poor. To this is added the great difficulty of planting enough broad-leaved trees, which increases the danger from fires. In spite of all, the results, particularly in recent years, have been more encouraging. Without doubt afforestation means a much enhanced initial expenditure, but as against this the expense of maintenance is reduced to a minimum, and one can even see some pecuniary profits in the future, without mentioning the advantage that will be obtained from the æsthetic and climatic point of view. I even estimate, not reckoning the eventual profits, that in the long-run the fixation of dunes by means of afforestation will turn out more advantageous than the costly use of marram, &c., which involves each year great expense in maintenance.

The "Anconia Sheep-dip" Case.—In the *Journal* for March, 1918, a warning was given regarding a worthless preparation termed the Anconia sheep-dip, then lately placed on the market by one J. C. Harrison. After the lapse of a year—delays being caused by Harrison's flight from the Dominion and somewhat protracted legal proceedings after his return under arrest—the case ended in Auckland this month by the accused being convicted of fraud and sentenced to six years' imprisonment. Harrison was shown to have a bad criminal record in Australia for similar frauds.

Invaluable features in the control of field-crop insects are co-operation, clean farming, and a suitable scheme of crop-rotation, the last arranged according to the presence of any likely insect pest, thus breaking the continuity of the food-supply of such an insect.

SCIENCE AND AGRICULTURE.

IN the course of his presidential address at the opening of the recent Science Congress at Christchurch Dr. L. Cockayne, F.R.S., made the following cogent and interesting remarks on science in relation to agriculture, with special references to New Zealand conditions :—

"New Zealand is above all else a farming community. Many of Nature's secrets of one hundred years ago are now the priceless possession of man. These, when more generally applied than at present, will make our fields yield a much greater return. This would be a great advance, but without the discovery of further fundamental principles, now unknown, agriculture can only reach a stage far from perfection. Our scientific duty as a nation is not only to apply to the best of our ability our present knowledge, but by means of purely academic investigations to discover further fundamental principles on which the greatly improved farming of the future will depend. Suppose, for example, such characters as we wished could be bestowed at will upon certain fodder plants—*i.e.*, that the plant-breeder could by methods now unknown create exactly the plant suitable for a special environment, just as one can forge a special tool. Experiments of seemingly the most worthless kinds in genetics might lay the foundation for such knowledge. Even open-air studies of the plants of bog, or lake, or forest, or mountain-top might lend valuable assistance. . . . .

"In this farming community nothing more demands years of close study than the soil itself. The world over, soil-science, notwithstanding many books on the subject, is in its infancy. Chemical analysis of a soil, even were the methods of so doing far more satisfactory than at present, is only one portion of the question. The extremely difficult matter of soil-physics at once confronts the investigator. Then there is the rich soil-flora and the rich soil-fauna. When more is known as to the relation of soil-physics, soil-chemistry, and soil-biology to one another, then undoubtedly new methods of soil-utilization will be in sight. . . . .

"Our cultivated plants of all kinds are subject to attacks of parasitic fungi, the majority of which are considered identical with those affecting similar plants in other countries. For the suppression of such fungi many fungicides have been devised, especially in France and America. Now, these methods having been successful on trees in the country of their origin does not say that similar methods will serve equally well here. A certain apple-tree growing in California will probably differ greatly from the same variety grown on the clay soil of Nelson. The effect of the fungus on such a New Zealand tree, and the life-history of that fungus, must be studied in New Zealand; so, too, must be investigated the use of the fungicide. This method of attacking the pests of fruit-trees by means of fungicides and insecticides costs the State of California alone about £400,000 per annum. At best it is a rather clumsy way of dealing with the pests. It is exactly a case in

point with regard to pure and applied science.* Pure science paved the way by first classifying and then finding out the life-histories of the fungi; pure science had also to devise by aid of much experiment the beautiful technique with regard to pure cultures, and so on, which can be learnt in the laboratory. Then pure science devised fungicides, and finally applied science is brought into the orchard in the form of the spray-pump and its contents. But is science content to rest at this stage? Is she not eagerly seeking to find out more about the relation of fungus and host, more about the causes of parasitism? Here comes in the plant-physiologist, who strives to find out more about the actual life-processes of the plant—whose ultimate aim, indeed, is perhaps to find out what is life itself. This latter problem seems wellnigh hopeless, but long before the problematical success is achieved science will know so much about the plant that new methods of combating disease will be in the hands of every orchardist. The Cawthron Institute of Scientific Research could easily spend all its income on investigations with regard to plant-diseases; but it would not be performing its full scientific duty if it were not carrying out plant-physiological researches with regard to the living tree as it grows in the orchard, and thus working not for the present alone, but for the future."

* Earlier in his address Dr. Cockayne had thus expressed himself on this subject: "I must say something regarding the separation of science into the two classes—'pure' and 'applied,' as they are called—the former at best merely tolerated by the public, who value a scientific discovery only if it has an evident practical bearing. This state of mind would kill all advance. If carried out for a sufficient time throughout the world, civilization would not merely remain at a standstill, but deterioration would rapidly set in. The purely scientific must come first, and the practical, without any special coddling by the State, will assuredly follow. The cure of an infectious disease is only the last link up to the present in a long chain of researches, nine-tenths of which were purely academic, but each leading slowly but surely to the final result. And this great wealth of research—apparently medical—was the work of the biologist, the chemist, and the physicist. The electric tram, the frozen lamb, the marconigram, the spraying of an apple-tree, the moving picture, the field of turnips—all these, and far more of our everyday life, are but the final—again I say for the time being—practical application of exact knowledge painfully acquired by enthusiasts such as Michael Faraday. . . . ."

Beekeepers' Field-day at Ruakura.—The annual field-day of the Waikato branch of the National Beekeepers' Association, in co-operation with the Department, was held on 12th February at the apiary of the Ruakura Farm of Instruction, under perfect weather conditions. Between two hundred and three hundred members, representative of the whole of the South Auckland district, attended, under the presidency of Mr. C. S. Hutchinson. A pleasant and profitable day was spent, the programme comprising a number of practical addresses and demonstrations on various phases of the art and industry. The Apiary branch of the Department was represented by Mr. G. V. Westbrooke and Mr. A. B. Trythall; and, as usual at this annual function, Mr. A. W. Green, Farm-manager, gave every assistance for the general success of the gathering.

Brewers' grains (maltings) in the dried state have proved to be an excellent food for fattening stock, and seem to have a special value for sheep.

NOTES ON POTATO GROWING AND HANDLING.

By J. BEVERLEY, Assistant Agriculturist.

HARVESTING AND STORAGE.

THIS being the season for harvesting and storing the potato crop, it may be well to deal firstly with that part of the subject. Degeneration in seed-potatoes is brought about more quickly by improper storage than from any other cause.

The death of the haulm is the signal for digging the main crop. For the early market potato-growers do not wait for this, but are governed by the market price and the size of the tubers. As long as any portion of the haulm is green the tubers can continue to grow, and the longer the haulm is kept green and free from blight the better the crop will be. Experiments have shown that more than one-third of the merchantable crop is made during the last month of growth. In harvesting the crop it pays to handle the tubers carefully, as any inj ry affects their keeping-qualities. It is a mistake to allow potatoes to stand in sacks for any length of time in the open field after lifting, as the edible tubers get green and unnaturally heated if the weather is hot, and when carting them to the store they get bruised. Far better is it when lifting the crop for the pickers to have baskets and empty the contents into a cart moving along with them. With a stand-cart and a go-cart the work proceeds without any loss of time.

When the load of potatoes arrives at the clamp or pit or potato-cellar it should be backed into position and tipped. The clamp or pit should never be more than 5 ft. wide at the base—perhaps the best width for the base of a potato-clamp is 4 ft. 6 in., with a height of 3 ft. 6 in. After the potatoes are tipped they should be placed into position with a sippet. This tool shovels up the tubers without damage when lying on the ground; the sides of a clamp are also formed with the sippet. As soon as the clamp is a few yards long a start should be made to cover the sides with straw. The straw should be long, strong, and clean, and placed on the sides to a thickness of at least 4 in. After the two sides are covered straw should be placed on the apex, or top, and bent over. It is best not to cover the sides all over with soil immediately, but to leave spaces here and there for the heat to escape. In a few days the sides may be covered with soil, leaving about 12 in. of straw at the top uncovered. It is not necessary to cover the top with soil unless very severe frosts are experienced during the winter.

Never put potatoes in clamps or pits on the same place in succeeding years. In this way sources of disease-infection may be avoided to a certain extent. Avoid covering potatoes with wet straw, and do not forget that the tubers should be ripe if they are to be pitted. When a potato is ripe and lifted in fine weather, clamped upon dry and well-drained soil, not in too considerable a bulk, well covered with straw, and ventilation provided, there ought to be no cause for loss to any extent.

Darkness and cool temperature are primary requisites in the successful storing of potatoes through the winter. In harvesting, as well as in storage, the tubers should be exposed to the light as little as possible. When potatoes are allowed to green they become useless for culinary purposes, and, some authorities say, poisonous. Warmth encourages sprouting, which reduces the value of potatoes both for planting and eating. For storage the temperature should be an even one of 35° F. and not more than 40° F. The freezing-point of potatoes is 30° F. In countries where low temperatures are experienced during winter, pitting potatoes above ground in the manner described is the cheapest and most satisfactory. It is not claimed, however, that this method is suitable for the warmer parts of New Zealand.

If the water-level does not rise too near the surface during winter an inexpensive potato-cellar may be made by merely excavating a trench 5 ft. or 6 ft. deep and 8 ft. wide, and as long as is needed. When the crop is harvested the cart or dray is tipped on the side of the cellar. Never pile potatoes more than 5 ft. deep. Always make a cellar in a line with the prevailing air-currents. The roof should be given a pitch just sufficient to shoot water and afford sufficient strength. A small gutter or ditch should be dug along either side to carry away water shed by the roof. Up-to-date cellars or underground pits are constructed so that air may pass through at night, and, if the weather is hot, be closed up during the day. I have heard of an instance where potatoes were stored in an old mine-tunnel and remained good for two years. A current of air passed through the tunnel and the temperature remained about 40° F.

The method of storing seed-potatoes at Moumahaki Experimental Farm is to place them on wire-netting benches under pine-trees as soon as they are lifted. (See *Journal* for July, 1916.) When potatoes are exposed in this manner all winter it is necessary to see from time to time whether the larva of the potato-moth is doing any damage. If so, it may be necessary to dip or spray the tubers with arsenate of lead, using 1 lb. to 50 gallons of water.

For storing small quantities of potatoes kerosene-tins can be used—three sides being cut at the top to form a lid. A tin holds about 28 lb. when full. Dig a trench about 3 ft. deep and 15 in. wide, so that a tin will lie lengthwise. Place the lid close up to the bank-side, so that the lid may be kept closed, and this will prevent rats doing damage. Cover the top with a sheet of galvanized-iron sheeting. This is a very convenient method of storing a few special potatoes, or where there are several varieties which have to be kept separate for seed purposes.

SELECTION AND HANDLING OF SEED.

When the potatoes are ripe enough to keep, but before they are dug, and when the haulm is still green and in good condition, is the time to select potatoes to be saved for seed. Go into the potato-field and look for strong, healthy tops, and see if the soil is being well raised up by the growing tubers. If a stake is placed at each root selected, the lifting can be done later or as soon as sufficient selected roots have been secured. There is no better way of selecting potatoes than by taking seed from perfect roots. Seed should be selected only from

roots producing first-class marketable potatoes, in the growing of which there is little waste of plant-food. The true breed characteristics of a variety can be maintained by selection.

When selecting potatoes it is as well to know something about the quantity required to plant an acre. If the rows are 28 in. apart there will be 28 rows in 22 yards, and 280 chains of rows in one acre—that is, 6,160 yards to plant. Spaced at 18 in. apart, it will require 12,320 tubers to plant 1 acre; if the tubers weigh 2 oz. each, 14 cwt. of seed is required. The same weight of seed is required if large tubers (4 oz.) are cut in half.

In my opinion it is better to plant cut tubers at once and to place the cut surface uppermost when planting. The set is not so likely to decay before rooting, and if there are sprouts they are not knocked off in the covering. According to tests recorded in the *Journal of the Royal Horticultural Society*, covering the cut surface with plaster-of-paris gave the best results as to weight of crop, sulphur being also good. Lime was found to be injurious. It was also found that the sets that were cut immediately before planting gave a better return than those which were cut some time previously. Where the seed of the variety is limited a larger yield will be obtained if the sets are cut, but the average return per plant will not be so large.

