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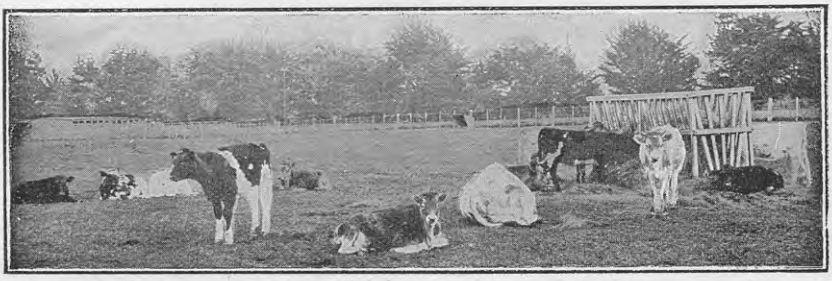
Freezers.



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WELLINGTON, NEW ZEALAND.

20TH JUNE, 1916.

CONVERSION OF FERN-LAND INTO GRASS.

A. H. COCKAYNE, Biologist.

INTRODUCTION.

THE sown grass-lands of New Zealand not entering into any special rotational system are of particular interest, owing to their being in general of quite recent origin. Although there are grass-lands in the Dominion that have been established over half a century, all the various types of pasture can be traced right from their primeval condition to their present state. All the changes and modifications of vegetation that occur in their development can be studied step by step from the original plant-formation into grass-land, the derivation of which it would be impossible to tell from its present condition alone. In all parts of New Zealand, but more extensively in the North Island, the evolution of artificial pastures can be seen in all its varied phases, and the origin of artificial grass-land can be investigated with a detail that is impossible in older-settled countries, where the origin of many of the types of permanent pasture is wrapped in obscurity.

Another point that is of surpassing interest from an ecological view is the fact that in primitive New Zealand there were no grass-lands that could be termed meadows and that could be cut for hay—that is, no grass-land showing seasonal growth, and where the herbage was more or less even-aged, was present. In fact, the only primitive grass-lands — the tussock areas — were composed mainly of grasses that, so far as their vegetative development is concerned, occupy a position nearer to shrubs than they do to the ordinary flat-leaved grasses which comprise the main vegetation of true meadows. The present artificial and artificially induced pastures of New Zealand are nearly all of the meadow type, and although not normally cut for hay to any appreciable extent (less than half of 1 per cent. are utilized for hay-production), they would be very largely so dealt with were our climate sufficiently rigorous as to necessitate general stall feeding during the winter months.

How New Zealand has converted her primitive vegetation into meadow-land is a matter of intense scientific interest, bearing as it does on the evolution of grass-land in general. At the same time its study is of far-reaching practical importance, as the process is still in operation. A complete knowledge of the basic principles involved, and the influence and interaction of the various factors concerned, would enable the art of the conversion of primitive vegetation into grass-land to be applied with even greater certainty of success than has been possible in the past. Each year in New Zealand the conversion of over a quarter of a million acres of native vegetation into grass is undertaken, and at the present time some fifteen million acres have been so dealt with. A fair proportion of this area is now under some type of rotational system, but over ten million acres is still occupied by a vegetation derived from the original grass mixture with which it was sown, often profoundly modified according to the conditions to which it has been subjected. Owing to the topography of much of New Zealand inhibiting any general use of the plough, much of this land is destined to remain in grass "for all time," and with this in mind the importance of success in the conversion of native vegetation into grass becomes clear. The effect of the failure of a crop under a rotation system is generally quite transient, but initial failure in the conversion of primeval vegetation into grass spells ruin to the land from a pasture point of view, or at least enormously increases the difficulty and cost of finally establishing a payable and permanent crop.

THE VARIOUS TYPES OF GRASS-LAND.

Excluding rotation grass, the principal grass-lands of New Zealand may be roughly classified under the following headings according to what type of vegetation they have replaced:—

Coastal-forest Grass-land.—The area devoted to this class of pasture is comparatively small. Typical examples may be seen over a large portion of the Wanganui coastal places and elsewhere along the coasts of both Islands. The majority of the grass-land of the Moumahaki Experimental Farm was of this type, but is

TYPICAL NATURAL FERN-LAND.

mainly now of a rotation character. Frequently coastal-forest grass-land a few years after the original sowing turns gradually into *Danthonia* pasture, as can be well seen on the coastal hills around Wellington.

Rain-forest Grass-land.—This class of grass-land comprises many millions of acres, mainly in the North Island, although there are very large tracts in the South Island. A feature of these grass-lands is the general predominance of cocksfoot, although, of course, many other grasses occupy an important position. The majority

of "bush-burns" in general can be relegated to rain forest, and the grass-land derived from it comprises much of the very best of the permanent grazing-land of New Zealand.

Southern-beech Forest Grass-land.—This occupies a comparatively small area, and forest-land of this type is amongst the most difficult of any in New Zealand to grass successfully. In many cases the earlier attempts resulted in failure, as can be well seen on the low hills along the eastern side of the Hutt Valley, near Wellington, where the land has in many cases reverted to manuka.

Tussock Grass-lands.—These are mainly located in the South Island, and are of various types. Much of the land originally covered with the lowland tussock type is now under rotational grass, nearly all the cereal-growing districts having been lowland tussock in the past. In Southland large areas of tall tussock (*Danthonia Raoulii*) moor have been converted by drainage and liming into both rotation and permanent grass-land.

Reclaimed-swamp Grass-lands.—This type of pasture is scattered throughout both Islands, and many of the areas comprise the best fattening-land in the Dominion. Their conversion has been attended with much difficulty, and the great expenditure necessary to drain them sufficiently to grow grass has been a bar to their rapid conversion into grass-land.

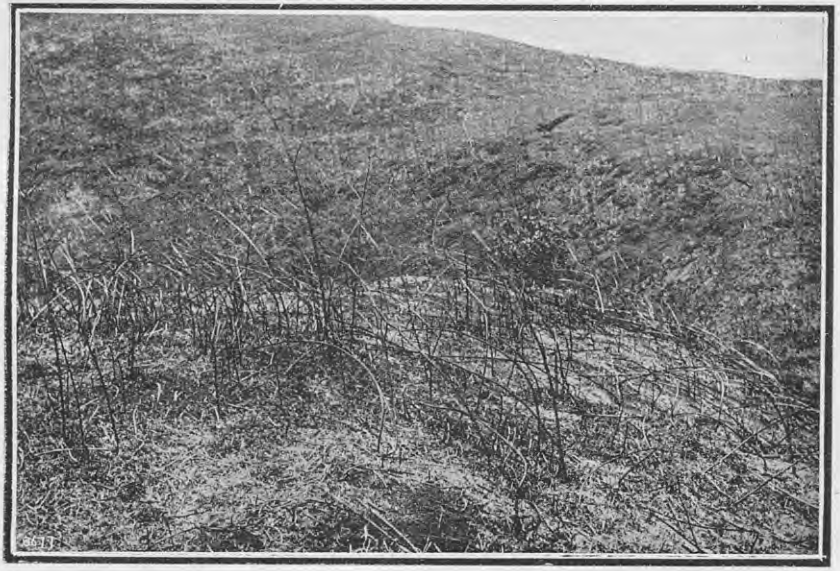
Heath Grass-lands.—These have been derived from two main types—wet heath, being very closely related to moor, and dry heath, mainly comprising fern-land and manuka scrub.

The above classification is an extremely rough one, but it serves to show from what varied types of original vegetation our grass-lands have been derived.

THE CONVERSION OF FERN-LAND INTO GRASS.

In dealing with the conversion of fern-heath into grass it is well to understand that there are two main types of fern-land. The first is what I term natural fern-land, and which has been continuously in fern, even prior to the time that the first Europeans landed in the country. The other type, which I term artificially induced fern-land, did not carry fern before being brought under occupation. Fern-land in New Zealand occupied very large areas prior to the advent of settlement; but, arguing from what has occurred over a very large extent of bush-burn country, I am inclined to think that much of the land now occupied by what appears to be a primitive vegetation became clothed with fern subsequent to extensive forest fires occurring in

the pre-European days of this country. It is a notable fact that many types of New Zealand forest-land when burnt and then left unstocked do not as a normal rule reproduce forest, but turn rapidly into fern. This feature is of such an outstanding nature that it would appear safe to generalize and say that all fern-lands in New Zealand, both primitive and induced, with a few notable exceptions, occupy the site of former forest, and that a plant covering of fern is one of the stages through which, under natural conditions, the land must pass before forest is again developed.



OLD FERN BURNT PREPARATORY TO EITHER PLOUGHING OR SURFACE-SOWING.

When this view is taken it is seen that there is not much difference in origin between natural and artificially induced fern-land—the destruction of forest, either naturally or artificially, being the all-essential requisite for the production of both types. If the history of the vegetation were carried back far enough to the plant-colonization of actually virgin ground, it seems feasible to expect that fern in all cases preceded the development of forest. A study of the fern-lands of the Central Volcanic Plateau seems to fit in well with this hypothesis.

There is, however, a very signal difference between natural and artificially induced fern-lands. The vegetation of the former is

of very considerable age, whereas that of the latter is of very recent origin, and its actual commencement can be seen in many parts of New Zealand. In addition to this, the vegetation of natural fern-land is much easier to eradicate than that of artificially induced fern-land. In certain cases quite light stocking of primitive fern-land has resulted in the eradication of the fern, as, for instance, in the Te Kuiti district, where fern-land has frequently been successfully broken in and the fern got rid of by stocking with milking-cows alone. Artificially induced fern, when properly established, could not possibly be dealt with in this way. The greater difficulty of dealing with induced fern is probably due to the fact that much natural fern-land, especially where tutu is becoming abundant, is in one of its later stages of development before the land again becomes clothed with forest, and the fern is naturally not so aggressive as when in the stage immediately following its successful invasion of previously forested country.

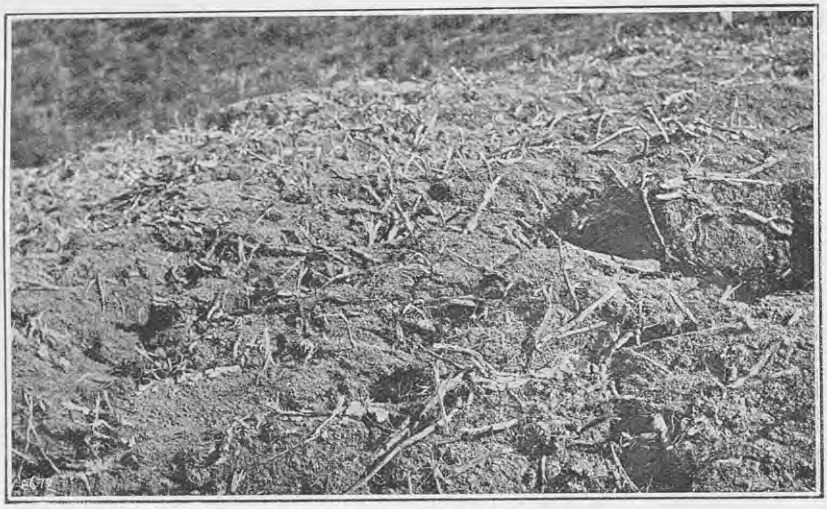
The grass-lands that have been converted from the type of heath I term natural fern-land are of very considerable extent, comprising some two million acres, the larger portion being located in the east coast region of the North Island, and also in the southern portion of the Auckland Province. Much that has been converted for many years—and this is particularly true of large areas in Hawke's Bay—no longer shows any signs of ever having been covered with a dense growth of fern, but the ready development of the plant on unutilized land adjoining such grass-lands shows clearly the previous condition of the land. During the past few years there has been a great extension in the work of converting fern-land in the King-country, and large areas still remain to be transformed into pastures. In this district all stages in the conversion of fern-land into grass can be seen—from those where the dominance of the fern is quite unaltered to those where fern is apparently quite non-existent.

With regard to the eradication of fern on artificially induced fern-land much work has been accomplished, and many hundreds of thousands of acres where fern had attained the mastery over grasses sown on bush-burns have been more or less cleared of the weed. In many places, however, such as the Marlborough Sounds, artificially induced fern-land covers large areas, and the eradication of the fern is yearly becoming more difficult. Theoretically, induced fern should not exist, provided proper methods to avoid its establishment were carried out, and it is probable that with a better knowledge of the necessary initial treatment of bush-burns the development of artificially induced fern could be enormously diminished.

Before detailing the methods of fern-land conversion it will be well to give some details concerning the life-history of fern and the general principles underlying its eradication.

THE LIFE-HISTORY OF FERN.

The dominant plant of fern-land, both natural and induced, is the bracken fern (*Pteridium esculentum* (Forster, F.), L. Cockayne). This plant is closely related to the European bracken, but is considered to be a distinct species. Like all ferns, it reproduces itself by spores, and not by seeds, as is the case in the higher plants. The spore on germination does not give rise to an individual



BURNT FERN-LAND PLOUGHED, SHOWING UPTURNED UNDERGROUND STEMS.

resembling the plant from which it was produced, but develops into a plant barely visible to the naked eye and known as the prothallus. On the latter sexual organs are produced, and from the fertilized ovum contained in the female organ the true fern-plant is later developed. This method of propagation, known as the sexual method, is often overlooked in the case of bracken fern, on account of the tremendous power of vegetative reproduction with which the ordinary spore-bearing fern-plant is endowed.

The two most conspicuous features of the bracken fern — or simply "fern," as it is generally termed in New Zealand—are its fronds that rise above ground, and its thick underground stem that penetrates deeply into the soil. This stem is popularly spoken

of as the "root," but the true roots are comparatively slender organs arising from the stem, especially at some distance behind the white-tipped growing point. The underground stem contains very large quantities of starch, which is manufactured in the aerial portions of the plant and transferred to the stem. This starch is utilized in the production of fresh underground-stem development, and especially for the maintenance of the young fronds until such time as they uncurl. The underground stem gradually dies back from its older end, but considerably less slowly than new growth is produced at its growing points.