Quoting the same authority, as regards the size of seed it was found that tubers weighing between 2 oz. and 3 oz. were the most economical and reliable. It was also found that the greater the space given to the individual plant the greater the yield of that plant would be, but the greater number of plants on a given area the greater the total yield of that area would be. In my own experiments I have found that the greatest yield per acre is obtained when the sets are planted 12 in. apart. As the distance increases between the sets the total yield decreases.

If early crops are required it is good practice to sprout the tubers, being careful to get short sturdy sprouts, which are not knocked off by planting. Another advantage to be gained by sprouting potatoes is that all the tubers affected with spindle-sprout disease may be picked out, as when these are planted blanks will be found. Light and air are necessary to get short sturdy sprouts. When there is no fear of spindle-sprout disease it is better to put unsprouted potatoes in for the main crop. Potatoes will not sprout if stored at a low temperature.

The practice of greening seed-potatoes is resorted to as a rule when crops intended for seed purposes are lifted when the skins slip—that is, before they are ripe, and the skin is not set. If tubers are greened they should be on the ground, and not be turned to green on both sides. There is no harm done in greening seed-potatoes if the potato-moth is not about; that point must be considered. For my part, I think that the practice of greening sometimes receives the credit which is more properly due to the immature condition in which the sets for planting were saved in the previous summer or autumn. The maturity of the seed seems to have an important bearing on productiveness. Potatoes not quite mature frequently give the larger yield. The potatoes in Scotland practically never fully mature, being often cut down by frost in the autumn; yet Scotland is at the present time the

potato seed-bed of the world. From every European State, from North and South America, Africa, and Australasia, growers are sending for Scotch seed. Much in the same way in New Zealand do we send to the South Island when we require a change of seed in the North Island.

In my experience the benefit of a change of seed is marked. It should come from a colder climate and a distance away—not necessarily from the South Island—as seed from a high altitude or a late district makes a good change for the drier and earlier districts. When one has a good line in potatoes it should not be allowed to deteriorate. Select seed every year, and lift it for seed whilst the haulm is still green. Keep the tubers cool, as previously advised.

When catering for the early market it is not advisable to plant large seed; small tubers will produce the earlier crop. In late wet districts, or where the land does not come into a friable and nice working condition very early in the spring, it is advisable to box the seed. Sprouted seed may be planted later, and then be just as early as if it had been planted in the best condition a month before. There is thus a relief to the pressure of spring labour, and it is also a relief to the farmer's mind to know that he need not battle with sticky land.

Seed should not be boxed all winter, as the sprouts get too long—that is, for the main crop. It is better to put potatoes to sprout about two months before they are required for planting, and keep them in a cool place until then. If the sprouts get knocked off fresh ones will appear, but they are not as vigorous as the first ones. Under rough-and-ready methods of planting, and where the land is under an indolent method of tillage, it is best to put in unsprouted potatoes.

It is always advisable to test the germination of seed-potatoes. Put a small quantity in a warm dark place to sprout two months before planting-time, in order to see if they all sprout well. Look carefully for tubers with sprouts almost as thin as cotton. Such tubers are affected with spindle-sprout disease, and wherever one is planted there will be reduced profits.

ROTATIONS AND YIELDS.

Where should the potato come in a rotation? Certainly, for preference, after a leguminous crop or a pasture in which clovers have formed part of the herbage. Potatoes are not hard on the soil—that is, they do not remove large quantities of its fertility. Many farmers in certain districts of England follow potatoes with autumn-sown wheat. Quite as good crops of grain have been grown following potatoes as from summer fallow. In Jersey an early-maturing spring wheat often follows the early potato crop, and it is not uncommon to see the Jersey mangold being sown immediately the crop of potatoes is off the land. A rotation I know of as having been successful was lucerne four years, potatoes in the fifth year, and the sixth year wheat. When lucerne-seed can be bought at 1s. 6d. per pound it is not a costly crop to grow so far as seeding is concerned, and where lucerne does well potatoes also do well. The heaviest crop of potatoes ever raised at Moumahaki Experimental Farm followed lucerne. Peas and vetches are good preparatory crops for potatoes. Crimson clover sown in early autumn and ploughed or dug in during the winter is also a good preparer.

Under good cultivation, following a legume and given favourable weather conditions, it is quite possible to get 30 tons of potatoes per acre. To set about it, space the rows 26 in. apart, equivalent to thirty rows in a chain. Space the sets in the row 12 in. apart. There will then be required 19,800 sets to plant an acre. If the sets weight 2 oz. each it will take 1 ton 2 cwt. 11 lb. of seed to plant an acre. Estimating the average yield per plant to be 3·4 lb., 19,800 plants × 3·4 lb. gives 30 tons per acre. Some of my seedlings at Weraroa this year have yielded more than 3·4 lb. per foot of row.

PUWERA GUM-LAND EXPERIMENTAL AREA.

THE following note on recent operations at the Department's gum-land experimental area at Puwera, near Whangarei, North Auckland, is supplied by Mr. R. Rowan, Fields Supervisor :—

Varieties of swedes, mangolds, carrots, maize, sorghum, soya beans, field-peas, kale, and millet were sown this season on the plots. Although late in being planted, and to a certain extent kept back by a wet spring and succeeding dry period, the plants made good growth and proved an interesting test. The results so far have satisfactorily demonstrated to farmers that these lands are capable of producing both pasture and forage crops if the land be properly cultivated.

All varieties of clovers and grasses came on well. Lodino, strawberry, red, and white clovers, Wakeman's fescue and meadow-fescue, Western Wolths rye-grass, crested dogstail, prairie-grass, and several others particularly evidenced the possibilities of gum-lands and their suitability for producing feed for stock. Nine varieties of lucerne were sown, Hunter River, Patagonian, Marlborough, Arabian, and Peruvian prominently indicating their ability to thrive on these lands.

The main factors which caused the excellent growth on the plots were drainage and subsoiling, the latter being specially necessary to permit of the surface water finding its way through the underlying hardpan.

The growing of oats—Algerian and Ruakura varieties—was a success. After they were about 5 in. high the land was tine-harrowed to break the hard crust on the surface. The crop is intended for chaffing. A splendid crop of hay was taken off one acre, equal in weight and quality to that produced on much richer land.

The pasture area, which had been limed, produced a fine sole, the rye-grasses and red clover making a heavy growth, which checked the growth of sorrel.

Pig-foods.—Buttermilk free from salt is fully equal to separated milk for the feeding of pigs, and is specially valuable for the young growing pig. Comparing other feeding-values, approximately 430 lb. of skim-milk is equal to 100 lb. of grain; 744 lb. of whey is equivalent to 100 lb. of meal; 100 lb. of meal equals 500 lb. to 650 lb. of roots. The presence of soda in pig-food, unless in small quantities, is injurious.

TESTS WITH UNFRUITFUL PLUM-TREES.

THE CROSS-POLLINATION FACTOR PROMINENT.

By GORDON ESAM, Orchard Instructor, Hastings.

On some of the heavier lands in Hawke's Bay difficulty is experienced in getting greengages and a few other varieties of plums to bear fair crops of fruit. The trees grow splendidly, and usually blossom well, but the fruit falls when it is about the size of a pea. With a view of elucidating this matter, the Department was recently requested by the Hawke's Bay Fruitgrowers' Association to carry out an experiment in one of the local orchards. Mr. E. F. Sibeth, of Clive Grange, very kindly placed his orchard at the Department's disposal for this purpose.

This orchard consists of a block of 133 plum-trees, made up of 92 greengages, 36 silver-prunes, and 5 giant prunes. The greengages are planted in a block. A poplar shelter-belt borders both ends of the plum block, pear-trees are on one side, and the silver-prunes on the other. The giant prunes are next the silver-prunes and farthest away from the greengages. The trees, although lacking proper training, are exceptionally well-grown specimens, as shown in the photograph on page 164. The greengages, particularly, have never cropped, the best average yield being not more than a half-case per tree. The silver-prunes have cropped a little better than the greengages. The giant prunes are by far the most consistent bearers. The trees have not been pruned for at least two years—possibly longer. The spur-development was splendid, especially on the two-year-old wood—in fact, the trees gave the impression of being overspurred.

This season three hives of bees were brought into the orchard; these were formerly situated at a distance of about 500 yards.

The property offered very favourable opportunities for investigation, and the following tests were established on defined plots for the purpose of ascertaining whether cultural methods were to any extent responsible or whether the trouble was wholly due to faulty pollination:—

No. 1: Centre of trees opened by cutting out large limbs; no other pruning.

No. 2: Centre of trees opened up and leading limbs well spaced by taking out at least one out of three leading limbs.

No. 3: Systematic reduction of spurs over the whole tree. For example, where there were six fruit-buds at least two were cut off. To carry this out most of the tree was cut back on to the previous season's wood.

No. 4: Centres opened up and limbs spaced, and similar spur reduction to No. 3.

No. 5: Ring-barked around trunk, 1st August. Piece of bark ully ½ in. wide removed below limbs.

No. 6: Each individual limb ring-barked in a similar manner to No. 5.

No. 7: Two limbs only ring-barked similar to No. 6; the remaining limbs not treated.

No. 8: Ring-barked, 1st August; similar to No. 5, but saw-cut only.

No. 9: Ring-barked, 1st August; similar to No. 6, but saw-cut only.

No. 10: Ring-barked, 1st August; similar to No. 7, but saw-cut only.

No. 11: Ring-barked similar to No. 8, but done when sap commenced to flow, 25th September.

No. 12: Ring-barked similar to No. 9, but done when sap commenced to flow, 25th September.

No. 13: Bound wire tightly around trunk, 1st August.

No. 14: Bound wire tightly around each individual limb, 1st August.

No. 15: Dug trench around tree about 8 ft. in diameter and 18 in. deep, allowing this to stand open all summer.

No. 16: Untreated trees.

No. 17: A portion were sprayed with bordeaux, 6–4–50, on 25th September, when in cluster-bud.

About sixteen trees were sprayed in the winter with lime-sulphur, 1–15; the remainder were sprayed with oil, 1–15.

All the trees blossomed abundantly. The giant prunes were the first out, the silver-prunes next, and then the greengages. A good deal of the late bloom on the silver-prunes was out at the same time as the early greengage blossoms, but the giant prunes were about over at the time the greengages blossomed.

The following report is from notes taken on 6th November, 18th November, and 11th December.

No. 1: Crop about equal to untreated trees.

No. 2: Crop not the equal of plot 1.

Nos. 3 and 4: Crop not as good as unpruned rows alongside.

Nos. 5, 6, and 7: Crop no improvement on untreated trees alongside. The treated arms on the same tree were no better or worse than the untreated arms.

Nos. 8, 9, 10, 11, and 12: Saw-cuts, both in dormant season and at sap-movement; no improvement on untreated trees.

Nos. 13 and 14: Wiring no improvement on untreated trees.

The crop on greengages was consistently heavier with all treatments, and even more so on the untreated trees, the closer they were situated to the silver-prunes—those immediately alongside the latter carrying the heaviest crops. The variation in the crop harvested ranged in the proportion of eight cases to one. Again, the silver-prunes next the giant prunes were the heaviest, while those alongside the greengages were slightly lighter in crop. The silver-prunes were also consistently lighter the greater the distance from each of the other varieties.

CONCLUSIONS.

It is evident from the great variation in the crops of the individual trees that both greengages and silver-prunes will set much better when

cross-pollinated. The giant prune proved a slightly better pollinator for the silver-prune than the greengage. I placed some branches of Pond's Seedling in some of the trees at flowering-time, but it was apparent that these were not sufficient to determine the influence of cross-pollination.

IN MR. SIBETH'S PLUM-ORCHARD, CLIVE GRANGE.

I think it advisable that at least two more hives of bees should be taken into the orchard. It is very probable that the bees this season had a good influence. The crop is very much better than previously.

The tests will be carried on next season to note the behaviour of the trees under the various treatments. It is also proposed to further test the value of cross-pollination, and transplant in the winter some of the bearing silver-prunes to the centre of the greengage block.

SHELTER-BELTS.

REQUIREMENTS FOR THE ORCHARD.

By W. H. TAYLOR, Horticulturist.

THERE can be no doubt that in the past the planting of shelter-belts in New Zealand has mainly gone along two lines, one being the factor of quick growth, the other as to what trees could be obtained. Quickness of growth is likely to be always a chief factor. It will be a mischievous one or not according to the view taken of what constitutes quick growth (this being capable of various interpretations) and to the purpose of the belt. Regarding the latter consideration, a tree or collection of trees that would be quite adequate for farm shelter might be quite inadequate for orchard shelter. As to the first consideration, an illustration of my meaning may be given. Pine-trees are, I believe, planted in greater numbers than any other species. It is inevitable that the lower branches die, thus leaving the lower portion of the trunks bare. The pine-trees mostly planted are *P. insignis* (properly *radiata*) and *P. muricata*. The *insignis* loses its lower branches at an earlier period than does the *muricata*. The distance apart the trees are planted has its effect—the closer they are the sooner the lower branches die. The trees are usually planted rather close together, otherwise they would provide no shelter for many years. While the trees are young they make good shelter, but when the lower branches are gone the wind goes through and creates a draught, which in its immediate neighbourhood is worse than uninterrupted wind. If the purpose of the belt was to give close shelter it may have done so for a time, but the eventual condition is worse than no shelter. How, then, can it be called quick growth, when it ended in nothing or worse than nothing? Such a plantation, however, might be quite sufficient on a farm where breaking the force of gales of wind and providing some shade are the primary objects. In such case the term "quick growth" is applicable. Pine-trees will continue to be employed in shelter-belts, and rightly so, but where close shelter is required there should be an outer row of some other tree or shrub.