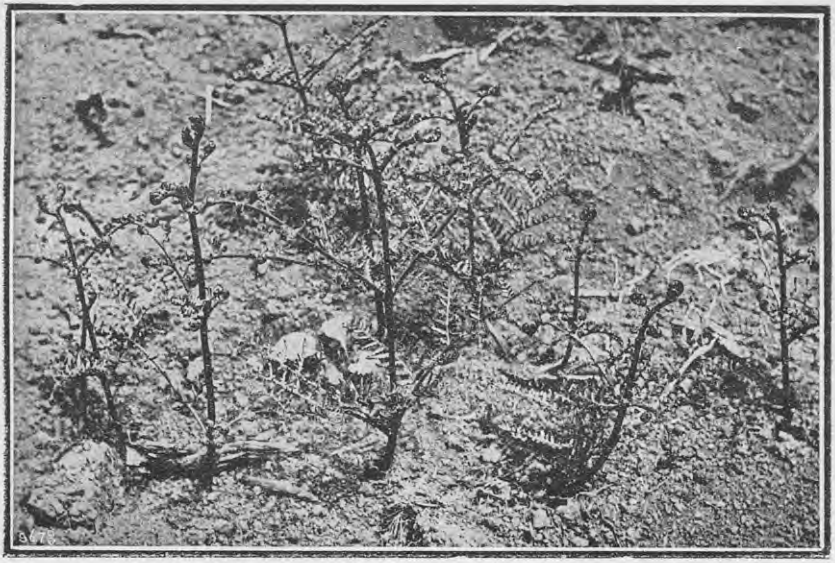
It will be noted that the development of the underground stem of fern is analogous to that of the ordinary Californian thistle; and the plant when once established can spread over a very large area of ground in a comparatively short space of time. However, there is an extremely important difference between the underground stem of fern and the underground stem of Californian thistle. From any portion of the underground stem of the thistle, especially if cut, buds can be developed, and each cut portion can thus give rise to a separate plant. When the fern-stem is cut the case is very different, and it is only those portions that have a frond developed on them or possess a growing point that can develop into separate plants. Any portion of the stem devoid either of a frond or of a growing point will die when cut in pieces. This fact—an important one—explains how ploughing or disking fern will thin it out considerably, while the same treatment on Californian thistle will only increase the vitality of the plant.

Another extremely important character of fern is the fact that if the frond is cut no further growth of that particular frond can take place. A fresh frond has to be developed from below the base of the cut one, and in this operation, again, a great deal of the reserve food in the underground stem is employed. It is thus seen that the whole of a frond of fern, no matter how large or small it may be, is merely a single leaf, and this fact has an immense bearing on successful eradication.

A further character of New Zealand bracken is that it is what it is termed a light-demander, and the growing of a crop that completely shades it will cause its early extinction. This point is not of any value so far as the average farmer is concerned, but from a forestry standpoint it is of especial significance. The fronds, however, have a great power of elongation, and in moderately shaded forests and on their outskirts the fronds, in their efforts to reach the light, may attain a height of 20 ft. or more before they uncurl. Such growth, however, is an immense tax on the reserve food-supply, and death rapidly occurs unless the efforts

of the fronds to reach the light are successful. This explains the complete absence of bracken in dense forest. Wherever forest becomes open, and on the outskirts, fern rapidly puts in an appearance to the point where the vertical depth of the forest shade is too great for the fronds to penetrate.

Another feature of fern — and this an important one from the eradication aspect — is the fact that the development of fronds more or less ceases from the late autumn to the late spring or early summer. In certain districts the fronds virtually die in the winter, but this is by no means universal, and in many localities,



YOUNG FERN IN PLOUGHED LAND, JUST COMING OUT OF CURL STAGE.
A little too advanced for sheep, but right for crushing by cattle.

especially in the North, the plant is truly evergreen. This cessation of growth is of importance, taken in conjunction with its other peculiarities that have been mentioned, but is not of itself sufficient to make the plant comparatively easy to eradicate under certain conditions. Californian thistle also undergoes a somewhat similar dormant period, but that does not make it any the easier to destroy.

Bracken does not seem at all particular as to what type of ground it occupies, and it is found abundantly on all classes of New Zealand soils. It is frequently asserted that fern is an indication of acid soils; and that it exerts a toxic effect on other types of vegetation, but more particularly on grass, is a common belief.

Whether fern is generally indicative of acid soils or not I cannot say, but it certainly does not object to what in New Zealand is termed limestone country. In the Te Kuiti district it grows abundantly actually on the limestone outcrops; and in a large part of that neighbourhood red clover flourishes amazingly on the fern-lands during the process of their conversion into permanent grass. If fern is taken as an indication of acid soil, then the soil on the sides of the railway from New Plymouth to Wellington —covered as it is with an almost unbroken line of induced fern, and adjoining some of the most highly prized agricultural land of the Dominion—should be of an acid nature. It would be interesting to ascertain the acidity of the soil along the railway-fence where this induced fern is growing—say, in the vicinity of Hawera —and compare it with the grass-land devoid of fern immediately adjacent.

A factor, however, that does act detrimentally on the growth of fern is altitude, as can be clearly seen by an examination of the Mount Egmont district, where the altitudinal limit of bracken is well under 3,000 ft. In places I know it ascends higher, but in general it can be looked upon as a serious pest only between sea-level and 2,500 ft.

The great and rapid development of the aerial portions of the bracken fern and the general unpalatability of the expanded fronds, together with the deep and powerful underground stem filled with reserve food, would appear to make this plant almost impossible of eradication. Yet with all its obvious advantages for holding possession of the ground it possesses four fatal defects that make its control possible. These are the incapacity of the underground stems to develop fronds except in specially defined places, the inability of the frond to grow when once broken off, the extreme ease with which the frond may be broken before it expands or when it is in what is known as the curl stage, and the long dormant season extending from autumn to late spring

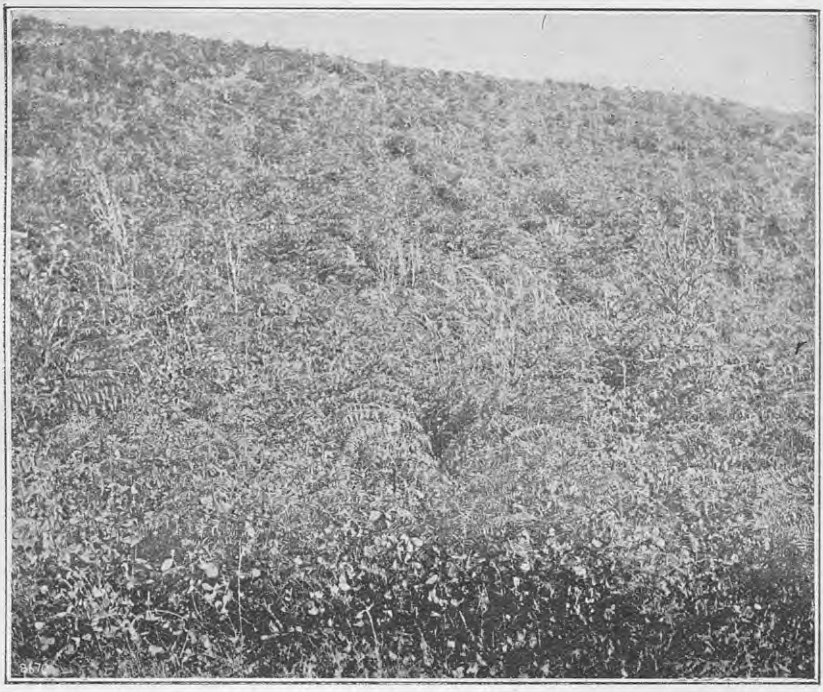
In the conversion of the fern-land into grass all these defects should be taken into consideration, but in many cases the measures necessary to direct against these vulnerable points cannot be practically carried out, and therein lies the difficulty of controlling fern over all areas where it is found.

PREPARATION OF THE SEED-BED FOR GRASS.

For various reasons it is well to discuss first the methods of natural fern-land conversion, and afterwards give some attention to those of induced-fern country, as certain special factors operate in

the greater part of the country of the latter type. In the conversion of natural fern the preparation of the seed-bed is the first essential. It is only in certain instances, and where by quite ordinary stocking methods the fern will finally disappear and grass-land assert itself almost naturally, that no attention need be paid to this matter.

In general, the first procedure to adopt is to burn the fern. Care should be taken to isolate the area to be burnt, so as to



AUTUMN-SOWN TEMPORARY PASTURE, ONE YEAR OLD.
Showing fern left rather long before feeding down the area with cattle.

avoid burning a larger area than was intended. There is a general consensus of opinion that fern should be burnt only in the autumn, but there is no really valid reason for this so far as the fern itself is concerned. In fact, midsummer burns, provided the grass sown can come away rapidly and be stocked before the fresh fern-growth develops, would be preferable to autumn burns. The reason is that in the summer the fern-stems are less provided with reserve food than in the autumn, and, provided each growth of fresh fronds can be broken off or eaten by stock while yet in the curl stage,

the eradication of the fern must be sooner accomplished than if burning is delayed. This system was in past times extensively followed by the late Archdeacon Williams on the east coast of the North Island; but, of course, the practice is unusual. The reason is obvious. In general, midsummer sowing of surface-sown grass is not likely to be uniformly successful, and heavily stocking a bad take of grass punishes the stock too much for such an operation to be entertained at the present day. Thus autumn burning not earlier than the end of February can be looked upon as the general practice for surface-sown fern-lands.

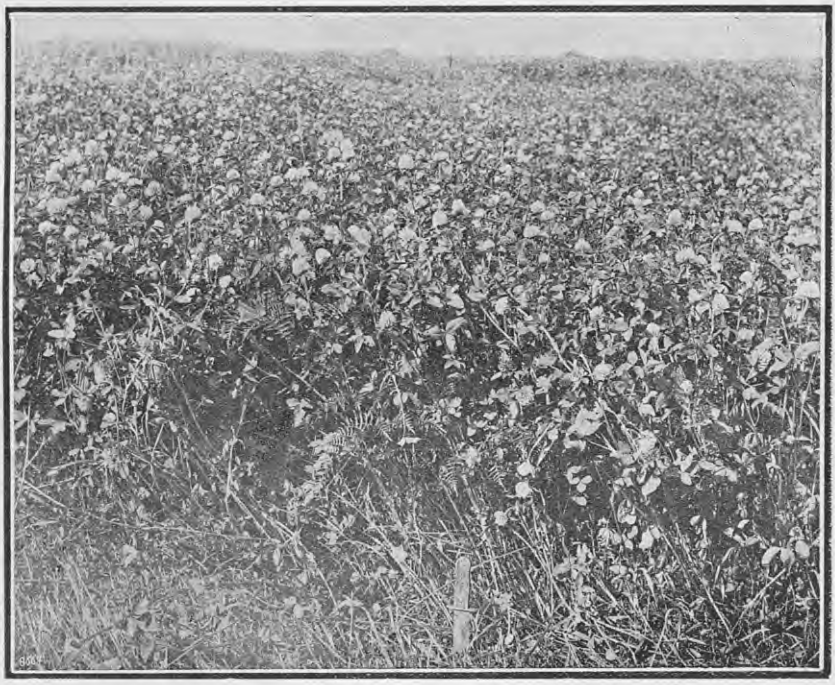
On fern-land that is ploughed the burning often takes place earlier, and the ground is stocked for a few days after the young fern appears after ploughing, the ground being thereby consolidated before the seed is sown in the autumn. On fern capable of being ploughed this operation should always be carried out and the land worked up in the ordinary manner. Many consider disking is preferable. It certainly has the merit of cheapness, and the cutting of the fern "root" is also highly desirable. Ploughing and disking, however, would be better. Where land cannot be ploughed the seed should be sown after the land has been somewhat consolidated by rain, or a temporary stocking to harden the ground should take place.

THE SEED MIXTURE.

In certain cases on a first-ploughed fern-burn turnips are sown, and at times even two successive crops are taken off before the ground is laid down to grass. Such methods, however, are applicable only on land where the fern is not particularly vigorous. I am inclined to think that in nearly all instances on ploughed fern-land a seeding with a temporary grass mixture is preferable to immediate conversion into permanent pasture. This is now a regular practice, and the mixture used should consist of about 15 lb. Italian rye-grass, 8 lb. cow-grass, 2 lb. white clover or alsike, and perhaps a little cocksfoot. In a couple of seasons under cattle-stocking such a pasture will be almost entirely cow-grass, and a preliminary crop of this description leaves the ground in excellent condition for the later permanent mixture sowing, and also even for the production of annual crops, both of a forage or cereal nature. The permanent mixture may be sown after the ploughing of the clover sod, but excellent results also follow harrowing the clover in the autumn and sowing almost immediately after. The temporary clover may remain from two to six years before being resown, its duration depending entirely on the condition of the pasture when the permanent mixture is sown. As much as 30 lb. of seed

per acre should be used, of which at least 10 lb. should be cocksfoot. The actual species used in the permanent mixture varies in different localities. Crested dogstail, *Poa nemoralis*, and perhaps timothy, should always be included in addition to clovers and ryegrass. Meadow-fescue is also well worth a place, and not less than 5 lb. per acre should be sown.

Ploughable fern-land is generally of quite good quality except in areas containing large amounts of "raw" pumice, such as is found on the Central Volcanic Plateau. The grassing of fern-land of



TEMPORARY PASTURE — MAINLY RED CLOVER.
Land ploughed four years out of tall fern.

the latter type is not yet in a satisfactory state, and many local problems present themselves. On the better-class fern-land, however, the ultimate aim should be pastures largely composed of cocksfoot and white clover, such as are the dominant pastures of ordinary rain-forest grass-land.

On surface-sown ploughed fern-burns the permanent mixture has to be sown as soon after burning as suitable, and should be similar to that sown on the ploughed land. If the land is poor, grasses such as *Danthonia pilosa* and red- or brown-top should be

included, and also about ½ lb. *Lotus angustissimus*. I should also advise including at least 2 lb. of *Poa pratensis* on all unploughable fern-burns.

The following table of mixtures, compiled from seed-merchants' order-books—all with the exception of the first three having been actually used during the past two seasons — indicates the wide range of variations that occur in fern-country sowings. This is to be expected when the very different classes of country occupied by fern is taken into consideration. It will be noticed that in the majority of the permanent mixtures cocksfoot occupies pride of place, and, in fact, is only excluded in one purely temporary mixture. In one mixture it will be noted that sixteen different species are included, many in small quantities evidently of a purely experimental nature. In many cases yarrow, from ⅛ oz. to ¼ oz. per acre, is also included in the mixtures. I am highly dubious of the value of this plant on fern country. Again, several of the mixtures represent very light sowings. This is a great mistake, and is done in nearly every case because the farmer is not sure whether he will be able to carry out the necessary measures to control the fern; accordingly he is apt to make his mixture as cheap as possible, so that if failure follows the monetary loss is not great.

GRASS-SEED MIXTURES ACTUALLY USED ON FERN-LAND.
(Pounds per Acre.)

Rye-grass, perennial	..	..	2	6	2	6	..	5	4	6	3	5	4	4	5½	9	4	6	4
Rye-grass, Italian	..	..	..	..	1	..	15	2	2	3	3	3	4	10	5	2	2	3	2
Cocksfoot	..	..	1	2	5	3	.	8	8	8	6	7	6	4	10	8	6	16	10
Crested dogstail	..	..	1	1	..	4	..	1	2	1	..	1	½	..	1	1	2	1	2
Timothy	..	..	..	..	1	..	..	½	..	..	..	2	½	..	..	1	..	..	2
Poa pratensis	..	1	1	..	..	1	..	..	..	..	1	..	..	..	..	1	1	..	½
Meadow-fescue	..	..	..	..	..	..	..	2	1	..	..	2	..	..	..	..	2	..	2
Sheep's fescue	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	½
Chewings fescue	..	1	..	..	..	..	..	..	..	1	..	1	½	..	..	1	1	..	½
Poa nemoralis	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	½
Danthonia pilosa	..	4	4	..	1	..	..	..	1½	½	3	..	3	..	..	1	4	..	1
Brown-top	..	..	..	..	..	..	..	..	..	½	3	½	3	..	..	..	..	..	..
Cow-grass	..	..	..	..	½	3½	..	6	3	2	..	..	3	3	4	4	1	1	2	1
White clover	..	..	2	1	½	1	2	2	2	½	1	1	½	4	1	½	1	½	1
Alsike	..	..	..	..	1	..	..	..	..	1	3	3	..	..	..	..	..	..	..	..
Trefoil	..	..	..	..	..	..	..	..	..	..	1	1	..	1	..	..	..	..	..	1
Lotus major	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	½
Lotus angustissimus	..	½	..	..	..	..	..	..	..	½	1	..	..	..	..	½	½	..	..	½
Total pounds per acre		9½	11	11½	15	15	23	23½	23½	25	25	25½	26	26	26½	26½	26½	28½	29

THE CRUSHING OF FERN.

After autumn sowing of grass-seed takes place on fern-land there is virtually no growth at all of the fern till the late spring. The exact time the young fronds begin to shoot through the ground varies with the district. In the North the first growth is considerably earlier than at the same altitude in the South. In general, however, it can be said that the first growth will not be

pushing through the ground till the middle of October. In the winter and spring following the sowing hoggets may be grazed on the young grass, but as soon as the fern begins to show up, and before the fronds begin to uncurl, heavy stocking with cattle from eighteen months to two years of age, or sheep (for preference heavy wethers in good condition), has to be carried out. The object of heavy stocking is either to feed off or break off the young fern. While yet in the curl stage the main stem or petiole of the leaf is very easily broken off, apart from being in the young state quite relished by stock. Where there is a fair growth of grass no evil effects appear to result. At times, however, cattle when fed solely on young fern are

GENERAL VIEW OF A TEMPORARY PASTURE (FOUR YEARS OLD) ON FERN COUNTRY.
Mowing for hay.

poisoned, or at least rapidly lose condition. Fern poisoning is, however, rare when the number of stock employed in keeping down fern is considered.

The prevention of the fern getting beyond the curl stage is the essential feature of fern control. When once the frond expands it becomes far more difficult to break off than when in the curl stage, and if sheep are being used to crush the fern the land must be stocked heavily before any sign of uncurling of the leaf takes place. If cattle are used the fern can be successfully crushed at a little later stage than it can with sheep, and this is the main reason why cattle are often looked upon as more efficient fern-

crushers than are sheep on land suitable for cattle. I should always advise the employment of cattle, as then a delay of a few days in the first heavy stocking in the late spring does not matter much, although it is always better to get the beasts on the ground before any of the fern has reached beyond the curl stage. On many types of ground cattle-stocking is not practicable, and sheep must then be used.

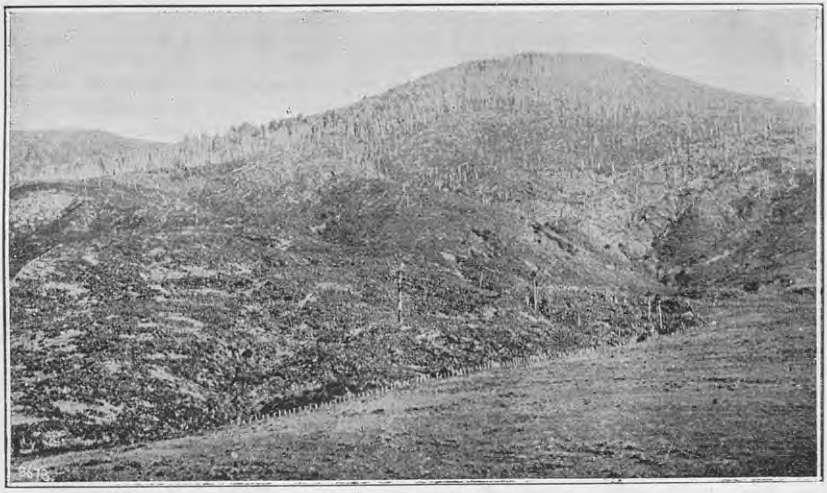
In crushing fern subdivision into comparatively small paddocks of not more than 50 to 100 acres greatly facilitates the process, and even smaller paddocks are desirable. The area annually broken in should never be so large as to necessitate insufficient fencing, on account of expense, as a small acreage thoroughly dealt with in the season following sowing is much more satisfactory than a larger area on which the fern is only partly kept in check. Every fern-frond that is allowed to expand only increases the difficulty of control, for by its activity in manufacturing food materials it restores vitality to the underground stems and renders them capable of producing fresh fronds. When stock are turned into an area ready for crushing, the quicker the land is cleaned up the better. As soon as they have eaten down or broken off by trampling all the young fronds the stock should be removed to another area and the process carried out there. It has been said that with sheep-crushing four days' stocking and eight days' resting of the paddocks should be carried out during the first season, but such an intensive treatment is not really necessary.

When once the first great growth of fern has been checked in the spring a considerable time often elapses before the next growth—developed from buds arising from the fronds previously eaten down—makes its appearance above ground. As soon as this occurs restocking has at once to be taken in hand and the operation repeated each time the fern reappears. If stocking is properly carried out the first season after sowing there should be very little difficulty experienced in the following years. Under no circumstances, however, should the fern be allowed to get away after the first season, and if this occurs the area may rapidly become fern-infested again. In paddocks where in the second or third season fern gets away in patches it should, if possible, be mown so as to force up fresh growth, and then be crushed out while the fern is young.

The crushing-out of fern, provided plenty of stock are available, presents no difficulties; but, unfortunately, in certain cases the conversion of fern-land is attempted without proper provision being made for an adequate supply of stock for crushing purposes during the initial crucial stages.

THE CONTROL OF INDUCED FERN.

The control of induced fern presents difficulties that are not so noticeable when breaking in natural fern country. Induced fern generally follows either an unsuccessful burn or else develops on bush-burn country where the grass mixture sown fails to permanently keep its hold on the land—that is, where a mixture not suitable for the district is used. On comparatively flat land induced fern should never become particularly troublesome, for the same methods as applied against natural fern can be carried out. But on steep, rugged country induced fern is often extremely bad,



BUSH-BURN COUNTRY (ON HILL) REVERTING INTO FERN.
Holding-paddock in foreground clear, owing to heavy stocking at intervals with sheep.

and when once well established is exceedingly difficult to eradicate. On hilly bush-burn country likely to turn into fern within a few years of sowing very particular attention has to be paid to the mixture used. Cocksfoot and rye-grass are generally the predominating seeds that are sown, and for some years the land may keep up a two-sheep standard. In a few years, however, the rye-grass disappears, and soil-creep occurring on the bare ground leaves the isolated cocksfoot plants raised above the general level, in which condition they are very liable to be actually pulled out by sheep. Fern then begins to appear, and, the carrying-capacity having dropped, sufficient stock cannot be maintained to keep it down. In a few years the fern attains the mastery, and frequent firing of the fern, followed by insufficient stocking, only makes its dominance

more pronounced. The farmer meanwhile has probably kept up his total number of stock by fresh bush-burns, which in turn finally become fern-clad.

Such a condition of affairs is, happily, not usual, but many areas can be seen that have been treated in this way. On this class of country I hold it to be better to grass with a mixture that is likely to produce permanent one-sheep grazing rather than virtually sacrifice the land for a few years' higher carrying-capacity by means of grasses that by themselves are not likely to remain permanent. I should advise the cutting-out of perennial rye-grass altogether and making a fairly liberal use of such grasses as *Poa pratensis*, Chewings fescue, crested dogstail, and *Danthonia*, with probably brown-top in the northern parts of the Dominion. Amongst these grasses *Poa pratensis* is one of the most important; it binds the association together well, gives excellent feed, and stops soil-creep —a very important consideration on steep hills.

A generalized mixture, somewhat as follows, should give good results on country where fern is likely to attain the mastery: Cocksfoot, 8 lb.; *Danthonia pilosa*, 5 lb.; *Poa pratensis*, 3 lb.; Chewings fescue, 5 lb.; crested dogstail, 2 lb.; *Poa nemoralis*, 2 lb.; white clover, 1 lb.; *Lotus angustissimus*, ½ lb.: total, 26½ lb. In addition, a few pounds of Italian rye-grass, to give an immediate bite, might with advantage be included.

The objection to a mixture of the above type is its expense, but this consideration should in no case determine the farmer to use a lower-priced but unsatisfactory sowing. In all cases the area of the bush-burn must be regulated so that an efficient—even if high-priced—mixture can be sown.

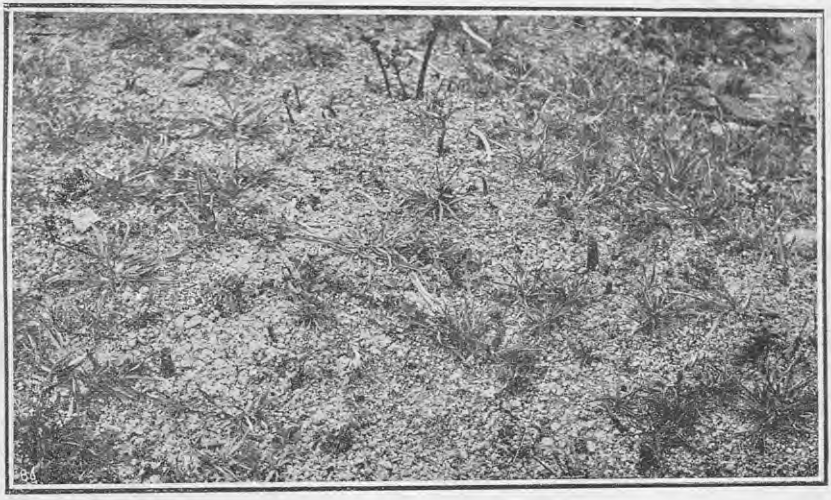
On induced-fern country that can be subdivided easily, and where the ground is not too hard for grass-seed to germinate, methods similar to those employed on natural fern country can be carried out. It is important, however, to let the fern develop a good growth before being fired. The burning each season of induced fern not followed by sowing is to be deplored, as in this way the chance of ever getting a good seed-bed is seriously reduced. Where it is found absolutely necessary to burn induced fern without previous subdivision an attempt should be made to turn the land into *Danthonia* country. After burning, a mixture somewhat after the following nature should be used: 8 lb. *Danthonia pilosa*, 8 lb. Yorkshire fog, and 3 lb. suckling-clover. Such a mixture, when even partly established, will survive periodical burning of the fern, and should later develop into exceedingly useful pasture.

On certain types of induced fern the utilization of pigs in the rooting-up and destroying of the underground stems has been applied

in many cases. Certainly the effect of pigs is often extremely satisfactory, but the main objection to this method is that only small areas can be dealt with, and the expense of fencing is very considerable.

CONCLUSION.

A consideration of the conversion of fern-land into grass shows clearly how whole-heartedly the farmer will attempt to control a serious weed provided practical and payable methods for its eradication are known. The control of fern has in most instances been shown to be highly remunerative, and no effort is spared to attain that end. How different it is with weeds whose control has not yet been shown to be a profitable proposition! Fern, although one



BUSH-BURN LAND REVERTED TO FERN, THEN BURNT AND SOWN, AND HEAVILY STOCKED AT DEFINITE INTERVALS.

Traces of the eaten fronds and fronds broken down are to be seen.

of the worst of our weeds, and in the control of which very large sums of money are annually expended, has not been deemed worthy of inclusion in the Noxious Weeds Act, nor would its inclusion be of any aid in its repression. The pioneer farmers of New Zealand showed that the control of fern under most conditions was both feasible and payable, and the average farmer stands in no need of compulsion in the conversion of fern into grass-land. In certain instances where fern is spreading seriously and its control is but half-heartedly carried out the main reason for the apparent apathy with regard to its eradication is because in such cases really payable methods of control have not yet been demonstrated.

PASTEURIZATION OF MILK FOR CHEESE-MAKING.

C. STEVENSON and W. GRANT, Dairy Instructors, Taranaki.

SINCE the pasteurization of cream for buttermaking resulted in such a marked improvement in the quality of butter considerable interest has been taken in the possibility of applying similar treatment to milk used for cheesemaking. For some time this was considered almost impracticable, owing, firstly, to the very large quantities of milk to be dealt with in the limited time available for this purpose —in most factories from two to two and a half hours; and, secondly, to the high cost of heating such large quantities of milk by the methods adopted in butter-factories for dealing with cream.

The advent of the regenerative heaters now on the market has, however, completely overcome both the difficulties indicated. These machines are capable of treating up to 1,800 gallons of milk per hour, while heating to a temperature of from 165° to 170° F., and at the same time regenerating up to forty degrees. Thus, a duplicate plant of this capacity running for two and a half hours would in that time be capable of dealing with 9,000 gallons of milk — a capacity sufficient for practically any of the largest cheese-factories in the Dominion. Moreover, there appears to be no reason why the capacity of these machines could not be increased to, say, 2,000 gallons per hour.

A complete plant of 1,800-gallon capacity can be installed for £300. As few cheese-factories have yet carried on this pasteurizing-work for a complete season, no reliable figures are available regarding the cost of running. It is, of course, evident to any one conversant with the business of cheesemaking that heating the milk to a temperature of 165° must cause an increase in the amount of fuel consumed, but this increase is actually not nearly so great as would at first appear to be the case. When pasteurizing is carried out there is obviously no necessity to heat the milk in the vats, as is the case under the old system of cheesemaking. This latter method of heating is a most extravagant one, whereas the system of regenerative heating is as economical a one as it is possible to obtain, the heaters in use being so constructed that they utilize to the fullest possible extent every unit of heat applied.

From information at present available it would appear that the increase in fuel-consumption when pasteurizing with live steam is from 15 to 20 per cent. A saving, however, may be effected in this direction by having exhaust steam from the engine connected to the heater.