One of the requirements of the present time is shelter for orchards. Where the acreage is small the width of shelter-belts must not be great—the narrower the better, provided they be effective. The cost of maintenance should also be considered. If trees or hedges that need much trimming be planted they are sure to be more or less neglected, for an orchardist can seldom find time for such work; therefore such trees or hedges should not be planted.

Climate is another factor to be reckoned with. Some trees that do well in the north will not survive in the climate of the south. In the Waikato and about Tauranga the black-wattle (*Acacia decurrens*)

is doing well. The belts on the Te Kauwhata Horticultural Station appear quite effective. At Tauranga they are even better, looking more flourishing. On the Tauranga Horticultural Station there is a belt about 15 ft. wide, with trees about 4 ft. apart. The seeds were put in five years ago, and the trees average from 30 ft. to 40 ft. in height. This is surely as quick growth as can be desired. The estate of Messrs. Mayfield and Chaytor, a little way out of Tauranga, where 75 acres are planted in orchard, is divided into blocks with narrow belts of the black-wattle. The trees in all the belts look very leafy and flourishing, and are answering their purpose very well indeed. Wattle plantations are established by seeding; the trees do not transplant well. It is the habit of the wattle to lose its bottom branches, and although this state can be postponed by pruning it is advisable, if not necessary, to plant a line of some tree or shrub on the outside that will retain its lower growths. This is necessary where the wind is very strong. The wattle is not very amenable to heading back; it cannot be relied on to break out again if cut back to bare wood, but shortening of branches can be done with good effect, provided some active growth is left below the cut. It would seem wise to extend the planting of wattles in northern districts. The cost of upkeep is trifling once the trees are established; lopping off branches where it is thought necessary is easily done, and all the wood is useful, even quite small branches making excellent firewood. Silver-wattle (*Acacia dealbata*) must not be planted, because it suckers badly; nor blackwood (*A. melanoxylon*), this being too slow in growth, though eventually making a good dense tree.

Where a high or moderately high shelter is required, and it is desired to keep it to narrow limits, the Lombardy poplar is, I believe, the best tree to plant. The trees require topping occasionally, but it is not an expensive operation, the wood being soft and easily cut. The objection may be raised that the wood is useless; but, while it is certainly less valuable than most wood, it makes firewood that many people are glad to use. In Hawke's Bay, where the tree is extensively grown, the wood is so used. It is also often used as fence-droppers. These last at least a few years, and they are easily split out of the green timber. A number of orchards in Hawke's Bay have a single line of poplars as shelter; in some instances the trees stand 2 ft. apart, in others at a greater distance; usually cuttings are planted. Some of these belts have a hedge of common barberry on the boundary side. A single line of Lombardy poplar makes a cheap and effective divisional shelter inside an orchard where the extent of the latter, or the climate, makes it necessary to supplement the belt on the boundary. So far as I have seen and heard, this poplar does not sucker to any extent, the suckers being restricted to roots near the surface, which will not exist in a well-kept orchard.

I consider that a combination of Lombardy poplar and *Elaeagnus japonica* will make the very best shelter-belt of the narrow order it is possible to obtain. Some years ago a combination belt of this kind was planted on one of the Department's farms. The poplar cuttings were planted in two rows 5 ft. apart, and about 3 ft. apart in the rows. The elaeagnus plants were put in 30 in. apart along the centre between the rows of poplars. Unfortunately there came a change in authority, and the elaeagnus was ordered to quit. In the meantime a mat of Poa pratensis had formed, which made the digging-out of the elaeagnus a fairly

heavy task. The plants were therefore removed with an adze, cutting the stems as low as possible. After this treatment, and notwithstanding the couch-grass, many of the plants made new growth, and they are to-day climbing many feet high in the poplars, the two forming at these places a fine shelter-belt. Had the plants been left as put in, the result would have been a barrier able to defy man or beast, and a first-class wind-break. In such position very little trimming would be required at any time, and the character of the growth would absorb the wind rather than drive it over the top, as often occurs with closely trimmed hedges and even with trees of a dense habit of growth. As indicated, I am of opinion that this combination is the best possible where the wind is very strong, and where an effective barrier is required to keep out intruders, either two-footed or four-footed.

A belt of this kind, however, would not suit the taste of every one, and that perhaps is fortunate, as from an æsthetic point of view some diversity in form of tree-growth is desirable, otherwise the landscape would have a monotous appearance. When planting is being planned the habits of the trees should be considered in relation to the space they are to cover, their capabilities for providing shelter, and the demand they would in future years make on labour to keep them within proper limits. In all cases the less trimming that is required the better, not alone as saving labour but also because the more a tree can be allowed to keep its natural habit the more beautiful it is. For this reason large trees, such as *Pinus insignis* and *Cupressus macrocarpa*, should not find a place in narrow belts. If they are allowed to grow unchecked they smother everything else, or occupy too much space, and if they are checked much labour is involved. Almost any other pine is better, with the exception, possibly, of a very few, such as *Pinus sabiana* and *Pinus Lambertiana*, which, being loosely clad with foliage, would not give good shelter. *Pinus muricata* is, I think deservedly, most valued for shelter-planting. It is a dense tree, eventually round-headed, and not inclined to be overpowering. It is also hardy in most parts, and is perhaps the best pine for planting near the sea-coast.

In inland positions there are many suitable trees the inclusion of which would add interest and beauty to a belt, and this might well be considered and acted on when the same result as to shelter, the primary object, can be secured. The redwood of California (*Sequoia sempervirens*) should also find a place. This tree is not wide-spreading, and retains its lower branches, as is usual with trees of pyramidal habit. *Cupressus torolosa*, *Cupressus Knightii* (with glaucous foliage), and *Cupressus Goveniana* are admissible. *Acacia decurrens* var. *mollissima* dotted here and there would add colour and brightness. A few deciduous trees of quick growth, particularly sycamore and planes, might be included. When there is a desire to keep out wind or to secure privacy, an outer row of a special character should be planted. What this is to be may be a matter of individual taste. Lawson's cypress—*Chamaecyparis* (*Cupressus*) *Lawsoniana*—stands out beyond all other trees for this purpose, being the hardiest evergreen tree we have, quite indifferent to wind, dense in habit, always clothed with branches right to the ground, and fairly fast in growth after the first few years. This tree does well planted at any reasonable distance apart—from as close as 12 in. for a pure hedge. For the shelter-belt purpose now under consideration

the plants would soon close up if put in 4 ft. apart; while if the distance was increased to 6 ft. or 8 ft. they would take longer to close up, but would do so eventually and make stronger trees than those planted closer. *Retinospora plumosa* bears wind well and thrives in dry soil; it also grows fairly fast, but hardly so fast as Lawson's cypress. *Retinospora leptoclada* is also hardy, bears drought well, and is rather more rapid in growth than *Retinospora plumosa*. The cypress formerly known as *Torolosa elegans*, now as *Cupressus elegans*, is a tree that furnishes well and never requires clipping. These trees are well adapted for dotting in a line of *Lawsoniana* to break the monotony.

Should the belt be intended for orchard-shelter an inner row of a hedge-like tree is not necessary if the outer line of trees has been well chosen, and, as the shade of the trees makes a good packing-place in dry weather, there should be free access to it. For ornamental purposes a hedge inside may be advisable, or it may be planted up with various small-growing trees and shrubs. Reverting to the outer line, it may be decided to plant something in the nature of a hedge. If this is done the nature of the plant used in relation to labour in trimming should be considered as previously discussed, and this is a matter the owner should decide. The African boxthorn (*Lycium horridum*) has a habit of growth that renders clipping unnecessary if height is not objected to, and might be planted instead of Lawson's cypress. It makes an impassable barrier and good wind-break, reaching a height of nearly 20 ft. The plants should be cut down to about 6 in. from the ground a year after planting; they then shoot up straight and need not be cut again. Elaeagnus would not answer so well in such a position, though it is dense-growing and hardy, as it requires a lot of trimming and is not a good thing to cut.

In the growing of shelter-belts practice shows that planting almost any reasonable distance apart answers, with the exception that if very fast-growing trees are planted near others of slower growth the slower subjects will be overgrown. For this reason wattles should not be planted close to pines, as the pines would be smothered. If pines are expected to preserve their natural form they need to be 20 ft. or more apart. I do not think that desirable for the shelter of small properties, but would prefer to have two rows rather than one row, the two only to occupy the space that one row could fill. As previously mentioned, the lower shelter should be provided for by an outside line of suitable character. The chief thing to consider, therefore, is the higher shelter. Pine-trees are for a number of years pyramidal in habit; some of them change later to round-headed trees, but in the first instance they are all alike. It is thus evident that for many years wind will have a free course between the heads of a single line. This is why it is preferable to plant two or more rows, as if planted in quincunx order the trees would make a perfect breakwind in a much shorter time than would a single row, the heads of one row closing the intervals in the other row or rows. It is known that pines do well planted as close as 30 in. apart. They quickly lose all but the top branches, but the tops remain in good condition an unknown number of years. In general, however, from 6 ft. to 8 ft. are good distances to plant. I would prefer three rows 6 ft. apart to two rows 8 ft. or more apart. Such a belt would provide good orchard-shelter; it would be best to plant it entirely with pines.

FORAGE CROPS.

By W. DIBBLE, Assistant Agriculturist.

SUMMER FORAGES.

AN old worn-out pasture that requires renewing may with advantage be devoted to the production of a course of summer forage crops. For this purpose the land should be ploughed in the late autumn, and permitted to lie exposed to the rain and atmosphere during the winter months. In the spring cross-plough and subsoil as deeply as the land will allow, and later, when the time for sowing is near, work down with disk and harrows until the seed-bed is made as fine and friable as possible. The extent to which the roller can be used at that period of the year can only be decided at the time and on the spot. The simplest way to determine whether it is advisable to roll cloddy ground is to kick some of the clods. If the clods fall apart the roller may be used, but if they are difficult to break and the ground is at all moist the roller should not be employed. Rolling is not satisfactory if the clods are merely forced into the soil without being broken up, for this only results in a hard crust being formed on the surface. Depth of cultivation, thorough preparation of the land, and a fine mellow seed-bed are all important.

If after a few days there appears to be a superfluity of water in the soil it is an indication that the land requires draining. Waterlogged land when it does dry loses nearly the whole of its moisture by evaporation. On the other hand, the small particles in a friable soil check capillary action, and thereby prevent undue evaporation, the soil remaining moist long after sodden parts of the field have become as hard as a brick. If drainage is required it should be done, as it pays, and pays handsomely. Drainage has an intimate relation to soil-moisture. By drainage is meant the means employed for the removal of the surplus free water. Surface or open ditches may serve to carry off surface water, but as soil-drainers they function imperfectly. The correct method for removing the surplus water of rainfall is to cause it to sink into the soil and be removed by under-drains.

The following course of summer forages will be found of valuable assistance to farmers, and especially dairymen who desire to keep up a good steady supply of milk during the season :—

For a dairy herd of from sixty to seventy in number sow 5 acres of oats and grey spring tares about the second week of October, at the rate of 2 bushels of oats and 1 bushel tares to the acre. These should be ready for feeding in January, and if not required can be utilized for hay or ensilage. In the first week of November sow 4 acres with soft turnips—purple-top Mammoth, Imperial Green Globe, or Lincolnshire Red. These should serve for February and March feeding.

In addition to the foregoing, sow between the third week of November and the second week of December from 5 to 8 acres of any of the forages

on the list which follows. These crops, which are all worthy of a trial subject to district conditions, will come in for April and May feeding (the Sudan grass and tares also for March), and any surplus that may not be required can be made into ensilage. The seeding specified is per acre.

Sudan grass, 30 lb., and grey spring tares, 60 lb., in 7 in. drills.
Brown barley, 76 lb., and grey spring tares, 60 lb., in 7 in. drills.
Japanese millet, 15 lb., in 7 in. drills.
Sorghum Early Amber Cane, 25 lb., in 28 in. drills.
Maize Red Hogan, 90 lb., with grey spring tares, 75 lb., in 14 in. drills.
Maize Ninety-day or Hickory King, 90 lb., in 28 in. drills.
Maize Clarence Wonder or Yellow Dent, 120 lb., in 28 in. drills.
Sorghum Saccharatum, 25 lb., in 28 in. drills.
Sorghum Imphee, 25 lb., in 28 in. drills.