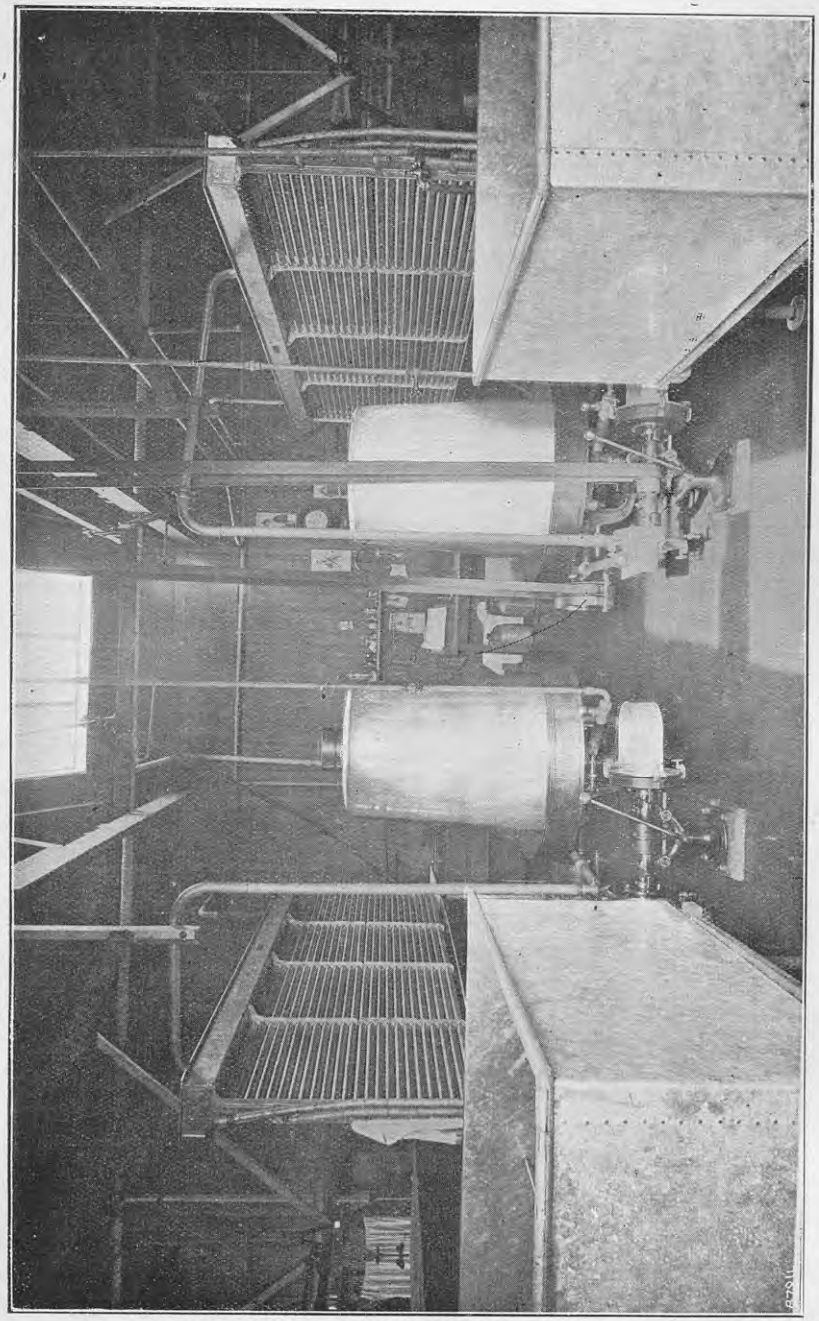
Some dairy companies contemplating the installation of a pasteurizing plant may be inclined to delay on account of the scarcity of water available for cooling purposes; but as the regenerative heater delivers the milk to the cooler at a temperature of 125°, and it requires only to be further cooled to setting-temperature—86° to 90°—it will be seen that no very great quantity of water is required. Where water is somewhat scarce a saving can be effected by installing a small pump, and pumping the waste water from the cooler to overhead tanks. This water is, of course, perfectly clean, though slightly warm.

In the manufacture of cheese from pasteurized milk practically the same treatment should be applied as in dealing with non-pasteurized milk under normal conditions. Extreme care must be taken to guard against the possibility of the milk becoming in any way contaminated during the process of pasteurization. Only the best-quality drawn brass piping should be used where piping is required. In order to facilitate cleaning, the piping should be joined by brass unions in fairly short lengths. Every part of the plant with which the milk comes in contact should be thoroughly cleaned as soon as possible after the machine is stopped.

A good starter is, of course, essential in either case; but in working with pasteurized milk, which is practically free from bacteria, the influence of the starter is naturally much more prominent. Consequently, in the manufacture of cheese from pasteurized milk only the best-quality starters should be used.

The best pasteurizing-temperature to aim at is from 160° to 168° F. In the very late autumn it will be found advisable to fix the maximum temperature at 160°. A temperature lower than 160° is not sufficient to destroy all the injurious germs, while, on the other hand, the curds obtained from milk heated to 175°–180° are always more or less broken, and, in addition, usually develop a slightly scorched flavour.

The use of a quantity of hydrochloric acid for acidulating the milk before adding the rennet has been tried in some cases; but, except when the milk was heated to high temperatures, practically no difference in the nature of the curds was observed. When heating the milk to temperatures of 175° or over, the addition of



TWIN PASTEURIZING PLANT AT PIHAMA CHEESE-FACTORY.

Showing whole apparatus—receiving-vats, milk-pumps, regenerative heaters, and coolers.

1 oz. to 1½ oz. of hydrochloric acid per 100 gallons of milk will be found to be an advantage.

There are many benefits to be derived from the pasteurization of milk for cheesemaking, chief of which is the great improvement in the quality of the cheese. Some very striking instances of this have been observed in Taranaki during the past season. One particular factory while working under the old method always produced a large percentage of second-grade cheese, but since pasteurization was adopted not a single second-grade cheese has been manufactured, and, in addition, the factory's average grade has risen from 89 points to 92.

Another important factor from the dairy-farmer's point of view is whether or not the expenditure incurred in installing a pasteurizing plant is going to be a good investment. From information now available there can be no doubt that the investment is an excellent one.

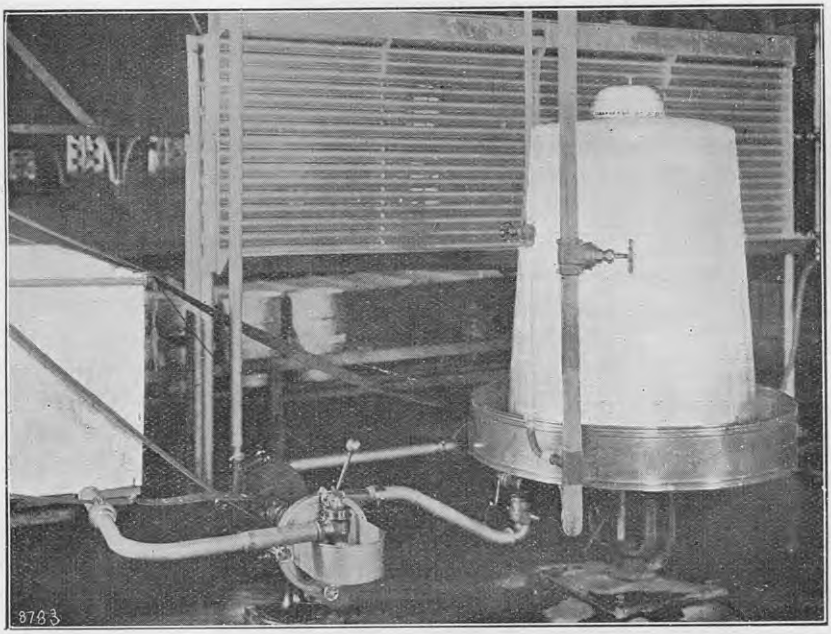
There are many ways in which the farmers' returns will be increased with the assistance of a pasteurizing plant. To begin with, "fast-working" vats, which are due to slightly overripe milk, are never experienced when pasteurizing is followed. All factory managers and directors are well aware of the enormous losses which take place while working with this class of milk, especially in a season such as the one just past, when the weather was for a long time exceptionally warm. The saving effected in this direction alone, by means of the pasteurizer, must be very material.

Again, we have the fact that there is a considerable increase in the amount of butter-fat incorporated in cheese made from pasteurized milk. This is proved by the small percentage of fat left in the whey, and also by the fact that no fat is found floating on the milk or in the cheese-presses. The presence of extra solids in the cheese indicates, of course, that the moisture-content can be increased without injury to the body, thus producing a direct increase in the amount of cheese made per pound of butter-fat contained in the milk.

The improvement in the quality of the cheese also means a direct increased return to the dairy-farmer. By working with milk which has been delivered to the factory in good condition and afterwards pasteurized, and by giving careful attention to the manufacture, second-grade cheese can be almost entirely eliminated. As practically all cheese sales are made on a basis of ¼d. per pound deduction for second-grade, the saving thus effected must also be credited for the most part to the pasteurizer.

Taking all these factors and the saving thereby effected into consideration, it is perfectly safe to assume that the total increased return of a cheese-factory working with pasteurized milk will be equal to at least a 3-per-cent. increase in yield. On this basis a very simple calculation will show the amount of net profit, after allowing for interest and depreciation on plant, extra fuel required, and also a reduction of approximately 20 per cent. in the amount of butter manufactured from the fat in the whey.

Regarding the quality of the milk supplied, it would be a fatal mistake for the dairy-farmer to assume that the installation of a

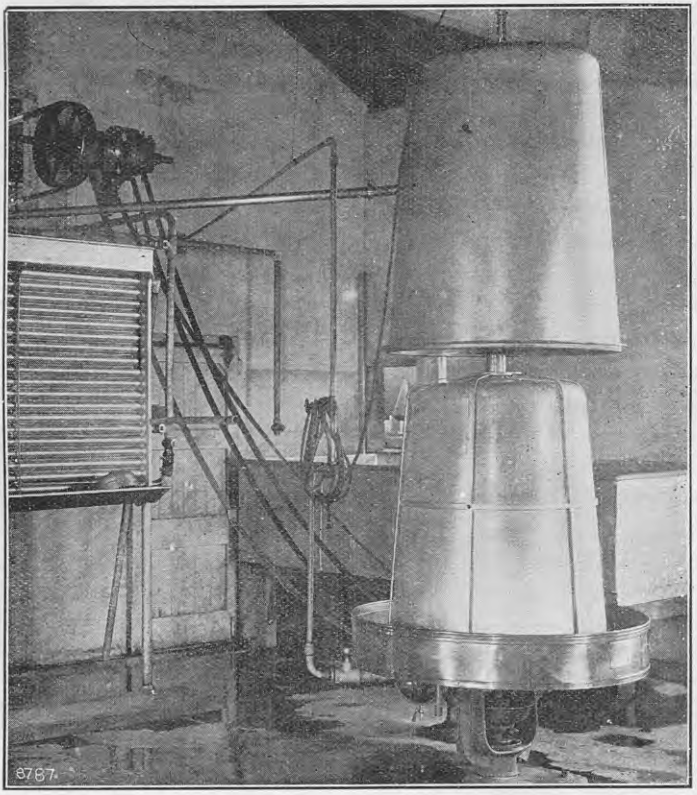


REGENERATIVE HEATER FITTED FOR USE OF EXHAUST STEAM.

pasteurizing plant at the factory in any way lessens his responsibilities with regard to the care of the milk on the farm. The quality of the milk supplied will always be the chief factor in determining the quality of the cheese made, whatever method of manufacture may be adopted. For instance, an experience in Taranaki during the past season with milk strongly tainted with turnip flavour proved conclusively that pasteurization would not entirely eliminate this flavour. The latter was easily detected in

the cheese, notwithstanding the fact that the milk had been heated to a temperature of 190°.

During the season 1914–15 seven pasteurizing plants were installed in cheese-factories in Taranaki, while at the present time thirty-two plants are in operation there. This large increase in the number of plants installed proves that the factory managers and directors in this district are fully convinced of the benefits



METHOD OF DISMANTLING REGENERATIVE HEATER FOR WASHING.

of pasteurization. From all the facts now available, it is quite evident that the pasteurization of milk for cheesemaking has been in all respects an unqualified success.

There is no doubt whatever that the general adoption of the system of pasteurization in the cheese-factories throughout the Dominion will cause as great a revolution in the manufacture of cheese as it has already effected in relation to butter.

CONTROL OF THE NEW ZEALAND FLAX GRUB.

PRELIMINARY OBSERVATIONS.

DAVID MILLER.*

JUDGING from observations made throughout the Dominion by the writer, the larval attacks of *Xanthorhoe praefectata* upon New Zealand flax (*Phormium tenax*) are most serious in the Makerua Swamp, on the left bank of the Manawatu River.

It has been asserted that the regularity or irregularity of floods causes respectively a decrease or increase of the grub; but it is found that *Xanthorhoe* is just as liable to seriously attack flax swamps which are very wet or subject to regular floods as areas that are perfectly dry. This is illustrated by the swamp at Otaitai Bush, in Southland, where four years ago, when the swamp was undrained and very wet, the larval attacks were very serious; while now, though the swamp is dry and well drained, the larvæ have practically disappeared. Again, in the Waikato the flax growing upon the river-bank and subjected to floods is more seriously attacked than the flax on the higher levels. The best example is the extensive swamp area in the vicinity of Te Puke (near Tauranga), where the flax grows not only at sea-level and along the banks of the Kaituna River, where the swamps are drained and dry, but also upon the terraces overlooking the river-flats, and consequently upon a variety of soils, such as clay, loam, and peat. Throughout the whole of this dry area the larvæ have not yet made an appearance. The hill flax of Southland is mostly free from *Xanthorhoe*, while, owing to the steepness of the ground, the country is well drained. This is also characteristic of many other swamp areas, such as those at Koputaroa (in the Manawatu), Otaika (near Whangarei), Hikutaia (near Te Aroha), &c. On the other hand, in the Makerua Swamp, which has of late been subject to few floods and has been well drained, the larval depredations have become extremely serious. Again, in the swamps at Kawakawa (Bay of Islands), which are low-lying and undrained and

* Mr. David Miller, well-known in the Dominion as an entomologist, was some months ago attached to the Biology Section of the Department for the purpose of conducting a complete investigation of the pests and diseases of New Zealand flax, especially with a view of devising methods of control of the grub *Xanthorhoe praefectata* in the interests of the flax-milling industry.—EDITOR.

subject to severe floods (there being no fall), *Xanthorhoe* is absent. After a flood these swamps are not only free from all insects, both winged and otherwise, but owing to the heaviness of the floods even the flax in parts is almost exterminated. The condition of the grub being absent from wet or flooded swamps is also seen at Gore, and two small areas in the vicinity of Te Aroha, and in a few other isolated cases. Although *Xanthorhoe* exists throughout New Zealand, its attacks on the flax are at present of no moment except in the Makerua Swamp.

With few exceptions it was observed that *Xanthorhoe* confined its attacks to those bushes around and within the roots of which was an accumulation of decaying leaves and other rubbish, which apparently afford a suitable shelter to the grub during the day. Also, as a rule, there were no attacks on those bushes free from rubbish at the roots and having the fans well separated at the base, the butts being exposed to the light. In most public and private gardens where phormium is grown rubbish is not allowed to accumulate at the base of the plant, and invariably in such cases the attacks were totally absent. However, in part of the Dunedin public gardens the flax-bushes have been neglected and rubbish has accumulated, in which case the attacks of the grub are well marked. If the larvæ be placed in the direct sunlight they become helpless. They are nocturnal in their habits, but have been noticed to commence feeding operations on dull and wet days. Temperature seems to affect their movements; practically few or no fresh attacks were noticed in the North Auckland districts, a few in the Manawatu, many at Waikanae, while great activity was observed in Southland, where the weather was very cold. It should be noted, however, that a month intervened between the observations of North Auckland and those in Southland, which last district was visited in April, about six weeks after the observations made in the Manawatu and at Waikanae.

The grub exists in districts where severe frosts occur—for example, in parts of Southland; while in other districts also subject to frost the grub does not exist—*e.g.*, on the margins of Lake Tutira, which has an elevation of about 800 ft. above sea-level. But the absence of the grub in this locality may be due to the presence of large numbers of swamp-hens and other native birds. The presence of birds may also cause the absence of the grub at Wairoa, where the flax grows at sea-level and is not subject to frosts which occur in the surrounding valleys.

The presence of birds (such as the swamp-hen) in the swamps probably plays an important part in keeping such pests as *Xanthorhoe* in check. I have noticed that in most of the Auckland, Hawke's

Bay, Wairarapa, and Southland flax areas, where the grub does no material damage and is in many places totally absent, the swamp-hen is present and in several cases very abundant. Also, where there are large flocks of starlings the grub is by no means serious. It is said that the grub became more apparent in the Makerua Swamp after the extermination of the swamp-hen. Though this may be one of the causes of the increase of *Xanthorhoe* in this district, it will probably be found that other changes in the environment have influenced the insect directly or indirectly.

It would prove invaluable to secure swamp-birds from various localities and dissect the crop in order to ascertain what forms their staple diet, and whether they are partial to *Xanthorhoe* when other foods exist, as it is well known that certain insects are unpalatable to birds. I have also observed several small brown lizards amongst the flax in those districts where no *Xanthorhoe* exists, and the same may apply to these animals as to birds. It would be a simple matter to confine two or three swamp-hens within an area of flax badly attacked by the grub, and keep them under close observation. A wire-netting fence would be suitable if the wings of the birds were cut. Lizards could be kept under observation within a much smaller area than the birds.

Live-stock would no doubt play an important part in freeing the swamps of undergrowth and rubbish. As already indicated, the larvæ, being nocturnal, doubtless require some such shelter as decaying leaves, &c., to protect them from the sun and daylight. In the Makerua no stock are run, but on the other side of the Manawatu River—the Moutoa—where the grub is not serious, there is a dense growth of grass, and stock are allowed access to the flax area. In many parts where the grub is not serious stock are allowed to graze upon the grass of the swamps. Such is the case in Auckland, Southland, Nelson, &c.; but at Wairoa and other large blocks, though the grub is practically absent, no stock are grazed, since the flax is so dense that beasts would be unable to move about without damaging the leaf.

If stock were employed it would be necessary to fence in each area as it is cut until the young flax had attained a sufficient growth not to be eaten by the animals. This would necessitate fencing off the newly cut areas, and for this reason I suggest that sheep would prove the most satisfactory in this case, as they are not so liable to inflict damage as cattle frequently do, chewing off the succulent parts of the leaves to about half their length and leaving the fibre stripped. Besides, the outlay on fencing for cattle would no doubt be prohibitive. It would also be necessary to know at what periods the stocking of the swamps

would be most likely to damage the pest, and consequently a thorough knowledge of the life-history of *Xanthorhoe* would be required.

In the Manawatu swamps the river, and to a less extent drains, form an impregnable barrier to the advance of the larvæ of *Xanthorhoe*, but of course would hardly check the distribution of the moth. The fact that two areas such as the Moutoa and Makerua, so closely placed—being only separated by a river—should differ so much as regards the attacks of the larvæ points to a probable local difference, such as a more palatable leaf in the Makerua than the leaf of the Moutoa. This might be caused by some latent element in the plant-food of the soil made available by the heavy draining of the Makerua—the peat sinking, becoming more compact and undergoing decomposition in contact with the atmosphere. The lack of this element may account for certain patches of the Makerua being almost free from the attacks of the larvæ, though surrounded by badly affected leaf.

Not only is the Moutoa Swamp free from serious grub-attacks, but also the other areas—the Lockwood Swamp—on the same side of the river. That the river should separate two classes of soil seems very probable; but none of the areas on the Moutoa side of the river have been so severely drained as the Makerua. Again, the heavy draining of the latter swamp, combined with the peculiarity of the soil, may present some favourable condition for the pupation of the insect, affording perhaps greater warmth and protection to the pupa. But the large flax areas in the Bay of Plenty have also been well drained, and the peaty portions have sunk considerably, as in the Makerua, yet *Xanthorhoe* is practically absent in the former locality. However, though the one condition may occur in both localities, they may differ in certain other features necessary for the increase of the insect. Or, again, in the Makerua the environment may have been so changed that some parasite or predaceous enemy has found the new conditions unfavourable.

It is apparent that *Xanthorhoe* does not abound on hill country except where some rubbish or decaying matter affords a suitable protection. But here, again, the succulent parts of the leaf may be found unpalatable to the larvæ, as it is well known that it takes less leaf of the hill flax to obtain a ton of fibre than is required for the same amount of the swamp flax, the former taking much longer to mature than the latter, and apparently having less edible tissue and more fibre.

Before any definite conclusions can be arrived at as regards pupation, it is necessary to know whether the insect pupates in

the ground, and, if so, at what depths; it would also be necessary to know where the female deposits the eggs, whether in sheltered or exposed conditions.

The extinction of a natural enemy, whether parasitic or predaceous, would release a very important check on the increase of *Xanthorhoe*, and if this be so it would be necessary to discover what was the enemy, and what the cause of its extinction—whether due directly to new conditions or indirectly through those conditions causing an increase of a secondary enemy preying upon the first; also what stage of the metamorphosis of *Xanthorhoe* is the most vulnerable, and if any stage is yet attacked by parasitic or predaceous enemies, or if each stage is liable to be attacked by its particular enemy. As the greatest mortality to insect-life occurs in the wingless stages—*i.e.*, egg, larva, and pupa—it would be most reasonable in this case to apply a check during these periods. However, by the use of birds a considerable decrease of the moths might be brought about if it were known the extent of their flight, and whether the moth be agile or sluggish, how far and high it is capable of flying, also whether it usually alights near the ground or otherwise, as it often is to be found with wings expanded on the flax-blades, its white colour rendering it conspicuous under these conditions.

The larval attacks of *Xanthorhoe* have been noticed upon other plants, such as bullrushes, and the absence within a particular area of an abundance of food plants other than flax would cause the larvæ to concentrate their attention upon the remaining available food material. I have been unable to ascertain whether the grub selects one or more varieties of flax in preference to all others, but, so far as has been observed, most varieties are liable to be attacked.

The insect fauna of the flax areas does not vary to any great extent throughout New Zealand, although I cannot definitely report on the insects of Southland, as the weather was extremely cold when the observations were made there. However, of the predaceous forms, the *Libellulidae* (dragon-flies) exist in large numbers in all areas of flax; but during the period of my visit (February–March) they were more abundant in the North Island than in the South (visited during April). It is curious that the *Asilidae* (robber-flies) abound in the Makerua Swamp, which in many places is very dry and the ground bare—their natural habitat. But across the river in the Moutoa Swamp, which is moister and carries a growth of grass, those *Diptera* do not exist. They may have some secondary bearing on the increase of *Xanthorhoe* in that they prey upon some other insect or insects which, before the advent of the

Asilidae, held *Xanthorhoe* in check, the new drier conditions of the swamp being more favourable to the *Asilidae* than formerly. These flies were not nearly so abundant, and were in most cases absent from the other swamps, both in the north and south. Another predaceous family, the *Therevidae*, with similar habits to the *Asilidae*, is represented in the Makerua but not in the Moutoa. It is evident that these predaceous insects do not prey upon *Xanthorhoe*, or at least to no marked extent—perhaps because the latter are nocturnal and the former diurnal—else the pest would not be so marked. The parasitic insects are also well represented throughout the flax areas, and some of these insects will require to be investigated.

In action taken to control *Xanthorhoe* it will probably be necessary to apply not only one method of checking, but a combination of methods, since the insect presents four different stages of development, each with its own peculiarities and, probably, enemies.

CERTIFICATE - OF - RECORD BULLS.

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

IN the last issue of the *Journal* comment was made on certain certificate-of-record bulls and the production of butter-fat by their C.O.R. daughters. The following notes refer to other certificated bulls that have attained an enviable reputation amongst dairy sires:—

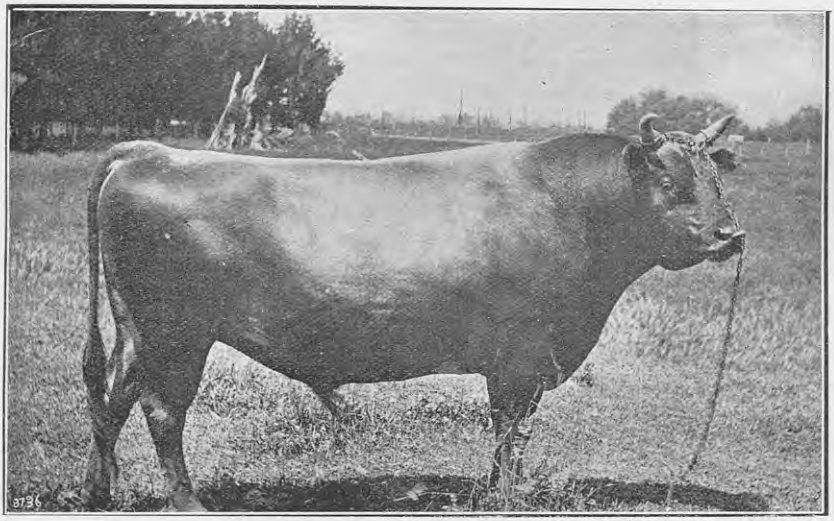
JERSEYS.

Starbright.—The bull Starbright was bred by Mr. J. A. McCrea, of Palmerston North, and first saw the light of day on 17th September, 1906. His sire, Starlight, was imported from Australia, and is the sire of Sabean III, which produced 625·38 lb. butter-fat in 365 days.

Eight of Starbright's C.O.R. daughters were bred by Mr. A. A. Ward, of Tariki, Taranaki, five of them being tested by him. Mr. Ward also tested, as mature cows, Psyche, with 531·24 lb. fat; Waif's Glory, with 522·19 lb. fat; and Michaelmas Day, which produced 480·87 lb. fat. Five of Starbright's C.O.R. daughters are from these dams, while another is inbred from a daughter of Michaelmas Day. With such foundation stock, Starbright had an excellent opportunity to "make good." That he has done so is a credit alike to himself and to Mr. Ward's original herd.

The record of Miro, a daughter of Starbright from Waif's Glory, has attracted considerable attention. She was the leader in the two-year-old class for a time, with a record of 548·69 lb. fat, which is almost double her standard of 276·20 lb. fat. Tuna, a half-sister of Miro's dam, and sired by Starbright, as a four-year-old produced 437·74 lb. fat. Waif's Frisky, a full sister of Tuna, qualified for a certificate by producing in 336 days 419·93 lb. fat in the class for three-year-olds, her standard being 309·30 lb. fat.

Starbright is the sire of three C.O.R. daughters from Michaelmas Day. The best of these records was made by Waitui, which produced 463·38 lb. fat as a three-year-old. Nellie, also as a three-year-old, has a certificate for 367·84 lb. fat in 349 days; and



STARBRIGHT.

Michaelmas Daisy, in the four-year-old class, produced 337·74 lb. fat in 302 days. Polly, a daughter of Starbright from his own daughter Waitui, produced 409·22 lb. fat as a two-year-old.

Only two other daughters of Starbright exceeded their requirement by as many pounds of fat as did Polly. One of these was Polly's dam, Waitui. So far as the record is an indication, the inbreeding evidenced by Polly's pedigree was not injudicious.

Two other daughters of this bull have also produced creditable records. Palm-tree, in the four-year-old class, has a credit for 411·70 lb. fat. Tui, whose dam is Psyche, referred to above, produced as a two-year-old 358·66 lb. fat in 320 days.

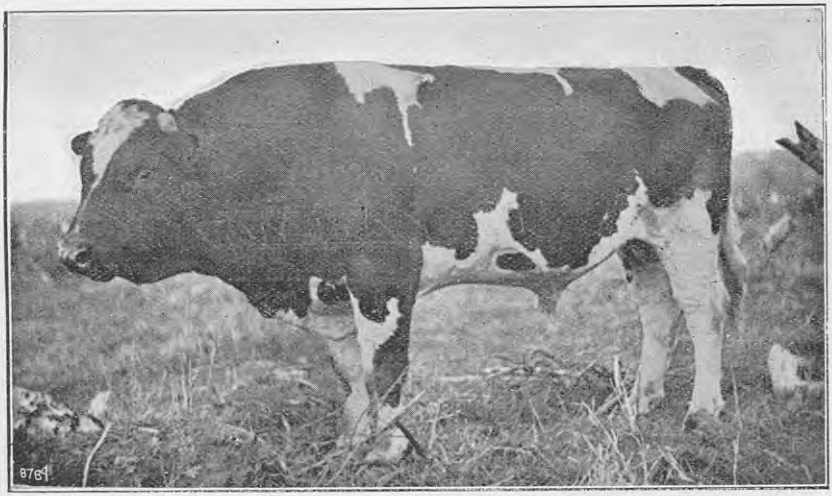
It will be noted from the foregoing remarks that the progeny of a number of these daughters of Starbright are backed by C.O.R.

figures for two generations, and that the strains indicated in a number of the pedigrees have been well proved as producing-lines.

FRIESIANS.

Colonel Manor of Riverside.—The name of the Friesian bull Colonel Manor of Riverside has been brought to the fore as the result of testing work done by Messrs. C. A. Hopping and J. Liggins. This bull was imported by Mr. C. Hopping, and is the sire of five certificate-of-record daughters, all of which were bred by Mr. Hopping.