Manure consisting of super, 2 cwt., and bone-meal, 1 cwt., per acre can be mixed with the seed and sown through the drill, or sown separately. With those crops that are drilled at 28 in. apart it will be beneficial to the plants and assist in keeping weeds in check if in the early stages of growth the soil is kept well stirred by the cultivator between the drills.

The varieties of maize mentioned, having plenty of flag, will yield from 25 tons to 45 tons of green forage per acre. The time to use maize is when the cobs are well formed and are becoming glazed. It is necessary that the drills should not be less than 28 in. apart, so as to admit the necessary sunshine to properly develop the crop.

From experience I can fully recommend the varieties of sorghum mentioned—Early Amber Cane, Imphee, and Saccharatum. Sorghum should be sown at a depth of 1½ in. to 2 in. It is necessary to give one stroke with the tine harrows after drilling, and if the land is very dry and of rough surface it should be rolled. After the crop is 4 in. high, and if the weather is favourable, draw the tine harrows across the drills once weekly until the crop gets too high for this to be done. The time to harvest is when the crop is in full bloom; the average yield is from 20 tons to 30 tons per acre.

Of the millets, I have found Japanese, White French, and Pearl to be the best. Sow 15 lb. of seed to the acre, mixed with manure, through the ordinary seed-drill, in drills 7 in. apart. The land should be harrowed across the drills and the crop treated in the same way as sorghum. Harvest when the crop is in full bloom. Do not delay, as the seed soon forms and the crop ripens quickly. Millet can generally be cut with an ordinary reaper-and-binder. The average crop yields from 15 tons to 20 tons per acre.

Maize, sorghum, and millet are all susceptible to frost. If a frost should come out of season and turn the crops white in the leaf put the binder in at once and make it into ensilage.

WINTER FORAGES.

For winter forage crops the land may be ploughed during December, and a thorough cultivation should be given during February and March

with the disk, cultivator, harrows, and roller. The land should be worked until in fine tilth and really good order for sowing the seed. Under ordinary conditions this will be about the first week in April, or as soon as there is sufficient moisture in the land to ensure a good germination. Many farmers will now have a paddock ready worked up in the manner indicated.

Among winter forages that have been proved suitable for average conditions, and that are practically free from disease, are the following, the combinations and seedings per acre given being recommended :—

Huguenot wheat, 90 lb., and Scotch tares, 60 lb.
Purple-straw Tuscan wheat, 90 lb., and Scotch tares, 60 lb.
Emerald rye, 55 lb., and Huguenot wheat, 58 lb.
Emerald rye, 87 lb., and Scotch tares, 60 lb.
Algerian oats, 45 lb., and Emerald rye, 55 lb.
Algerian oats, 45 lb., and Brown barley, 40 lb.
Algerian oats, 45 lb., and Huguenot wheat, 58 lb.
Algerian oats, 55 lb., and Scotch tares, 60 lb.

For manure use from 2 cwt. to 3 cwt. of superphosphate or basic superphosphate per acre.

These forages can be grazed, or they may remain to be cut and carted out to the stock as required. Any balance of the crops not required for feeding during the winter months can be utilized for ensilage, chaff, or hay, and will be found equally valuable for feeding to stock during the month of January following, or at any other time when required.

LUCERNE.

The writer would like to see a lucerne-field established on every suitable farm to the extent of a tenth of its area, for grazing, making hay, or, when the weather is unfavourable for haymaking, for ensilage. Lucerne in either form fed to stock with an abundant supply of mangolds will enable the farmer to tide over many difficulties. This practice should appeal to the small farmer especially. Trussed lucerne hay generally realizes from £7 to £10 a ton in the open market.

Investigation of Fruit Industry in America.—Following a decision of the Department to send an officer of the Horticulture Division to investigate the fruit industry in the United States and Canada, Mr. J. A. Campbell, Assistant Director of the Division, is leaving for Vancouver this month. Mr. Campbell will make full observations and inquiries in connection with fruit growing, storage, marketing (particularly co-operative systems), control of pests and diseases, and other related matters of general interest. He will be in America during the whole of this year's northern growing and harvesting seasons. During Mr. Campbell's absence Mr. Gordan Esam, Orchard Instructor, Hastings, will hold the position of Acting Assistant Director at the Division's headquarters, in Wellington.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE stone-fruit crop is about finished, and the seasonal spraying programme for the control of insect pests and diseases of apples and pears almost completed. With the exception of an isolated spray here and there, the orchardist will now be able to devote most of his time and energies to picking, grading, and handling his main crop of apples and pears. Too much care and attention cannot be given to this important branch of the orchardist's business, as upon it the successful financial position of the year's undertaking largely depends.

A large proportion of the main crop of apples and pears is cool-stored, and in order to get the best results from storage the fruit must be delivered to the store in the best possible condition. When picking, the trees should be gone over several times and only the best-coloured and more matured fruits selected. When severing the fruit from the tree take care to leave the stem attached to the fruit, as slow decay will often develop when the stem is pulled out. Handle the fruits carefully, and avoid every operation that tends to bruising. Sun is beneficial to fruit while it is on the tree, but harmful once the fruit is picked; therefore do not allow the fruit to stand about in the orchard on hot days, but get it away to the packing-shed as early as possible.

Again, there should be no delay in the packing-shed. The fruit should be sorted, graded, and placed in the cool store the earliest possible moment after it is picked. Delay in the orchard after the fruit is picked, and also in the packing-shed, places the fruit at a disadvantage, and is often the cause of it not keeping perfectly in cool store. It pays better to store only the medium-sized fruits, as they not only realize better prices than the larger fruits but also keep better and longer in store.

To sum up: Supply the cool-storage companies with the best-matured fruit, handled carefully, packed well, and despatched expeditiously after picking. Always remember that successful cool storage depends very largely on the state and condition in which the fruit is received and placed in store.

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

AUCKLAND.

By the end of April the fruit season will be about ended, and orchardists will be engaged in getting their later varieties of apples and pears into the cool stores, after which time may be profitably occupied in a general clearing-up.

It is usual during April for fresh colonies of woolly aphis to appear on the young growth in apple-trees. This attack almost invariably being the heaviest of the season, growers are advised to lose no time in getting on a spray of nicotine sulphate, in the proportion of 1 to 800.

Growers of stone-fruit will do well to make a thorough inspection of all trees in the orchard, also the ground immediately under the trees, and collect all

mummified fruits, which are a source of infection from brown-rot. These fruits should be destroyed either by burning or burying.

Citrus trees attacked by thrip or by scale insects, if not already sprayed, should be now attended to, applying red-oil emulsion, 1 to 40, provided young autumn growth has hardened. This should follow the bordeaux spray, 4–4–40.

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

HAWKE'S BAY.

Codlin-moth is likely to be troublesome right through March, and even in the early part of April. Not only is spraying for codlin-moth advisable, but arsenate of lead should not be omitted on the later varieties of fruits for leaf-roller caterpillar. A final spray in the early part of the month for leaf-roller is usually sufficient. A late infection of black-spot on Dougherty, Rome Beauty, and Stone Pippin can be anticipated. These varieties should be sprayed with bordeaux, 3–4–50, on the first appearance of live fungus. A final spraying for woolly aphis is advisable. Use Blackleaf 40, 1 part to 800 parts of water, and combine it with lime-sulphur, 1–100 to 1–120. The combined spray is more effective against woolly aphis than when Blackleaf is used alone.

—T. Pitt, Acting Orchard Instructor, Hastings.

NELSON.

Spraying: In localities where leaf-roller is troublesome a further application of arsenate of lead may still be applied to pip-fruits with advantage. Stone-fruit trees that have been troublesome during summer with fungus parasites should receive attention. Carefully gather and destroy all infected fruit, and apply a bordeaux, 3–4–40, spray. Raspberry, black-currant, and gooseberry plants should receive the same attention unless it has already been given recently.

Gathering the crop: This will be the chief work for the month in most orchards. In this connection the picking of the fruit may well receive more attention. Assistants engaged to pick the crop should be carefully instructed and supervised until they have shown themselves capable. Remind them that most varieties should be gathered without severing the stem from the fruit, and immature fruits should be allowed to remain on the tree to finish their growth.

Grading: Much of the cull grading may be done by the pickers but apples and pears should be graded for size before they are packed. One way of doing this in a small shed where a machine is not available is to grade off the "out" sizes—the very small and very large—when a capable packer will often pack the remainder, sizing them by sight.

Packing: Size-grading is the basis of a good pack. When the grading is properly done there is no trouble about getting a firm even pack of the right height. Such a pack travels well, keeps well, and as a result sells well. For cool storage pack only moderate-sized fruit that is clean, sound, and mature; other sorts are not worth the extra expense.

Weeds: Orchard operations at this season are often made difficult by a strong growth of tall weeds, which are sometimes wet. Should there be any extent of such growths it will pay to run a mower through, and then leave the plants where they lie. If this is done early, before they seed, many troublesome weeds will be checked.

—William C. Hyde, Orchard Instructor, Nelson.

OTAGO.

Powdery mildew has spread very rapidly in consequence of the very wet weather during January, followed by a dry spell; but during a trip through Central Otago I have failed to find any evidence of black-spot on fruit or foliage. A final application of lime-sulphur, 1–120, or atomic sulphur, 1–10, in bad cases of powdery mildew is still advisable. The former is safe in cool weather, but if hot, dry weather continues take no risks with a good crop of fruit and use the atomic sulphur. I found one instance of lime-sulphur injury caused through combination with arsenate of lead.

Keep an eye open for red spider, especially on Delicious, Sturmer, and London Pippin. If allowed to persist, depreciation of the crop can be expected. The previous directions regarding mildew will control this pest. Woolly aphis is reported by growers to be worse than usual. This trouble certainly is fairly prevalent in some orchards, and it will pay to spray with Blackleaf 40 at a

strength of 1–800. Summer prune the insides of the trees to allow of more effective spraying. Spray thoroughly while at the job.

Codlin-moth infection will be over before this is in print. Fresh strikes are scarce now, but there are a good many grubby apples in some commercial orchards. Careful growers will clear these up and destroy them, and all should do so to save the danger of infection next season. Brown-rot has not so far been reported in any of the orchards.

Growers would find it to their interest to wipe apples before packing, as they would look more attractive and realize better prices free of dust and recent spray-stains. When picking later varieties intended for late storage grade the fruit, and market the large ones first. They do not keep so well, and each one lost represents a greater weight in comparison to the smaller grades. Paper-line the cases for storing; it keeps fruit clean and minimizes the shrivelling.

Some orchards would be the better for a green crop to turn in for manure. A mixture of oats and peas or vetches is recommended. It will not only assist growth but help to keep the soil from getting hard after rains or irrigation.

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

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

THE MOULTING BIRDS.

At this time of the year most of the adult females of the flock will be on the point of going through their moulting process. Far too many poultry-keepers fail to realize the importance of feeding the moulting bird to the best advantage, merely because she is not laying. This short-sighted policy is much to be deprecated; it is not only cruel but decidedly unprofitable. It should be remembered that during moulting-time the bird's system is taxed to the utmost in producing her new crop of feathers, which must necessarily come from the food she eats. Especially is this the case with the high-type layer that has just finished an exhaustive laying-period. If her next season's laying is to be profitable it is therefore imperative that she be given ample food in order to recoup her strength and resume laying in the shortest space of time. Undoubtedly the length of the next laying-period depends on the attention the birds receive now. As to the feeding of moulting stock, there is nothing better than their usual diet, making sure, however, that ample green food is provided. Maize may be added to the grain ration, and the morning mash should be made as appetizing as possible by mixing it with boiling water or milk, while a pinch of sulphur, given once a week in the mash (say, an ounce for every twelve birds), is always helpful during the moulting-period.

THE PULLETS AND WINTER EGGS.

The fact of possessing pullets is not in itself an assurance that winter eggs in good numbers will be secured; there are other requirements necessary to attain this end. In the first place, the birds must be hatched out at the right time—say, August or September for the heavy breeds, and September or early in October for the lighter breeds. As a rule, the very early-hatched pullet lays a few eggs in the late summer and early autumn, and then moults like the adult fowls during the dear-egg

season. On the other hand, the late-hatched chicken can scarcely ever be depended on to lay before the late winter or early spring, except, of course, when it has been specially cared for and is the descendant of an early-maturing strain. The object must be to have the pullet commencing to lay in April and go right through her first laying season without moulting.

To secure a good winter egg-yield not only must the pullet be brought out at the right season of the year, but in addition it must be properly fed and managed from the time it leaves the shell and throughout all stages of its development. Special care is necessary with the pullet just before or after it has commenced to lay. The treatment must be uniform in every respect or disappointment will be met with at a time when dear eggs are expected. The pullet should be placed in its winter quarters well before the laying-period commences, in order that it may get over the fretting stage and feel at home before being called upon to lay. A change of food or quarters will usually upset any laying flock, but this applies in double force where the young pullet is concerned, having the effect of putting the bird into a premature moult at a time when eggs are most desired. Not only does the maintenance of the one diet often prevent a false moult, but it encourages a bird to attain its maximum production. That laying-birds require frequent changes of diet is one of the theories which sadly fail when put into practice. The truth of this is borne out by results obtained at egg-laying competitions, when the one class of food was used from start to finish.

Of course, practically any old hen, even when subjected to indifferent treatment, will lay in the spring and summer months, the natural breeding season for bird-life. In the case of the pullet, however, although she may be bred to lay in winter she will not produce her artificial product unless everything is in her favour. In short, the birds should be provided with conditions resembling as far as possible those that prevail in spring and summer time. The house must be roomy, with an open or partly open front in order to secure the admittance of fresh air and sunlight to all parts of its interior. Care must be taken that there are no cracks in the back or side walls to let in a cold draught—a most common cause of colds, the forerunner of roup. The floor of the house should be at least a few inches above ground-level, in order to keep it dry, as a wet cold floor does not tend to promote winter laying. Have the floor well covered with scratching-material, such as straw, &c., in which the whole-grain food should be scattered. This will induce the birds to exercise and keep busy, an essential for the maintenance of good health and vigour.

Referring again to the importance of not subjecting the pullet to any sudden change when entering her productive season, it may be mentioned that even suddenly changing the class of litter used will sometimes have an undesirable effect on the egg-yield. I have seen flocks of pullets go right off laying from no other cause. Any contemplated change in this respect should be introduced by degrees. Another important point in handling the pullets is to have the birds so tame that the attendant can go among them without frightening them. In this connection more eggs will be gathered if the care of the birds is left to one person. Keep the quarters sweet and clean—the secret of preventing vermin from making their appearance.

It goes without saying that for a pullet to do its best in winter it must be fed to the very best advantage. Only the best grain foods available should be provided, while the ration should include meat or meat-meal, preferably fed by itself. Where such forcing-foods are oversupplied in a mash, it will have the inevitable result of bringing on ovarian troubles, protrusion of the oviduct being a common phase. As is the case with all classes of poultry, green food should be provided in abundance, while grit, crushed oyster-shell, and clean water should be always in reach of the birds.

It will thus be seen that the management of the pullet with a view of securing winter eggs is a delicate matter, and that the poultry-keeper who gets them well deserves his reward.

TUBERCULOSIS.

This is becoming a common disease in poultry, and at no time is it more prevalent than just before or after the moulting-period. The disease affects old birds, though young stock are not immune, and is caused by a micro-organism known as tubercle bacillus. The chief source of the infection is through the digestive tract. The droppings of an affected bird contain enormous numbers of the deadly germs, and it will therefore be readily understood that the feed, &c., may become contaminated, and the disease spread at an alarming rate. Usually tuberculosis attacks flocks where the surrounding conditions are insanitary and the birds do not possess a vigorous constitution. The disease is very contagious, and if it once gets a good foothold there is no telling when it will be stamped out.

Tuberculosis is undoubtedly the worst disease the poultryman has to fear, chiefly because in its early stages there are no definite signs by which it can be detected. As the disease develops, many symptoms manifest themselves, which are apparent only to the experienced. A gradual loss of weight and an apparent shrinkage of the body is perhaps the first and plainest sign of the disease. Then the breast-bone stands out sharply, and the neck is devoid of flesh. Later the comb becomes dark, and the bird gets dull and listless and is not inclined to mix with other members of the flock. Sometimes at this stage diarrhœa accompanies the disease, and there is lameness in one leg. From this on the disease rapidly develops, the bird becomes more and more emaciated, and finally dies. When a diseased bird is opened up the liver is found to be greatly enlarged, and spotted with tubercle nodules. Sometimes the terms "spotted liver" and "going light" have been used to designate the conditions of a bird whose liver presents this appearance. It is, however, tuberculosis and nothing else.

For this disease there is absolutely no cure. The only way to fight it is to prevent it, and the first thing to do in this connection is to breed birds with the necessary constitution to resist the infection. Any bird showing symptoms similar to those described should be killed and burnt without delay. It often happens that the heaviest layers in the flock are the first to contract the disease, but no sentiment should be allowed to enter into the matter. Drastic methods of suppression are most necessary. The houses where the affected birds have been kept should be thoroughly cleaned and all sources of infection removed. This should be followed by a good spraying of strong sheep-dip or similar preparation.

Until the disease is thoroughly stamped out all the droppings should be carefully gathered up and burned, or deeply buried with lime. Where possible, the quarters where infected birds are found should be given a rest, and the runs turned up, heavily limed, and sown down. It cannot be too strongly emphasized that prevention is the only way of combating this disease. It is therefore imperative that the environment should be as sanitary as possible, and the birds strengthened and invigorated by good feeding and sensible management generally.

THE APIARY.

By G. V. WESTBROOKE, Apiary Instructor.

By the time these notes are published extracting will be over in most districts. All utensils used in the work should be thoroughly cleaned and dried. Parts liable to rust may be given a light coating of oil or vaseline, and then covered over to be kept free of dust.

WINTER STORES.

The question of leaving sufficient stores for the winter and early spring months will now occupy the attention of the apiarist. In examining hives in the autumn care must be taken to prevent the starting of robbing. It is therefore necessary to carry out the manipulation of the hives as expeditiously as possible. In estimating the amount required to successfully winter the bees locality may be taken into consideration. In districts where there is an abundance of early spring flora, such as willow, &c., less stores are required. It is generally recognized that it takes from 30 lb. to 40 lb. of honey to carry a colony through in good condition until the following spring. A Langstroth frame of honey will usually average about 8 lb. in weight. Five full frames or the equivalent in partly filled frames should therefore be sufficient.

The high prices being obtained for honey will probably tempt bee-keepers to extract very closely. In such cases autumn feeding will have to be resorted to. Where such feeding is necessary only thick sugar syrup or candy should be given. The syrup should be made up of two or three parts of best cane-sugar to one part of water. This may be made up in quantities if it is brought to the boil. Candy is perhaps safer to feed than syrup when the honey-flow is over, as it is less liable to set up the excitement of robbing. Where gable roofs are used a slab of candy may be placed over the mat, making a small hole in the mat to allow the bees to gain access to it. Always feed inside the hive, and towards evening, so as to discourage robbing.

PREVENTION OF ROBBING.

It is much easier to prevent robbing than to check it when once started. Every care should therefore be taken to leave no pieces of honey about, nor to spill any syrup in the apiary, as nothing will set

up robbing quicker. When the honey-flow is over, hive-entrances should be contracted to the requirements of each colony. A strong colony may have a fairly wide entrance, but weak ones should be given only sufficient to allow a few bees to get in at a time. If robbing is prevalent the entrance should be closed down to one bee-way space. Care should be taken to see that there are no crevices or badly fitting lids by which robber-bees could gain admission. A mild case of robbing may often be stopped by placing wet green grass at the entrance.

A little carbolic and water sprinkled in front of the hive will usually discourage robbers. In bad cases it is sometimes necessary to close up the hive for the day, opening it up after sunset to allow admittance to the bees belonging to that hive.

In cases of robbing in an out-apiary, or where it is not possible to return for a day or two, a good method is to contract the entrance of the hive in trouble, and block it up with a tight wad of green grass. This can be safely left, as it will wither in about a day, allowing the bees once more free exit and ingress. By this time the excitement will have died down.

FOUL-BROOD.

The final examination for foul-brood should take place before the honey-flow is quite over. Colonies worth saving may be treated, provided care is taken to allow no robbing. For autumn treatment all infected material should be taken away, the hive closed for three days while on starters, and then frames of honey given from a clean hive. Note the hive, and watch carefully in the spring for any symptoms of disease.

Perhaps the greatest source of infection is caused by the tins thrown out by consumers of honey. Some method should be adopted to educate the general public as to the great danger to the beekeeping industry caused by failing to clean out honey-tins before discarding them. The best of honey may contain germs of foul-brood, which, although harmless to human beings, are a source of great danger to the bees. The latter will readily find out and carry home any honey left about, thus perhaps spreading disease far and wide. In this connection it would be advisable for beekeepers in clean areas to insist on local storekeepers being supplied with local honey only, or such as is known to come from a clean apiary.

CLEANING UP WET COMBS.

The Deadman super-cleaner is strongly recommended to all beekeepers who use an extractor. This device was fully described in the *Journal* for April and July, 1918. It is specially useful in apiaries where there is the slightest trace of foul-brood. By its use all the wet combs from the extractor can be cleaned up by one colony, thus minimizing the danger of spreading the disease. The combs when thoroughly cleaned up may be removed and stored in the comb-room for the winter. A few carbon balls placed among the combs will assist in preventing the intrusion of the wax-moth. If the combs are stored in supers, place a queen-excluder on the top and bottom of the pile to prevent the entrance of mice.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

DURING the last half of March in cold districts, and the first week in April in warm districts, cabbage, cauliflower, onions, and lettuce should be sown for spring supply.

In most places it will be sufficient to sow cauliflowers at the time stated to secure a supply from the end of October to the early part of January, an early and a late kind being sown. Experimental work carried out at the Arataki Horticultural Station, Havelock North, has shown that this sowing will not suffice in that locality, as they head in a shorter time than in colder places. Cauliflowers are represented by two distinct types. One type makes comparatively small heads that come quickly, the best known varieties being Early London, Early Paris, and Early Snowball. The other section comprises the large-headed varieties, of which Veitch's Autumn Giant and Early Erfurt are types, the term "early" being rather a misnomer in this case. The Arataki trials resulted as follows: Snowball, sown 1st April, planted 6th June, came into cut 24th September, last used 31st October; Early Erfurt, sown 1st April, planted 6th June, first cut 21st October, last cut 23rd November; Veitch's Autumn Giant gave practically the same results. Sowings were again made on 1st May. The trials with Snowball were a failure, the seeds supplied proving to be a broccoli. Early Erfurt came into cut on 30th November, and Veitch's Autumn Giant eleven days later.

These trials show that the warmer districts are able to produce cauliflowers earlier than is possible in other parts, and also that a sowing on 1st May is necessary if it is desired to carry on a supply into the New Year. This information should be valuable to both market-gardeners and growers for home use, as carrying out the practice will to a large extent do away with the necessity for growing broccoli. The latter occupies the ground for a much longer time, it being necessary to plant the mid-season varieties in January to get heads in September and October; whereas the same result can be obtained by planting cauliflowers in June, a very great saving of ground-space in favour of the warmer districts. It may, however, be as well to warn growers that the mere geographical position of a locality is not sufficient warrant for classing it as a warm place. There are many places in the North where the climate approximates so closely to South Island conditions as to render it necessary to observe the same routine of cultivation.

Trial sowings of turnips at Arataki show that the warm climate is a disadvantage with this vegetable. The Snowball variety sown on 1st March gave the first pulling on 23rd June, three months from sowing. Sown on 1st April the first were used on 11th August, four months from sowing. Sown on 1st May very few were obtained for use, and all bolted to flower the first week in September. It is evident that it is not serviceable to sow after the second week in March, and that better results are obtained in colder districts. However, if there is an actual shortage of turnips it may be well to sow up to the

end of March. Later than that appears to be labour lost, and the ground might be better occupied.

Spinach succeeds admirably in the warm districts if sown the last week in March. For sowing at this date spinach is easily the most valuable of all garden crops, giving a liberal amount of produce for from five to six months if desired. Either basic slag, superphosphate, or bonedust, are suitable fertilizers, giving 2 oz. per square yard. The soil should be fairly well supplied with lime applied a few weeks before sowing. Fowl-droppings kept out of the rain, gathered fresh, and stored till a dry powder are an excellent manure. Give 1 lb. to 2 lb. per square yard according to the conditions of the soil. Sow the spinach in rows at least 12 in. apart, and thin to single plants, leaving them a minimum of 8 in. apart. After thinning, if growth lags at all, give a dressing of nitrate of soda, ½ oz. per square yard, repeating the dressing four or five weeks later. In the same warm localities Short Horn carrot sown at the same time gives good returns, but it is necessary to sow at least a month earlier in colder places.

Lettuce should be sown not later than the first week in April in order to provide the spring crop in all but the warmer places. In the latter a month later will answer.