The best record held by any one of this bull's daughters is that of Lady Mooie Blanco III of Ashlynn. She commenced her test at



COLONEL MANOR OF RIVERSIDE.

the age of 5 years 295 days, and in 321 days produced 15,022·40 lb. milk, containing 652·21 lb. fat. Doubtless this cow inherited some of her ability as a milker from her dam, which in 241 days produced 10,602·80 lb. milk and 401·43 lb. fat. Not only is Lady Mooie Blanco III a heavy producer of milk and butter-fat, but that she transmits her qualities to her offspring may be noted from her daughter's record as a three-year old, which stands at 14,671·70 lb. milk, containing 626·06 lb. fat, in 290 days.

Sunflower of Ashlynn, in the three-year-old class, produced a record which reflects credit on her sire, Colonel Manor of Riverside. In 251 days she gave 11,308·80 lb. milk, containing 498·30 lb. fat. Riverside Violet, another daughter of this bull, was tested by Mr. C. A. Hopping as a two-year-old. In 297 days she produced 11,762·20 lb. milk, containing 398·98 lb. fat.

Two of the daughters of this bull made their records on the farm of Mr. J. Liggins, Tokomaru. Each cow was in the mature class, and each did creditable work as a producer. Ashlea Daphne in 302 days has a production of 12,352·0 lb. milk, containing 463·36 lb. fat, while Ashlea Cissy in 286 days gave 10,457·50 lb. milk and 404·96 lb. fat. Both Ashlea Daphne and Ashlea Cissy represent a mingling of the American strain of the sire with a dam representing Mr. Grigg's breeding.

Paul Pietertje.—Paul Pietertje is a son of Sir de Kol Inka Pietertje, who has twelve certificate-of-record daughters. His sire and dam were both imported from North America by Mr. Newton King when he founded his purebred herd.

Paul Pietertje was purchased from Mr. King by Mr. J. Donald, who placed him at the head of his herd at Westmere, Wanganui. To daughters of this bull bred by Mr. Donald ten certificates have been awarded.

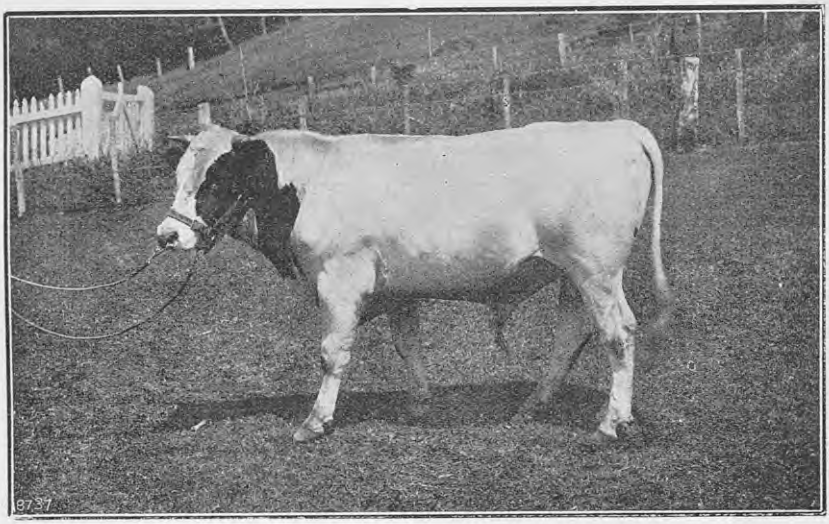
In the Westmere herd Paul Pietertje was mated with females of the strains imported from Holland by Mr. John Grigg, of Longbeach. A general survey of the C.O.R. testing results indicates that this system of breeding—*i.e.*, the mating of sires of North American descent with females of Dutch lineage—has frequently produced very satisfactory results, and in many instances the progeny have proved of outstanding excellence. It was by using Nazli de Kol, a full brother to Paul Pietertje, with foundation cows descended from Mr. Grigg's importations that Mr. G. Aitchison, of Kaitangata, got such splendid results.

Netherland Princess IV, the highest C.O.R. daughter of Paul Pietertje, is well known to those readers of the *Journal* who are interested in purebred dairy stock. Her production of 805·77 lb. butter-fat has been exceeded only once in Australasia, and then by an older cow in New Zealand. The dam of Netherland Princess IV was Netherland Princess, a daughter of Netherland Queen VII, which cow produced 659·31 lb. fat under our checking system, although no certificate has been granted. Two full sisters of Netherland Princess IV were bred and tested by Mr. Donald. Of these, Westmere Princess Pietertje gave the higher production. Commencing at 1 year 236 days of age, for 303 days she has a credit of 424·10 lb. butter-fat from 11,113·70 lb. milk. The other full sister, Princess Paul Pietertje, in the two-year-old class, produced in 280 days 10,388·60 lb. milk, containing 386·08 lb. fat.

All of Paul Pietertje's C.O.R. daughters were tested young. Westmere Duchess V commenced at the age of 1 year 304 days, and produced 13,724·80 lb. milk, containing 461·17 lb. fat. Caroline Paul started her first season at the age of 1 year 295 days, and

in 314 days produced 325·16 lb. fat. The succeeding season she commenced her record in the two-year-old class and raised her repeat certificate to 402·85 lb. fat.

Brookland Johanna Pietertje was sired by Paul Pietertje, her dam being a daughter of Netherland King, an illustration of which bull appeared in the May *Journal*. In the two-year-old class this daughter produced the creditable record of 417·17 lb. fat in 305 days. Another daughter of similar breeding to the foregoing is Netherland Duchess Pietertje. This young cow, in the three-year-old class, in 331 days produced 11,019·70 lb. milk, containing 383·82 lb. fat.



PAUL PIETERTJE.
Photographed when a two-year-old.

The last daughter of Paul Pietertje to qualify is Domino Queen. She is a granddaughter of Domino, imported by Mr. J. Grigg, and bears the same relationship to the imported cow as does Domino III, who, before the commencement of the C.O.R. testing, had a credit at the Weraroa Experimental Farm for 365 days of 21,264 lb. milk and 762·4 lb. fat. Domino Queen milked 334 days and produced 322·21 lb. fat as a junior two-year-old.

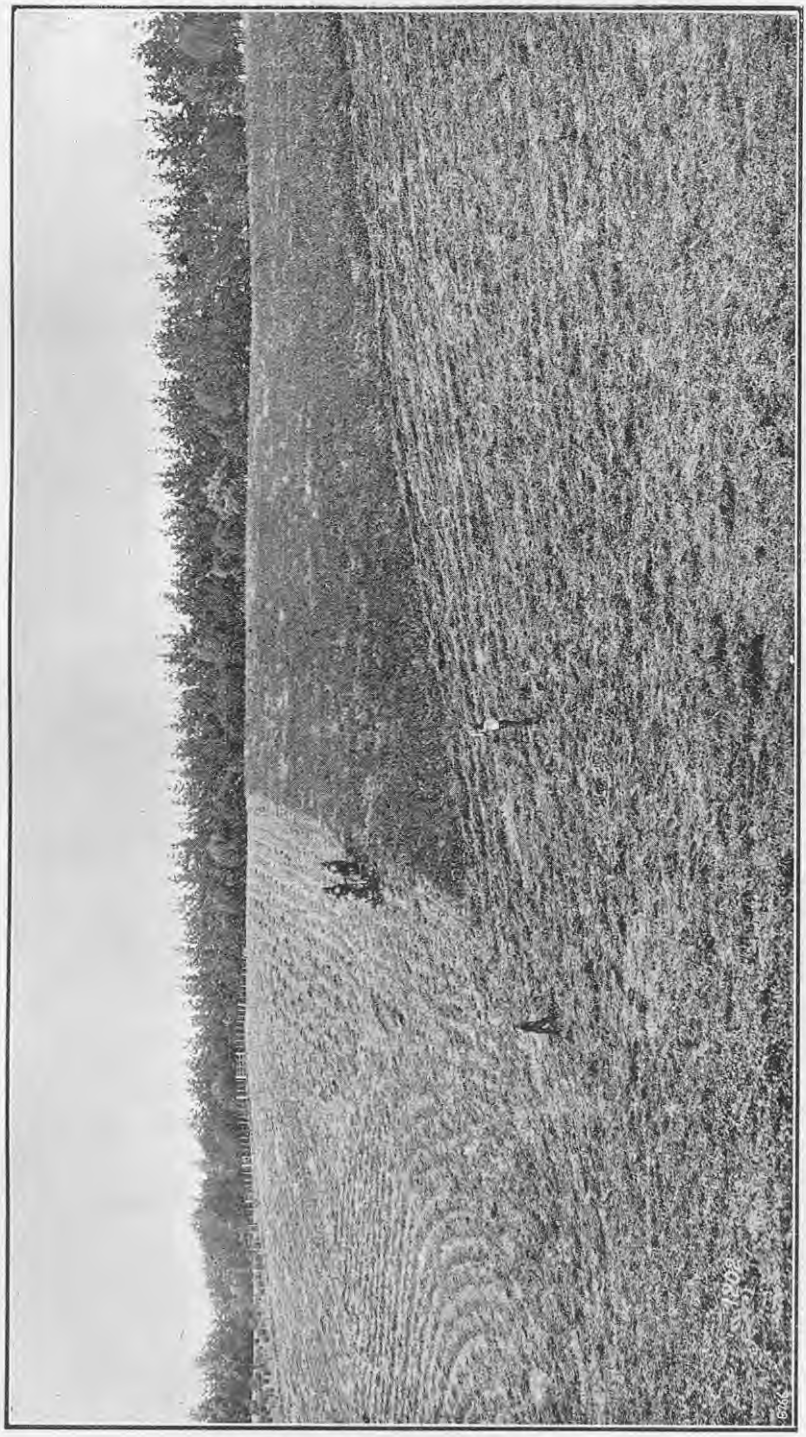
With the exception of Netherland Princess IV and Caroline Paul, all of these daughters of Paul Pietertje made their records during 1914–15. This was a particularly dry season at Westmere, and twice-per-day milking was followed much of the time. The productions are, therefore, more creditable than the abstract figures indicate.

LUCERNE-CULTURE.

A MOUMAHAKI FIELD.

AMONG the best-established and cleanest stands of lucerne in the Dominion is the area of some 15 acres at the Moumahaki Experimental Farm, known as Field No. 5. The accompanying photograph shows the field with the second cutting in progress last summer. The following particulars are supplied by Mr. T. W. Lonsdale, Manager of the Farm:—

The seed from which the lucerne crop was established was sown in November, 1913. The history of the field for the previous two years is, briefly, as follows: In 1911, following rape fed off with sheep, Algerian oats were sown, no manure being supplied with this crop. After harvesting the oats the stubble was disked, and a catch-crop of mustard, rape, buckwheat, and vetches was sown, the principal part of the crop being grazed and the residue ploughed under. Rye-corn was then sown, and manured with 3 cwt. of basic slag per acre. This crop was also grazed with ewes and lambs and the land again ploughed, and sown with swedes in December, 1912, 1 cwt. of basic slag, 1 cwt. Island phosphate, and 28 lb. muriate of potash per acre being applied with the seed. The swedes were carted off the land, after which vetches, 1½ bushels, and barley, 1 bushel, per acre were sown in July, 1913. This crop was ploughed under early in October following, and immediately afterwards ground limestone, 15 cwt. per acre, was applied. The land was then worked down for lucerne, and a few days prior to sowing the seed 300 lb. per acre of soil taken from an established lucerne-field was applied and harrowed in. On the 14th November 13 lb. of lucerne-seed per acre was sown on a well-rolled surface, 4 cwt. basic slag and ½ cwt. sulphate of potash per acre being applied at the same time. Over the major portion of the field three varieties of lucerne were sown — namely, Colonial (Marlborough), Hunter River, and Tamworth. The yields from these three have been even throughout, and very little difference is noticeable in any respect. A smaller section of the field sown with the Dryland variety has given less even results, and has been marked by an exceptionally long dormant period. The first cutting, a light one, was made on the 14th January, 1914, since when seven crops have been



CUTTING LUCERNE IN FIELD NO. 5, MOUMAHAKI EXPERIMENTAL FARM.

taken, and in addition the paddock has been twice grazed. The total yield, irrespective of grazing, has been 120 tons of hay, and approximately 200 tons of green material carted to stock or made into ensilage. Each autumn the field has received vigorous cultivation with the solid-tooth cultivator and tine harrows, and is free from weeds.

LUCERNE AT BURNHAM.

Lucerne trials which present several special points of interest are those which have been carried out at the Industrial School, Burnham, on what is probably one of the most shingly portions of the Canterbury Plains. The Manager of the school, Mr. T. Archey, has supplied the following report to the Department's Fields Instructor for the South Island, Mr. A. Macpherson, with whose co-operation the test was initiated :—

The lucerne-seed you sent me in 1911 was sown in November of that year in drills 9 in. apart : The area of the test was 1 acre, which was divided into four plots, as follows : Plot No. 1 was sown with seed only ; plot No. 2 was sown with seed and inoculated soil ; plot No. 3 was sown with seed and lime only ; plot No. 4 was sown with seed, lime, and inoculated soil.

The first cutting for produce took place early in April, 1912, with the following results : Plot No. 1, 1,100 lb. ; plot No. 2, 1,500 lb. ; plot No. 3, 1,900 lb. ; plot No. 4, 2,300 lb. (green weights throughout).

The land was kept clean and worked constantly. Cutting took place four times, and the total yield from the four plots was 12 tons.

For the following season the land was well cultivated, limed ($\frac{1}{2}$ ton to the acre), and heavily dressed with mixed stable and farmyard manure and cleanings from Addington railway-sidings. Crops were cut four times, and the yield for 1913 and 1914 respectively was 15 tons.

The year 1914 to 1915 was very dry, and, notwithstanding the labour and fertilizer, the yield was poor. The crop was cut with total result of 6 tons.

For 1915 to 1916 I heavily manured with home-made fertilizer, made up as follows : (1) 1 cwt. powdered fowl-droppings, 1 cwt. dried gorse or wood ashes, 2 cwt. sieved soil from the shingle-pit ; (2) 1 cwt. cow-dung plus wood-ashes and soil ; (3) 1 cwt. sheep-droppings (powdered) plus wood-ashes and sieved soil ; (4) 1 cwt. pig-dung plus ashes and soil. The whole of the fertilizer passed through $\frac{1}{8}$ in. sieve. In many instances I added 10 lb. to 15 lb. calcined bonedust. On this acre I applied 25 cwt. of these various fertilizers and irrigated the plot. The crop has had five main cuttings this season, with a final light cut early in May, making a total yield of rather over 13 tons.

As a forage crop I think lucerne unequalled.