Onions: The giant kinds must be sown in autumn or they will not develop properly. It is bad practice to sow where they are to grow, as under this treatment many of them bolt to flower. They should be transplanted. Keeping-kinds of the smaller varieties are in some places sown with advantage in autumn. This is the case in districts where onion-mildew is very troublesome. Autumn-sown onions of the small kinds will be coming toward maturity when mildew appears, and in consequence are not much injured. Even these are best transplanted, though it is not always done, and they certainly do better without transplanting than do the large kinds. In private gardens it is wise to sow a line or two of a large kind, even if it is not intended to grow large specimens, as they come in very useful for pulling in a green state in spring-time, and for many purposes answer as well in cooking as ripe bulbs, thus effecting economy with these. There are great advantages gained by transplanting onions in spring. Growth is very slow during the winter months, and the soil is likely to get sodden and sour; also weeds are sure to grow, and are likely to demand a lot of labour; whereas if transplanting is practised final preparation of the soil is left till spring, when, the ground being vacant, it is easily and effectually done. The labour of transplanting is trifling compared with that of keeping the soil clean between seed-rows in winter, and, above all, the spring preparation leaves the soil sweet, in good tilth, and free of weeds, summer cultivation being easily done. Another point that should be considered is that bulbs of keeping-varieties that were autumn-sown rarely keep long. They are useful for early marketing, but are rarely fit to hold for a rise; moreover, the bulbs usually average rather too large for the market. Medium-sized bulbs usually command the best price.

Asparagus: The tops should be cut down level with the ground when they are nearly dead. This should be done before the berries begin to fall to any extent, as if many of them fall the plants that spring up become a nuisance. Burn the tops, or if trenching is being done they may be placed in the bottom trench. Whatever is done, take care not to scatter the seeds about the garden, where they may come up as weeds. If the plants are arranged in the old-fashioned beds, as much of the top-

soil as can be removed should be raked off and a foot deep of half-decayed stable manure placed on top. The soil is to be left off until spring. Some growers—very few—strip the soil from the beds so as to expose the crowns, and leave them in that condition until they show signs of starting growth in spring, and then apply manure and return the soil. This is a very bad plan and should be discontinued. Asparagus-culture will be more fully treated in a future issue of the *Journal*.

Growing crops of the brassica tribe should be moulded up before the plants get large enough to be affected by wind. Brussels sprouts require heavy moulding in exposed places as they grow tall. Yellowing leaves on the lower part of the stems should be pulled off, but by no means cut off the good leaves, as done by some amateurs, this being quite a mistake. The rosettes form in the axils of the leaves; they are but small, and soon spread if the leaves are taken off; they may be removed when the sprouts are cut. The grey aphis that attacks brussels sprouts at this time of the year can be easily cleared by forcible syringing with nearly boiling water.

SMALL FRUITS.

Strawberries: Planting will be carried out in many places during the next few weeks. See that the soil is in a clean state before planting. If the soil is light pass a roller over it both before and after planting. Where large areas are planted the young plants carry no soil on the roots. In such cases most of the present roots die, and should be cut to half or one-third their length. The plants can be taken in bundles and the roots laid on a block, severing the roots with a tomahawk. Take care that the plants do not dry up during the necessary handling. Bundles may be kept moist under wet sacks, taking out only a sufficient number at a time to enable the person who lays them in place to keep a little way ahead of the planter. It is bad to plant in very dry soil, still worse to plant in wet soil, and it should not be done while rain is falling. Old beds that it is intended to keep for another year should be gone over, all runners removed, and all the old leaves cut off. The leaves should be burned, which may be done after removal from the bed; or if leaf-spot be prevalent let them lie a few days till dry, then, if necessary, scatter a little straw or pine-needles among them and set fire to them, letting the fire cover the stools. It will not injure the crowns unless there is too heavy an accumulation in any part. If pine-needles were used as a mulch it may be worth while to collect the bulk of them and keep them for next season. They usually serve for two seasons.

Raspberries: Old canes should be removed from plantations. It is better to do so now than to leave them till winter.

Loganberries: Bushes should have the shoots that have fruited removed, with the reservation that if there are not sufficient young rods to provide a crop for next season some of the rods may be kept. In this case the lateral growths that bore the fruit should be cut back to spurs of one or two buds, but this should not be done till midwinter.

In case of necessity calf-meal is quite suitable for mixing with the mash for fowls, and takes the place of meat-meal, as it generally contains about 20 per cent. protein. It is best used in the mash in the proportion of about 20 per cent. to 25 per cent. of the total quantity.

ORCHARD PESTS AND DISEASES:

DIRECTIONS FOR CONTROL.

THE Department's Bulletin No. 57, "Principal Spraying-compounds: Directions for Preparation," has been recast, and is being reissued as Bulletin No. 82, with the title of "Orchard Pests and Diseases: Directions for Control." No. 57 will be allowed to lapse. For general information and further publicity the text of the new bulletin is also printed in the *Journal*, as follows:—

CODLIN-MOTH, LEAF-ROLLER, PEAR-SLUG, ETC.

ARSENATE OF LEAD.

Use not less than 1½ lb. arsenate-of-lead paste or ¾ lb. of arsenate-of-lead powder to 50 gallons of water. *Commence* spraying as soon as the majority of petals have fallen, and *repeat* the application at intervals of about twenty-one days throughout the season, the main object being to keep the fruit and foliage *thoroughly covered* with the spray.

RED MITE, MUSSEL, SAN JOSE, AND OTHER SCALE INSECTS; AMERICAN BLIGHT AND OTHER APHIDES, MEALY BUG, THRIP, ETC.

(1.) *For Use in Winter and Early Spring.*

RED-OIL EMULSION.

For application while deciduous trees are in a dormant state.

Apple, pear, and quince, 1 part to 10 or 12 parts of water. (In some districts of the South Island 1 part of oil to 8 parts of water is considered more satisfactory.)

Plums, 1 to 12. Other stone-fruits, 1 to 15.

Citrus fruits, 1–35 to 1–40. Apply and repeat once or twice at short intervals when the young scales begin to move. This may be looked for from October onward, according to the variety of scale.

There are numerous brands of commercially prepared oils on the market needing only the addition of soft water to make them ready for use. It is advisable to dilute in the proportions recommended above, as the strength stated on the container labels are often too weak to give satisfactory results.

PREPARATION OF OIL EMULSIONS.

(*a.*) Proportions: 1 gallon oil to 1 lb. soft-soap and 10 to 15 gallons water according to requirements.

Preparation: Place the oil and soap in a vessel; heat over a fire until the soap is dissolved; remove from fire, and with spray-pump *thoroughly* agitate the contents, at the same time *slowly* adding ½ gallon of water. Add balance of cold water, and the mixture is ready for use.

(*b.*) Proportions: 1 gallon oil, 2 lb. common soap (home-made caustic-soda soap may be used), 10 to 15 gallons water according to requirements.

Preparation: Dissolve soap in 1 gallon of boiling water, and while boiling pour slowly into the oil, agitating well; then add balance of water.

In the case of thick oils difficult to emulsify this method may be improved as follows: Pour only half the dissolved soap into the oil, and bring to the boil, and allow to simmer for about five minutes, stirring well; pour the remainder of dissolved soap into the bulk water, then slowly add this to the oil, particularly the first gallon or two, agitating thoroughly.

It is imperative with both formulæ that the water used should be *soft*. Where it is questionable, add 2 oz. of washing-soda to every 5 gallons of water. Rain-water is always to be preferred for the mixing of spraying-compounds.

(2.) *For Use in Late Spring and Summer.*

KEROSENE EMULSION.

A spring and early summer remedy for scale and thrip on citrus and deciduous fruits.

Proportions: Kerosene, 2 gallons; common soap, ½ lb.; boiling water, 1 gallon.

Preparation: Place the soap in the water, which should by preference be rain-water. Hard water is unsuitable, but if only such is to be had, make it soft by adding some soda. Boil till the soap is thoroughly dissolved; then take it off the fire and pour the solution into the kerosene. Thoroughly churn up by placing both suction and delivery ends of the spray-pump hose in the liquid and pumping steadily for a few minutes; the emulsion should then, if perfect, form a cream, which thickens on cooling without any appearance of free kerosene.

For most plant-lice (aphides) and other soft-bodied insects, from 12 to 20 parts of water are added to one of the emulsion.

"VISTOLENE."

A contact insecticide valuable for destroying plant-lice, especially the black aphis of the peach. Recommended for use in the ratio of 1 to 100.

"MCDOUGALL'S INSECTICIDE."

This specific, used in the proportion of 1 part to 50 parts of water, has also proved effective in controlling black aphis of the peach.

"KATAKILLA."

This is a contact insecticide useful for the control of black aphis and other soft-bodied insects. Use in the proportion directed on the packets.

"BLACKLEAF 40" (NICOTINE SULPHATE).

A nicotine preparation valuable for summer use in controlling woolly aphis, red mite, &c. It can be used in the proportion of 1 part of Blackleaf 40 to 800 parts of water.

Three to four pounds of dissolved soap to every 100 gallons of diluted wash considerably increases the efficiency of nicotine sulphate. Soap, however, should not be added when nicotine sulphate is being used in combination with other compounds.

PARASITIC FUNGI GENERALLY, ESPECIALLY THOSE ATTACKING STONE-FRUIT.

BORDEAUX MIXTURE.

Proportion: 8 lb. sulphate of copper, 6 lb. fresh quicklime, and 40 gallons water.

Preparation: Dissolve the sulphate of copper in 20 gallons water; slake the lime slowly, and make up to 20 gallons; pour both solutions simultaneously into a third vessel.

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

The efficiency of bordeaux depends upon the *intimate blending* of the two solutions, obtained by pouring both solutions *simultaneously* into a third vessel. It is imperative that the chemicals used be pure, the lime *fresh* and having a high percentage of calcium oxide. The best results are obtained when the application is made as soon as possible after blending the two solutions. If allowed to stand over eight hours its fungicidal properties largely depreciate.

In the case of peach, nectarine, and apricot, apply when buds show colour, and for apple and pear when the buds are bursting.

BLACK-SPOT OF APPLE AND PEAR.

BORDEAUX MIXTURE (SPRING FORMULA).

Proportions: 6 lb. sulphate of copper, 4 lb. fresh quicklime, 50 gallons water.

Preparation: As for winter formula.

Apply when cluster-buds are expanded and showing colour.

PURE BLUESTONE.

The use of pure bluestone (sulphate of copper) has become popular in some fruitgrowing countries as a fungicide for winter use. It has so far proved satisfactory in the Dominion, and may supersede the bordeaux mixture (winter formula), used in the proportion of 1 lb. of bluestone to 10 or 15 gallons of water for pip-fruits, and 1–15 to 1–20 for stone-fruits.

DUAL-PURPOSE SPRAYS (INSECTICIDE AND FUNGICIDE).

COMMERCIAL LIME-SULPHUR (SPECIFIC GRAVITY 33° BEAUME).

This is beneficial in controlling fungus diseases, particularly powdery mildew, and is also useful as a summer spray for red mite and other soft-bodied insects.

Late winter or early spring strength: Pip-fruits—1–10, when buds are bursting; stone-fruits—1–15, when buds show colour.

Spring or early summer strength: Pears—1–15 to 1–20, when buds show colour; apples—1–25 to 1–30, when buds show colour; stone-fruits—1–125, when fruit has set.

Summer strength: Pears—1–80 to 1–100; apples—1–100 to 1–120; stone-fruits—1–125.

The several brands of commercial lime-sulphur are supposed to be of a standard strength, but considerable variation has been found in different barrels of the same brand, and further, through settlement, different specific gravities have been noted in the same barrel. This applies particularly to the home-made article. Where possible stir the vessel well before drawing off, test frequently, and dilute according to the table on next page.

SELF-BOILED LIME-SULPHUR.