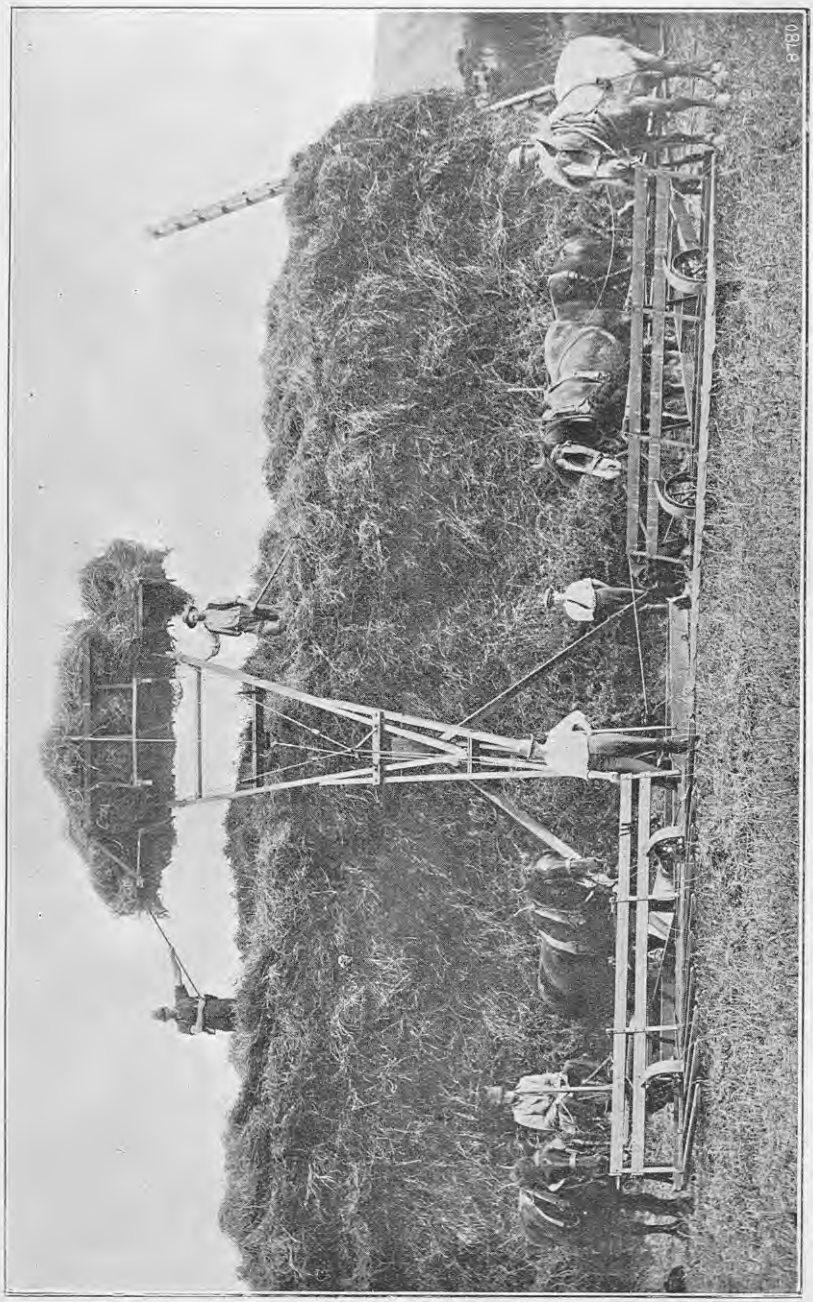
Commenting on this report Mr. Macpherson makes the following remarks :—

The manuring of this plot, like that of many others in the South Island, cannot be considered a success. The yield for 1914–15 would no doubt have been quite 15 tons had no manure been applied, and would have continued similarly during 1915–16. It will be noted that the crop for 1914–15, after the application of manure, was poor, and also that the past season's yield was not up to that of the best years. It is much to be desired that definite tests be conducted on lucerne plots as to whether fertilizers should be used or not after the crop has been established. Past experience appears to indicate that a well-established lucerne-field is better left alone, manuring only encouraging the growth of weeds and grasses on the surface, which is injurious to the lucerne-growth ; whereas the lucerne feeds not from the surface but far down into the subsoil and below.

LUCERNE MANAGEMENT IN POVERTY BAY.

Mr. A. G. Faulkner, of Wairakaia, Gisborne, a successful lucerne-grower, forwards the photograph of lucerne-stacking operations reproduced on the following page, together with the following note :—

When once a lucerne-paddock is established (which in Poverty Bay is usually in the first year) it is very little harder to work than the ordinary clover or rye-grass paddock. The farmers one meets who think lucerne is only of value to the small dairy-farmer, if they only put in a couple of acres would realize what a valuable thing lucerne is. The number of sheep lucerne will carry per acre is greater than most readers of the *Journal* would believe. Cattle grazed do well on lucerne, and with an efficient stacking plant four or five men and a boy can stack from 14 tons to 16 tons of hay per day. In saving lucerne hay it is absolutely essential to have a swath-turner, as it is necessary to dry and stack the hay as quickly as possible after cutting. Lucerne and prairie-grass I find very satisfactory, but it is better to get lucerne well established before sowing the prairie-grass. In the second or third year we run the disk harrows over the paddock as often as necessary, and sow not over a bushel of prairie per acre. One often hears it said that lucerne will not carry stock in the winter-time. This, I should say, depends greatly on climate and locality. Here, where frosts are very slight, a 6-acre paddock last winter carried seven dairy cows and ten hoggets for the four winter months, and the stock always had more than they could eat.



STACKING LUCERNE ON MR. AND MRS. A. G. FAULKNER'S WAIRAKAIA FARM, NEAR GISBORNE.

Stack 16 ft. high, 50 ft. long, and 20 ft. wide. Nine hours' work with patent stacking plant. Only two forks used.

LUCERNE-GROWING IN THE "SEVENTIES."

Mr. A. Macpherson, Fields Instructor, Christchurch, writes :—

It may be of interest to many to know that the New Zealand and Australian Land Company, who were the pioneers of many of the improved methods of farming and did so much for the advancement of agricultural and pastoral pursuits in New Zealand, grew lucerne over forty years ago on their big Levels Estate, in South Canterbury (since subdivided for closer settlement), also on their Clydevale Estate in Otago. The following is from Mr. R. Irving, farmer, of Albury, who at that time was overseer on the Levels Estate :—

In 1875 we had over 100 acres in lucerne on the Levels Estate. It was sown in rows 15 in. apart and seeded at the rate of 15 lb. per acre, which we found to be plenty of seed. Attention was paid after each cutting to give intercultivation. This was done by taking the mould-board off the single-furrow plough, leaving only the share on it, and running this between the rows. Afterwards we used to tine-harrow it. It was a great success, and we usually cut a crop from three to four times during the season. As a hay crop it was unrivalled ; all farm animals were fond of it. It was stocked with sheep some two or three years after it was sown, but it never did well after that.

THE GRASS-PEA.

A. McTAGGART, M.S.A., Agriculturist.

THE valuable type of legume called the grass-pea has been grown, particularly for fodder purposes, fairly extensively in parts of Ontario, and local experience gained since its recent introduction to New Zealand (upon the recommendation of the writer) bears out the good name the plant has in Canada.

The grain of the grass-pea is dark yellow in colour, angular in shape, and small. The plant is a fine-leaved edition of the field-pea, though more decumbent, and to some extent it resembles the vetch-plant. It requires a fair amount of warmth, not too much moisture, and a fairly good soil.

The crop may be grown either alone or with oats, rye, or barley for soiling (green-feed producing) purposes. It is highly palatable to stock, is easily grown, makes an excellent cover-crop in orchards, makes good hay, is a fair yielder of grain valuable for feeding (crushed) to various classes of farm animals, and is an excellent soil-renovating crop.

GRASS-PEA—PART OF PLOT AT MOUMAHAKI EXPERIMENTAL FARM.

At the Ontario Agricultural College, Guelph, an average of 30 bushels per acre of grain of the grass-pea has been obtained over a series of years. At the same institution in 1909 various leguminous crops yielded per acre green fodder as follows: Harbara soy beans, 9·2 tons; grass-peas, 8·0 tons; Amherst soy beans, 7·6 tons; Shingto soy beans, 7·5 tons; Cloud soy beans, 7·4 tons; hairy vetches, 6·8 tons; Isurunoko soy beans, 6·5 tons; Chernie soy beans, 6·1 tons; and Nuttall soy beans, 6·1 tons.

Over a period of five years ending in 1909, of six varieties of leguminous crops grown at Guelph for green fodder the following gave the greatest yield: Grass-peas, 6·9 tons per acre; Ito San soy beans, 6·8 tons; Early Yellow soy beans, 5·5 tons; and Wonderful cow-peas, 5·2 tons.

For a period of ten years ending in 1910, of four varieties grown in succession for that period at Guelph for the production of green fodder the following average results were obtained: Hairy vetches, 7·4 tons per acre; grass-peas, 7·2 tons; Early Yellow soy beans, 6·9 tons; Wonderful cow-peas, 5·2 tons.

From the above it will be readily seen that the grass-pea, in common with the hairy vetch, is a decidedly desirable crop to grow for soiling purposes. The tests at Moumahaki have fully justified the importation of the grass-pea, and it should prove an acquisition to the dairy-farmer and to the fruitgrower, just as the hairy vetch is a decided boon to the fruit-farmer, particularly, in Canada. But this can only eventuate when steps are taken to raise sufficient seed, and to sell it at a price satisfactory to the farmer and orchardist.

Mr. J. Beverley, Assistant Plant-breeder, supplies the following particulars regarding the tests with the grass-pea at the Moumahaki Experimental Farm during the past season:—

The tests were made with the seed harvested at Moumahaki in April of last year. Following a crop of early potatoes, seed was sown broadcast at the rate of 1 bushel per acre on the 3rd November, 1915. The crop was cut with a scythe on the 6th January last to facilitate the operation of digging in, while an adjoining plot of hairy vetch has not produced sufficient bulk to make the scythe necessary. A later trial of the pea was made with a similar seeding on the 12th January on a plot of 160 square yards. The illustration shows part of this crop on the 19th May still in flower and vigorous, with a little seed forming. Approximately the grass-pea weighs 5·3 oz. per 1,000 seeds, and it should be sown in October or November if a seed crop is desired.

VETERINARY NOTES FOR HORSE-OWNERS.

E. L. SIDDALL, M.R.C.V.S.

THE following notes deal briefly with three horse troubles—strangles, nasal catarrh, and influenza—against which farmers, and horse-owners generally, do well to be on guard, more especially at the present time of year as regards the two last-named complaints.

STRANGLES.

This very infectious disease is only found in horses. It is generally seen in young animals, but may attack horses of any age, rarely affecting the same horse twice. Strangles is caused by a germ which is found practically all over the world.

The symptoms are as follows: The animal is first noticed to be dull and off its feed, with a discharge from one or both nostrils. This discharge, which is at first thin and watery, after a few days becomes thick and sticky. Soreness of the throat is generally present; this is shown by the horse having some difficulty in swallowing. The chief symptom is the formation of an abscess in connection with the glands situated between the branches of the lower jaw. This abscess commences as a small hard swelling, which gradually becomes larger and is always very tender. As the swelling increases in size it also becomes softer, until it is ripe. This is shown by a falling-off of the hair at one part, accompanied by a slight sweating at the same point. At this time the abscess is ready to be opened with a sharp, clean knife, taking care to make a good-sized opening.

For treatment, it is advisable to let the animal have a run at grass in a well-sheltered paddock, provided the weather is favourable. The throat should have one dressing with a sweating-blister, in order to hasten the ripening of the abscess; this dressing should be applied from the base of the ears, down both sides of the throat, between the jaws, and a little distance down the throat.

Where medicinal treatment is necessary, 2 drams of extract of belladonna together with 2 oz. of chlorate of potash should be made into a soft paste with 4 oz. each of treacle and sugar, and a piece the size of a walnut smeared on the tongue twice daily.

If the horse is kept in the stable the bowels must be regulated by giving soft feed, such as bran mashes and scalded linseed.

The most important point in curing a case of strangles is to keep the abscess well open until all the discharge has stopped, because if it is allowed to close up too soon the abscess will re-form.

There is one rather severe form of strangles, in which the abscess does not form, but the animal has soreness and tenderness of the throat, which is shown by flinching when pressed in the region of the larynx or "voice-box"; the head is extended, and there is difficulty in swallowing water, which may return through the nostrils accompanied by particles of grass, &c. Generally in these cases there is a roaring noise made in the breathing, which is often laboured in the advanced stages. Such cases are best treated by a mild blister rubbed in for eight minutes—after clipping off the hair—from the base of one ear, down round the throat, between the jaws, and up to the base of the other ear.

NASAL CATARRH.

This is the name given to an inflammation of the membrane lining the nose and air-passages of the head.

The symptoms commence by sneezing, with a dryness and redness of the membranes of the nose; this is followed by a thin discharge, which afterwards becomes thick and yellow. In the later stages there is generally a cough and slight fever, which is shown by the patient looking very dull, shivering, and having a rough coat.

For treatment, if the cough is troublesome the throat should be rubbed with a liniment made of equal parts of ammonia, turpentine, and olive-oil. Two drams of extract of belladonna and 2 drams of camphor should be mixed into a paste with linseedmeal and treacle, 40 oz. of each, and a small quantity smeared on the tongue twice daily.

INFLUENZA.

This suddenly occurring complaint is often noticed after wet seasons, and is always accompanied by great weakness.

The symptoms are indicated by the suddenness of the attack, together with great weakness and depression, and a high fever noticed at the very commencement of the attack. There is, as a rule, swelling of the eyelids and a profuse discharge of tears. The patient generally has a cough, and this is usually accompanied by some soreness of the throat; in some cases there is difficulty in breathing.

As treatment, the diet should at first be laxative and cooling, but as soon as the animal begins to recover every attention must be paid to keeping up its strength. Three times daily give the following drench: Carbonate of ammonia, 2 drams; nitre, 1 dram; cold gruel, 1 pint. This is to be continued for three or four days, or until the symptoms become lessened.

If owing to the soreness of the throat the drench cannot be administered, give an electuary made by mixing up 2 drams of

chlorate of potash and 1 dram of nitre with linseed-meal and treacle, and smear on the tongue twice daily.

Relief is sometimes given by applying a mixture of flour and mustard in equal parts, made into a thin paste with cold water, to the sides of the chest, and covering with newspaper before putting the cover on the patient.

It is most essential that every precaution be taken to prevent the spread of infection in this complaint, as its dissemination is more than rapid if once allowed to get the upper hand.

PIGS AND GRASS-GRUB CONTROL.