Another form of lime-sulphur is the self-boiled mixture. Although this is not such an effective fungicide as the commercial or ordinary home-made article, it provides a useful alternative for use on the more tender-foliaged varieties of trees. The standard self-boiled lime-sulphur mixture is composed of 8 lb. fresh stone lime and 8 lb. sulphur to 50 gallons water. Any finely powdered sulphur (flowers, flour, or "commercial ground" sulphur) may be used in the preparation of the mixture. In order to secure the best action from the lime the mixture should be prepared in rather large quantities, at least enough for 200 gallons of spray, using 32 lb. lime and 32 lb. sulphur. The lime should be placed in a barrel, and enough water (about 6 gallons) poured on to almost cover it. As soon as the lime begins to slack the sulphur should be added, after running it through a sieve to break up the lumps, if any are present. The mixture should be constantly stirred, and more water (3 or 4 gallons) added as needed to form at first a thick paste and then gradually a thin paste. The lime will supply enough heat to boil the mixture several minutes. As soon as it is well slaked water should be added to cool the mixture and prevent further cooking. It is then ready to be strained into the spray-tank, diluted, and applied. The stage at which cold water should be poured on to stop the cooking varies with different limes. Some limes are so sluggish in slaking that it is difficult to obtain enough heat from them to cook the mixture at all, while other limes become intensely hot on slaking, and care must be taken not to allow the boiling to proceed too far. If the mixture is allowed to remain hot for fifteen or twenty minutes after the slaking is completed the sulphur gradually goes into solution, combining with the lime to form sulphides, which are injurious to peach-foliage. It is therefore very important, especially with hot lime, to cool the mixture quickly by adding a few buckets of water as soon as the lumps of lime have slaked down. The intense heat, violent boiling, and constant stirring result in a uniform mixture of finely divided sulphur and lime with only a very small percentage of the sulphur in solution. It should be strained to take out the coarse particles of lime, but the sulphur should be carefully worked through the strainer.

COMBINATION SPRAYS.

When desired the following sprays can be used in combination: Arsenate of lead and bordeaux; arsenate of lead and lime-sulphur solution; arsenate of lead and Blackleaf 40; arsenate of lead, lime-sulphur, and Blackleaf 40.

Care should be taken when combining arsenate of lead with lime-sulphur. It is advisable to make a heavy dilution of both before mixing. To ensure maximum safety against damage to foliage add a dilute solution of lime to the arsenate, using approximately the same weight of lime as arsenate of lead.

REFERENCE TABLE FOR STANDARDIZING HOME-MADE LIME-SULPHUR SOLUTION BASED ON A 33° BEAUME STANDARD.

Beaume.	1–10.	1–15.	1–20.	1–25.	1–30.	1–40.	1–50.	1–60.	1–70.	1–80.	1–90.	1–100.	1–110.	1–120.	1–125.
15° ..	4·6	6·8	9·1	11·4	13·6	18·2	22·8	27·3	31·8	36·4	40·9	45·5	50·0	54·5	56·8
16° ..	4·8	7·3	9·7	12·1	14·5	19·4	24·3	29·1	33·9	38·8	43·6	48·5	53·3	58·2	60·6
17° ..	5·2	7·7	10·3	12·9	15·5	20·6	25·8	30·9	36·1	41·2	46·4	51·5	56·7	61·8	64·4
18° ..	5·5	8·2	10·9	13·6	16·4	21·8	27·3	32·7	38·2	43·6	49·1	54·5	60·0	65·5	68·2
19° ..	5·8	8·6	11·5	14·4	17·3	23·0	28·8	34·5	40·3	46·1	51·8	57·6	63·3	69·1	72·0
20° ..	6·1	9·1	12·1	15·2	18·2	24·2	30·3	36·4	42·4	48·5	54·6	60·6	66·7	72·7	75·8
21° ..	6·4	9·5	12·7	15·9	19·1	25·5	31·8	38·2	44·5	50·9	57·3	63·6	70·0	76·4	79·5
22° ..	6·7	10·0	13·3	16·7	20·0	26·7	33·3	40·0	46·7	53·3	60·0	66·7	73·3	80·0	83·3
23° ..	7·0	10·5	13·9	17·4	20·9	27·9	34·8	41·8	48·8	55·8	62·7	69·7	76·7	83·6	87·1
24° ..	7·3	10·9	14·5	18·2	21·8	29·1	36·4	43·6	50·9	58·2	65·5	72·7	80·0	87·3	90·9
25° ..	7·6	11·4	15·2	19·0	22·7	30·3	37·9	45·5	53·0	60·6	68·2	75·8	83·3	90·9	94·7
26° ..	7·9	11·8	15·8	19·7	23·6	31·5	39·4	47·3	55·2	63·0	70·9	78·8	86·7	94·5	98·5
27° ..	8·2	12·3	16·4	20·5	24·5	32·7	40·9	49·1	57·3	65·5	73·6	81·8	90·0	98·2	102·3
28° ..	8·5	12·7	17·0	21·2	25·5	33·9	42·4	50·9	59·4	67·9	76·4	84·8	93·3	101·8	106·1
29° ..	8·8	13·2	17·6	22·0	26·4	35·2	43·9	52·7	61·5	70·3	79·1	87·9	96·7	105·5	109·8
30° ..	9·1	13·6	18·2	22·7	27·3	36·4	45·5	54·5	63·6	72·7	81·8	90·9	100·0	109·1	113·6
31° ..	9·4	14·1	18·8	23·5	28·2	37·6	47·0	56·4	65·8	75·2	84·5	93·9	103·3	112·7	117·4
32° ..	9·7	14·5	19·4	24·2	29·1	38·8	48·5	58·2	67·9	77·6	87·3	97·0	106·7	116·4	121·2
33° ..	10·0	15·0	20·0	25·0	30·0	40·0	50·0	60·0	70·0	80·0	90·0	100·0	110·0	120·0	125·0
34° ..	10·3	15·4	20·6	25·8	30·9	41·2	51·5	61·8	72·1	82·4	92·7	103·0	113·3	123·6	128·8
35° ..	10·6	15·9	21·2	26·5	31·8	42·4	53·0	63·6	74·2	84·8	95·5	106·1	116·7	127·3	132·6

The specific gravity of home-made lime-sulphur is invariably lower than that of the commercial solution. It is therefore advisable when using the former to first ascertain the Beaume specific gravity of the mixture, and to dilute it according to the above table. To prepare a spray of any standard strength, first find the specific gravity of the solution by means of a Beaume hydrometer. Mark the figures in the column on the left of the chart corresponding with the reading of the hydrometer. Next select the figures in the top line representing the strength of the spray required. The figures where this column and the cross-line denoting the specific gravity of the solution intersect represent the quantity of water required to make a spray mixture of equal strength to that given at the top of the column. (The table does not apply to self-boiled lime-sulphur.)

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.

HORSE WITH IRRITATION OF FETLOCKS.

A. H. Cox, Marima :—

We have a horse troubled with irritation around the fetlock. It always seems to be rubbing that part against fences and logs, making the fetlocks bleed, and also causing swelling. It is an aged animal. Can you give me any information in regard to treatment ?

The Live-stock Division :—

We recommend you to give the animal a dose of physic (aloes or linseed-oil), clip the hair off the affected part, wash thoroughly (removing all scurf, &c.), and then apply a little benzoated oxide-of-zinc ointment. The ointment should be applied once daily. A change of diet with occasional doses of Epsom salts (1 oz. to 2 oz.) has a beneficial effect in these cases.

TREATMENT FOR PITTOSPORUM HEDGE.

"INQUIRER," Springston :—

Matipo in some cases seems to get a kind of blight, making the hedge look half-dead and restricting growth. Could a spray be used to advantage ? Am sending sample.

The Horticulture Division :—

The plant is Pittosporum. Your hedge would probably be somewhat improved by spraying it with bordeaux. Much more good would, however, follow some improvement to the soil. The soil becomes impoverished, dry, and hard, and unless the roots have free access to good soil near them growth is sure to suffer. The soil close to the hedge should be broken up, if necessary, and a good dressing of superphosphate given. If fresh soil of a good description can be afforded, place a layer at least 6 in. deep over the roots, letting it reach right under the hedge. The Maori name " matipo " is wrongly applied to this plant, though often used by settlers. There are several Maori names for this Pittosporum; the one most commonly accepted is " tawhiri." The name " matipo " as used by the Maoris refers to *Myrsine Urvillei*.

FOWL-MANURE.

THOMAS LAWS, Napier :—

Is there any method of breaking down fowl-manure so that it could be applied in the same way as guano ? When mixed with soil and dug in it takes a long time for the hard dry lumps to dissolve and incorporate with the soil.

The Chemist :—

The value of fowl-manure is very much enhanced by the addition of about half its weight of superphosphate. This should be mixed with the manure as it is collected from the roosts from time to time. This prevents the volatilization of any ammonia which would otherwise be liberated continuously from the manure. To

improve the mechanical state of the final product it is advisable to intimately mix it with about one-third its weight of sawdust or peat. Such a mixture when sold as a garden manure should command a good price, and give good results where used with discrimination by vegetable-growers. For field crops and fruit is should be used with extreme moderation, as, owing to the high availability of the nitrogen, it may unduly stimulate growth and produce a rank, weak plant which will be subject to attacks of disease organisms.

HEDGES FOR COASTAL SITUATION.

"BERESFORD," Makarau :—

Will you advise as to the most suitable quick-growing hedge for shelter on good flat country facing the sea ?

The Horticulture Division :—

Taupata (*Coprosma Baueriana*) thrives near the sea better than any other hedge-plant. Plant a double row, the plants 2 ft. apart in each row, and the rows about 10 in. apart ; the plants in each row to be opposite the intervals in the opposite row. *Elaeagnus japonica* and boxthorn also do remarkably well in coastal situations, but both are difficult to trim. The thorns of boxthorn are poisonous, and care is required in trimming to prevent injuring the hands.

SUSPECTED MAMMITIS IN COWS.

"NEW CHUM," Kaipara :—

I should be pleased to know the cause and remedy for my cows coming into milk with a very hard swelling, mostly in one quarter only. In most cases it lasts only one day, and then quite a lot of thick curdled milk can be taken away

The Live-stock Division :—

From the description given your cows are apparently suffering from mammitis. It would be as well for you to send samples of milk from the affected quarters for examination at the Wallaceville Laboratory. Directions regarding the sending of samples have been sent you, together with a bulletin dealing with this complaint.

GRASSING GUM-LAND.

W. BROTHERTON, Puwera :—

I have several acres of hilly gum-land in fallow, it having been ploughed since last June. I wish to sow it down in paspalum and *Lotus angustissimus*. Please let me know how many pounds of each to the acre to sow, also what quantities of ground limestone and best manure to use.

The Fields Division :—

Paspalum is slow to establish, and when sown pure takes several years before it begins to give large summer yields. For this reason special paspalum paddocks should not be laid down with paspalum alone, but the seed should be sown with an ordinary type of temporary-pasture mixtures. Such a procedure will result in the production of a profitable type of pasture until such time as the paspalum has become thoroughly established. The following standard mixture is suggested : Italian rye-grass, 20 lb. ; cow-grass, 6 lb. ; cocksfoot, 6 lb. ; paspalum, 16 lb., depending on the variety of the seed, together with 2 lb. *Lotus angustissimus*. The cocksfoot is included to help fill the ground after the rye-grass has disappeared and before the paspalum has formed a continuous sole. A mixture containing paspalum being difficult to sow by machine, broadcasting is necessary. The land should be well cultivated, and the paspalum then sown separately ; after it has been tined and brush-harrowed the other seeds can be sown. Use 1 ton of ground limestone and from 3 cwt. to 5 cwt. of manure per acre, the manure to consist of basic super and guano in equal quantities, or 3 cwt. of super and 1 cwt. bone-meal. The lime had better be disked in prior to the sowing of the paspalum. March is a good time for sowing.

SEED-MIXTURE FOR LAWN.

"NOVICE," Runciman :—

Please name me a suitable seed-mixture for laying down a lawn, stating also the best time to sow.

The Horticulture Division :—

Fiorin (*Agrostis stolonifera*), Crested dogstail (*Cynosurus cristatus*), and Sheep's fescue (*Festuca ovina tenuifolia*) are recommended. Sow an equal weight of each, allowing 1 oz. per square yard. March or early April is the best time to sow.

RAPE AND CATTLE.

S. F. S., Takapau :—

Would you kindly inform me whether rape is a suitable food for dairy cows, alone or with hay.

The Live-stock Division :—

Rape is not a suitable food for dairy cows, either alone or with hay, it being essentially a sheep-feed. In the event of cattle being put on rape great care must be taken, otherwise losses will occur through tympanitis. They should only be allowed to remain on it for short periods at a time.

SHEEP BOT-FLY.

"BOT-FLY," Waimarie :—

My sheep are very subject to bot-fly. Would daubing every sheep's nose with strong sheep-dip act as a preventive ? It could be done quite easily by putting the sheep through a race.

The Live-stock Division :—

We do not think that daubing every sheep's nose with strong sheep-dip would act as a preventive to any extent. Better results would be obtained by spraying the sheep with the dip as they pass through the race ; but frequent dipping during the season is the best preventive for the trouble.

SPLITTING OF PEACH-STONES ON TREE.

J. G., Christchurch :—

I have a peach-tree eight or nine years old in full bearing. It has a lot of well-grown fruit, but now just as it is getting ripe the fruit, especially on the lower branches, is splitting perpendicularly from the stalk, exposing the nut, which is split in the same manner. The covering of the kernel is black in all split fruits, but in some the kernel is a rotten pulp. Under this tree, during the summer, I have had a large basin of water for ducks, and the basin for cleaning purposes has been emptied under the tree. No other tree in the orchard is so affected. What is the cause and remedy ?

The Horticulture Division :—

The splitting of peach-stones and imperfect formation of the same is usually attributable to want of lime. Cracking of peaches may be caused by a fungoid disease (*Cladosporium carpophilum*), which causes fruits to crack, shrivel, and decay. In the case of the tree you mention the constant washing into the soil of the droppings of the ducks, which are highly charged with nitrogen, has doubtless been contributory to the trouble, and should be avoided in future. Had the basin of water been removed from tree to tree it might have done good instead of harm. It must be understood, however, that it is bad to give much water to

a tree and then none, the alternative from wet to dry being only less harmful than a constant state of wet. Spraying is necessary to control disease, this phase being amply dealt with in the *Journal*.

CLEARING DAM OF RAUPO.

A Rangitikei correspondent writes: "I shall be glad if any of your numerous readers can tell me the best way to clear my dam of raupo."

NOTE.—A reply cannot be given to "Subscriber," Carterton, regarding blackberries, unless name is furnished.

SOLDIER SETTLERS.

THE following are extracts from a recently issued report of the Lands Department on Discharged Soldiers Settlement:—

Advice has been given to soldier settlers whenever practicable by experts of the Agriculture Department, Crown Lands Rangers, and other officials of the Lands and other Departments of the State, and by private individuals. This advice is of great assistance, and every endeavour will be made to see that all new selectors are given practical advice to enable them to deal with the particular class of land allotted. The purchase of stock is supervised most carefully, so that advances made for this purpose may be expended to the best advantage. In some cases settlers have purchased out of their own funds implements and machinery in excess of their requirements, and it has been pointed out to them that, where several small farms adjoin, a system of co-operation is advisable wherever possible in the purchase of expensive implements, with a view to avoiding waste of money. This, however, is largely a matter for the settlers themselves, and the Department does not desire to interfere beyond giving practical advice on the subject; but it does not make advances where the requisitions are in excess of what is reasonable for working the sections. . . .

There is a tendency amongst some of the soldier settlers to rely too much on outside labour to do the work for which Government advances have been made, instead of doing it themselves wherever possible, as "improved-farm" settlers would do. This should be discouraged, or the soldiers will soon find themselves at the end of their resources. This advice particularly applies to bush farmers, who should earn the advances by felling and grassing the land themselves, by which means they will gain experience in the management of land as they progress, and their future will be assured. On the other hand, with labour so dear the money that may be advanced will soon fritter away, and the soldier with very little experience and no money will not be able to make the best use of the grass he has grown by contract labour. . . .

Sympathy with returned soldiers found practical expression in the action of the settlers located in the vicinity of the Stalker Settlement, at Seaward Downs, in the Southland Land District. It was necessary that an area of 180 acres, comprising portions of each of the allotted sections, should be ploughed, and the work was taken in hand by the neighbouring settlers, with the result that the whole area was ploughed in less than two days. While ploughing operations were in progress it was also decided to make provision for the necessary seed, and upwards of £100 was subscribed for the purpose. In many other settlements the soldiers have received practical assistance and also valuable advice from the local patriotic societies.

In mating fowls and ducks for breeding-purposes good results are obtained from females in their second and third year mated with males fifteen to eighteen months old. The difference in age will have no effect on the proportion of males hatched.

SALE AND PURCHASE OF WHEAT.

REGULATIONS as to the sale and purchase of wheat of the current season were gazetted on 25th February. With the exception of amended prices, and added provisions regarding the sale of old wheat, the scheme of Government control is similar in general to that of last year, a descriptive summary of which was published in the *Journal* for February, 1918. The clauses of the present regulations embodying new matter of chief concern to farmers are extracted as follows :—

PURCHASES OF WHEAT BY THE GOVERNMENT.

16. Government brokers will buy good milling-wheat on account of the Government at the following prices :—

A. Good milling-wheat grown in the South Island elsewhere than in the Provincial Districts of Nelson and Marlborough :—

(1.) Sold for delivery free on board at the nearest port—

(*a.*) In January, February, March, April, May, or June, 1919, 6s. 6d. per bushel.

(*b.*) In July, 1919, 6s. 6½d. per bushel.

(*c.*) In August, 1919, 6s. 7d. per bushel.

(*d.*) In September, 1919, 6s. 7½d. per bushel.

(*e.*) In or after October, 1919, 6s. 8d. per bushel.

(2.) Sold for delivery otherwise than free on board at the nearest port, a price equivalent as regards the seller to the prices aforesaid.

B. Good milling-wheat grown in the North Island or in the Provincial Districts of Nelson or Marlborough :—

(1.) Sold for delivery free on rail at the nearest railway-station—

The same price as that fixed by subclause A hereof for good milling-wheat grown in the South Island (elsewhere than in Nelson or Marlborough) and sold for delivery free on board at the nearest port, with an addition of 4d. per bushel.

(2.) Sold for delivery otherwise than free on rail at the nearest railway-station—

A price equivalent as regards the seller to the price aforesaid.

* * * * *

19. Sacks will be paid for, in addition to the above prices, at the fair market value, not exceeding an amount less by 2d. than the maximum prices of sacks as fixed by an Order in Council of the 21st January, 1919, made under the authority of section 2 of the Regulation of Trade and Commerce Act, 1914.

* * * * *

SALE OF OLD WHEAT.

74. Nothing in the foregoing regulations shall apply to wheat of the season 1917–18 (hereinafter referred to as old wheat), and, save as herein otherwise provided, all such wheat that has not been disposed of before the date of the making of these regulations shall remain subject to the Wheat Trade Regulations, 1917.

75. (1.) Old wheat will be purchased by Government brokers at the prices fixed by clause 16 of the Wheat Trade Regulations, 1917, for wheat to be delivered in or after the month of September, 1918. Sacks will be paid for at the price fixed by clause 19 of these regulations in lieu of the price fixed by clause 19 of the Wheat Trade Regulations, 1917.

(2.) All old wheat so purchased shall be sold by Government brokers as if it were wheat of the season 1918–19 sold to the Government for delivery during the month in which it is sold by the Government. Clause 33 of the Wheat Trade Regulations, 1917, is hereby modified in so far as it is inconsistent with this clause.

76. Every person who sells old wheat to the Government shall disclose in writing to the Government broker the fact that it is old wheat, and every seller of old wheat who fails to make such disclosure commits an offence against these regulations, and shall be liable under the War Regulations Act, 1914, accordingly.

77. Every person who is knowingly concerned in the sale to or purchase by the Government of any old wheat at a price in excess of the prices fixed by the Wheat Trade Regulations, 1917, for wheat to be delivered in the month of September, 1918, commits an offence against these regulations, and shall be liable under the War Regulations Act, 1914, accordingly.

PERMITS FOR EXPORT OF HIDES AND CALF-SKINS.

THE following notification by the Comptroller of Customs, which appeared in the *Gazette* of 6th March, is published for further information:—

Whereas by Order in Council of the 16th day of April, 1918, the export of hides and calf-skins to any destination is prohibited save with the consent of the Minister of Customs: And whereas it is expedient to publish, for the information of all whom it may concern, the conditions on which such consent will be given: Now, therefore, it is hereby publicly notified as follows:—

1. The notice dated 6th December, 1918, and published in the *New Zealand Gazette* of the 12th December, 1918, is hereby cancelled.

2. Applications for permits for the export of hides and calf-skins must be made in writing to the Collector of Customs at the intended port of shipment.

3. The Board of Trade will at the ports of Auckland, Wellington, Christchurch, and Dunedin appoint representatives of the tanners of New Zealand, and no permit will be granted unless the applicant satisfies the Collector of Customs at the intended port of shipment, by the production of documentary evidence and in such other manner as the Collector may require, that the hides or calf-skins have been offered for sale to the tanners of New Zealand through such representatives at each of the said ports at prices not exceeding those specified in the First Schedule hereto (or such other prices as may from time to time be substituted therefor by the Minister of Customs on the recommendation of the Board of Trade), and have been refused in such circumstances as to show that the goods are not required for local purchase at those prices.

4. No permit will be granted for the export of hides or calf-skins by or on behalf of any tanner carrying on business in New Zealand or by or on behalf of any person who has purchased hides or calf-skins from any such tanner.

5. Every application for a permit shall be in the form set out in the Second Schedule hereto.

6. When the ultimate destination is not the United Kingdom or a British possession, such further conditions and restrictions as the Minister of Customs thinks fit will be imposed on the grant of permits.

The First Schedule is as follows:—

	Per lb. s.	d.
1. Free on board at the nearest port,—		
Ox-hides, first quality, over 45 lb., up to freezing companies' best standard	1	1
Others, first quality	1	0
Ox-hides, second quality	0	11½
Cow-hides, first quality, up to freezing companies' best standard	1	0
Others, first quality	0	11
Cow-hides, second quality	0	10½
Bull-hides, good quality	0	9
Calf-skins, first quality, 10 lb. and under	1	6
All other grades and qualities, including cut and slippy hides and calf-skins at relative values.		
2. Otherwise than free on board at the nearest port, prices equivalent as regards the seller to the foregoing prices.		

The tare allowances shall be as follows: On all hides up to the best freezing-works' standard, which have been properly washed before salting, 4 per cent. On all other hides the tare to be—Per hide, 6 lb. to 16 lb., 1 lb.; 17 lb. to 32 lb., 2 lb.; 33 lb. to 69 lb., 4 lb.; 70 lb. and over, 6 lb.

Fowl-wheat and Seed-wheat.—As was the case last year, the maximum price, to the grower, of "free" inferior wheat has been fixed at 2d. per bushel less than the Government price of good milling-wheat in the same month. The maximum selling-price of seed-wheat is again 5d. per bushel higher than that of the millers' price for good milling, and machine-dressed seed is allowed a further addition of 5d. per bushel. A wheat-grower may sell directly to any other grower wheat in quantity not aggregating more than 100 bushels for use as seed by the purchaser.

THE WOOL SITUATION.

THE following cablegram from the Secretary of State for the Colonies to the Governor-General of New Zealand, dated London, 8th February, 1919, has been published through the Acting Minister in Charge of the Department of Imperial Government Supplies (Hon. D. H. Guthrie):—

The wool situation is changing rapidly in all parts of the world since the Armistice was signed. Contracts for military woollen equipment have been freely cancelled in the United States and United Kingdom, and such production is coming rapidly to an end. Demands for civilian woollen goods have not yet fully taken the place of military orders, and the wool-markets are somewhat depressed. The Government of the United States, who are the principal holders of wool stocks in that country, are holding fortnightly auctions. Prices, which in Boston were 30 per cent. above British level, have now fallen to British level, and at each auction many lots are withdrawn for want of buyers. The South American markets are stagnant. There are no buyers anywhere here at 1918 prices, and sellers are not yet ready to accept prices which buyers offer. Nevertheless, South African farmers almost unanimously declined the offer made by His Majesty's Government to purchase the present season's clip on the same terms as agreed with Australia and New Zealand. South African wool will be sold to Japan, the United States, and the United Kingdom in the open market. Transactions up to the present are limited. His Majesty's Government has decided not to buy the British clip for 1919, because farmers in general are dissatisfied with prices, and because the Government do not now require British wool for military purposes. Under the conditions, therefore, British, South African, East Indies, and South American wool will be sold freely in British markets without restrictions. Australian and New Zealand wool held by the Government under the purchase scheme will be auctioned in London, open to all British and Allied buyers. Reserved prices will be fixed somewhat below the present Bradford issue prices. At present it is intended that the first auction shall be held early in April, owing to the greatly improved shipping prospects, which will render the supply sufficient by that date. It is not thought possible to handle by London auctions more than 100,000 to 160,000 bales monthly, which might not be sufficient to meet the demand. His Majesty's Government, therefore, proposes to continue the issue of additional quantities of wool, concurrently with auction sales, to British and Allied buyers, at fixed issue prices, revised from time to time as occasion requires. Up to 30th April at least the present issue prices will be maintained.

FORTHCOMING AGRICULTURAL SHOWS.

Strath Taieri A. and P. Society: At Middlemarch, 1st April.
Oxford A. and P. Association: At Oxford, 3rd April.
Methven A. and P. Association: At Methven, 3rd April.
Temuka and Geraldine A. and P. Association: At Winchester, 3rd April.
Malvern A. and P. Association: At Sheffield, 16th April.
Mackenzie County A. and P. Society: At Fairlie, 21st April.
Otago A. and P. Association: Winter Show, at Dunedin, 3rd to 6th June.
Waikato Winter Show Association: At Hamilton, 3rd to 7th June.
Manawatu and West Coast A. and P. Association: National Dairy Show, at Palmerston North, 17th to 20th June.

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