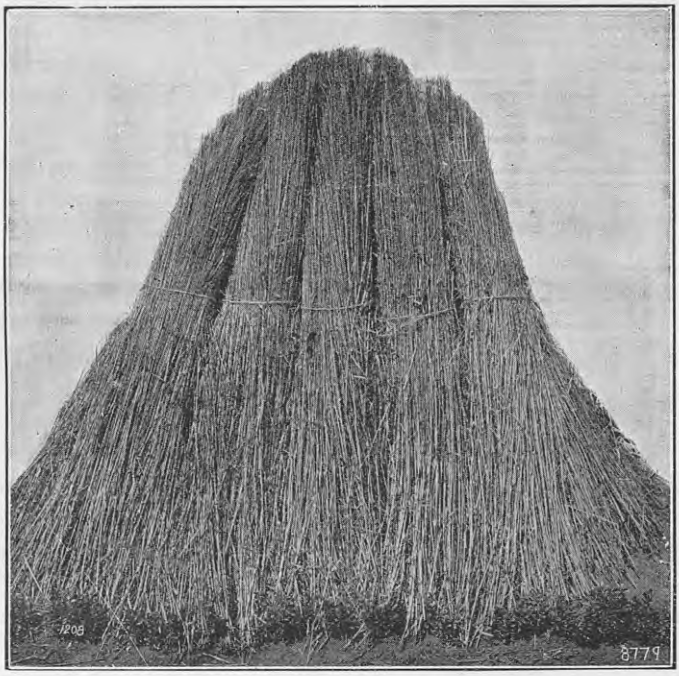
THE dry seasons experienced in many parts of the Dominion have been very favourable for the increase of the grass-grub, and extensive damage has been done to pasture and grain crops by the pest. Various methods have been suggested to assist in the control of the grub, but they generally involve the cultivation of the infested area. This is expensive and not always satisfactory, and it frequently happens that on small farms (dairy farms in particular) it is not convenient to break up a field.

A South Taranaki farmer, Mr. Johns, has to a great extent solved the difficulty, and has successfully treated several infested paddocks. His method is to ring his store pigs, and then turn them on to the infested field about the month of May. The pigs, being rung, will turn up only the patches of grass that have been cut by the grub. As the pigs root up the grass numbers of grubs are eaten by them, and they are greatly assisted by large numbers of birds, chiefly starlings and minahs. After the pigs and birds have passed to a fresh patch a careful examination of the patch they have just left will reveal scarcely a grub, so well has their work been done. When the pigs have gone thoroughly over a paddock and rooted up all the infested areas Mr. Johns resows the patches, rakes as much as possible of the old pasture back on to them, and gives them a good rolling.

I recently examined a paddock treated in this way last winter, and at the time of my visit (April) the previously infested areas were the bright spots of the pasture, being covered with a splendid sole of rye-grass and clover. Where conditions as to surface-sowing, &c., are suitable, farmers troubled with the grub may be confidently recommended to give Mr. Johns's method a trial. Although autumn is probably the best time for the operation, it might also be carried out in spring.—*J. W. Deem, Fields Supervisor.*

PLANT-SELECTION AND QUICK PROPAGATION.

THE following record of a grass selection at Moumahaki Experimental Farm is presented as an encouragement to those interested in the improvement of farm crops to carry out similar work, also as showing how quickly a selection of the class described can be propagated when correct methods are used.



ITALIAN RYE-GRASS AT MOUMAHAKI, PROPAGATED BY DIVISION FROM A SINGLE PLANT, IN NINE MONTHS AND A HALF.

Height of sheaves, 30 in.

On 24th March, 1915, the writer's attention was attracted to a plant of Italian rye-grass in the field forage-crop tests at Moumahaki, owing to it not having run to seed like its neighbours and on account of its freedom from rust. The plant was lifted, and eighteen divisions were made from it and planted out. On 7th June the eighteen plants were lifted and 183 plants made by further

division, these being given about 1 square foot each in the plot to allow of a hoe being used for cultivation. In order to delay seeding until a good roothold had been established the plants were cut on 21st October, the weight of the cutting being 68 lb. The plants then made strong fresh growth, pollination took place between 12th and 14th December, and the plot was harvested on 5th January, 1916, yielding 6 lb. of seed — approximately 1½ million seeds. Some of this seed was plot-tested during the past autumn and made a vigorous, heavy growth. The illustration shows the sheaves from which the seed was threshed in January.—*J. Beverley, Assistant Plant-breeder.*

POULTRY-FEEDING WITHOUT WHEAT.

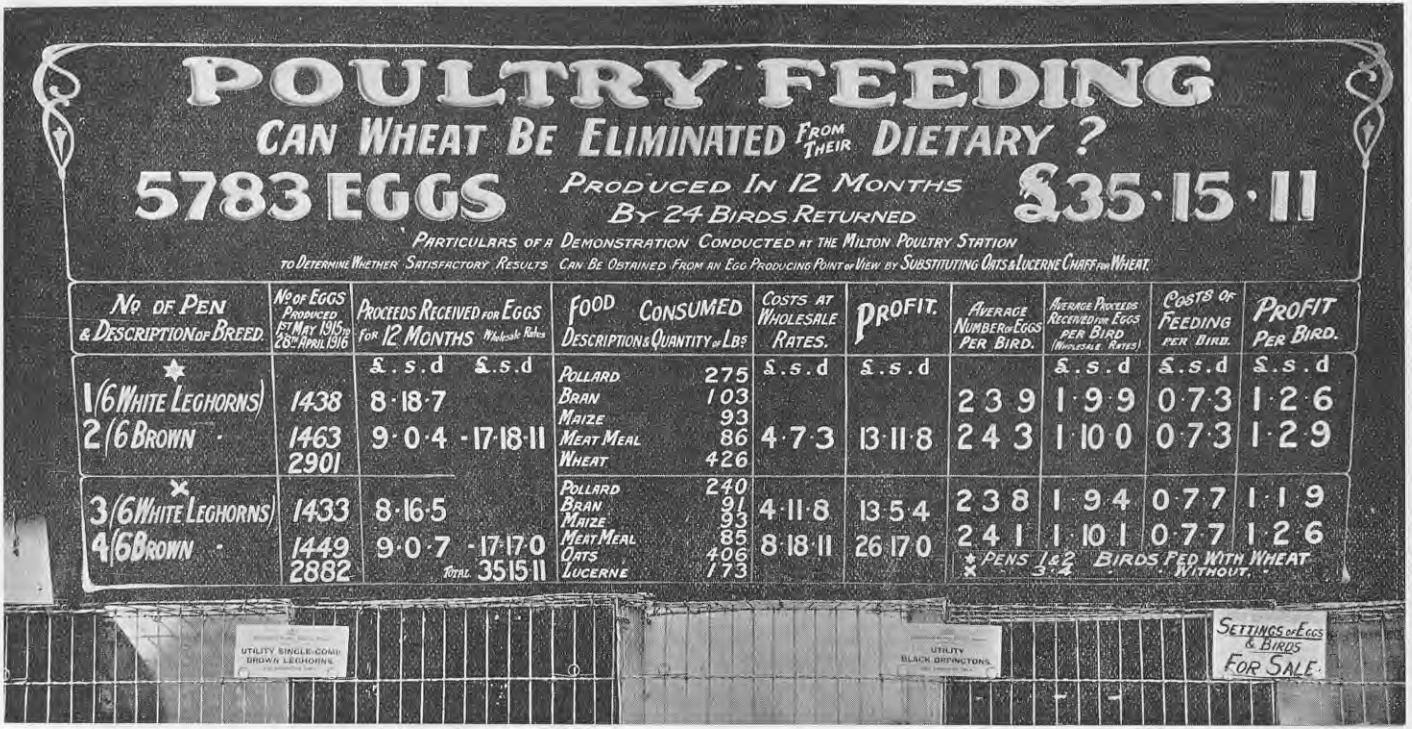
NOTES ON THE MILTON TEST.

F. C. BROWN, Chief Poultry Instructor.

THE feeding test recently concluded at the Department's Milton Poultry-station, final results of which were published in last month's *Journal*, has brought out several useful facts. The most important of these demonstrates what was really the sole object of the test—namely, that a satisfactory egg-yield can be secured where wheat is totally eliminated from the ration. It has also been shown conclusively that lucerne is a most valuable constituent of a fowl's diet. As oats were also used with the lucerne, the favourable results obtained from a diet from which wheat was eliminated cannot, of course, be attributed to the lucerne entirely.

The morning mash during the test for pens Nos. 1 and 2 (birds fed with wheat) consisted of 2½ parts pollard, 1 part bran, 1 part maizemeal, with 5 per cent. meatmeal added. In both rations the proportion of pollard had at times to be slightly varied according to its quality. The whole was moistened with hot water, and the birds were given as much as they could eat without waste. The evening meal consisted of whole wheat, and was fed in straw litter.

The morning mash for pens Nos. 3 and 4 (birds fed without wheat) was prepared and fed on similar lines to that of pens Nos. 1 and 2. In this case, however, the lucerne-hay chaff was placed in a bucket with boiling water overnight, covered with a sack and allowed to steam in its own heat. This process had the



THE MILTON FEEDING TEST DEMONSTRATED IN THE DEPARTMENT'S WINTER SHOW EXHIBIT, 1916.

effect of making it swell, practically doubling its bulk. The moisture contained in it, together with any liquid that was not taken up, usually provided sufficient moisture for bringing the mixture to a right consistency. The amount of lucerne used was varied according to the birds' appreciation of this food. When it was found that the lucerne was being left in the trough and the ground grains eaten, the indication was taken that the birds were getting too much of the lucerne, and the proportion was reduced for a time. It may be mentioned that, apart from the amount of meat-meal mixed in the mash in both cases, it was supplied in a separate receptacle and left always before the birds, thus giving them an opportunity of balancing their own ration. When there was no grass in the pens green feed (chiefly turnips) was fed during the day, while gravel-grit, crushed oyster-shell, and also clean water were always before the birds. The oats used in connection with the test were Sparrowbills of a good plump quality.

The test has also demonstrated that nothing less than the yearly record can be taken in regard to a bird's laying-capacity. This is proved by comparing the results put up by the individual pens for the first twenty-four weeks of the test with the yields for the full year, as shown in the following table :—

	Totals for First 24 Weeks.	Totals for 52 Weeks.
Pen No. 1	778 eggs	1,438 eggs.
Pen No. 2	610 ,,	1,463 ,,
Pen No. 3	742 ,,	1,433 ,,
Pen No. 4	602 ,,	1,449 ,,

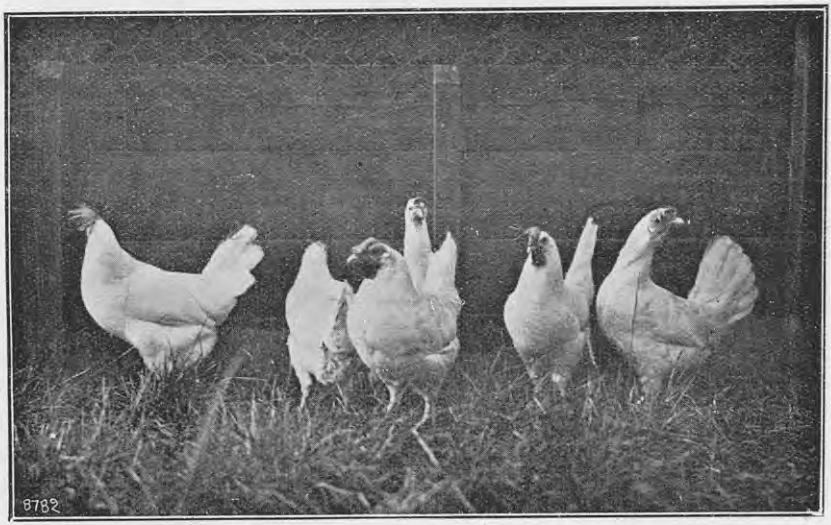
The most striking comparison is in regard to pens Nos. 1 and 2. It will be seen that during the first period pen No. 1 led pen No. 2 by 168 eggs, whereas for the fifty-two weeks pen No. 2 not only caught up pen No. 1, but beat it by twenty-five eggs.

It will be noted that twelve White Leghorn and twelve Brown Leghorn pullets took part in the test, one pen of each breed having wheat in the ration and the others having none. By using one pen of each breed of the same age and strain, and supplying a different ration respectively, it was considered that the results obtained would be more conclusive than would be the case if only single pens of the same breed were used. The birds were selected as evenly as possible, both in regard to laying type and points indicative of constitution, while breed-points were not overlooked, the whole of the birds being good specimens of the breeds they represented. The

even laying returns produced by the individual breeds, as well as the individual pens, clearly indicate that there is a special laying type, and that a bird's laying-capacity can to a great measure be determined by any one possessing the natural eye for form.

The test has demonstrated in a striking manner that the Brown Leghorn when bred from an egg-producing viewpoint is a highly profitable breed to keep, and that it is well adapted to the southern climatic conditions. The two pens of this breed laid a greater number of eggs than the White Leghorns, and No. 2 pen returned the highest profit over the cost of production. It may be mentioned that this particular strain of Brown Leghorns is the result of crossing at Milton some six years ago an American standard male with English standard females. From that time the flock has been bred and selected on egg-producing lines, while combining the points that go to make up an English standard Brown Leghorn. The birds now conform in a great degree to Ludlow's plates in Lewis Wright's "Book of Poultry," being smaller and more active than the majority of Brown Leghorns to be seen in the classes at the poultry shows in New Zealand.

The accompanying photographic reproduction of a table compiled to present the test in a compact form at the Department's winter-show exhibit will enable the above comments to be followed. Other tabular matter concerning the test has been printed in previous issues of the *Journal*.



ONE OF THE PENS IN THE MILTON FEEDNG TEST.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

CULTIVATION.

As a rule July is one of the wettest months of the year, and very little in the way of cultivation can be attempted on the arable farm. Up to the time of writing in June, however, the rainfall in most districts has not been so heavy as to really saturate the land. A thorough soaking followed by good hard frosts would, in fact, be an all-round benefit, and should such conditions ensue farmers would be well content to keep the teams off the land during July. If, however, conditions are favourable for work, the ploughing of lea for green or root crops—or, in districts of good rainfall, for spring cereals—may go on. It is too late now to break lea for cereal crops in the drier districts. Towards the end of the month the sowing of spring cereals, particularly oats, may be commenced; but, except from the point of view of having work well forward, there is no advantage to be derived from July sowings. On the contrary, heavier seeding is necessary, and, except on light land, much of the seed may fail to germinate.

FIELD-PEAS.

One of the most suitable crops for sowing from July onward is field-peas. This is a crop which in recent years has become very popular for fattening in parts of Australia where dry weather, aphis, and other troubles make rape altogether too uncertain. A similar state of affairs, unfortunately, is all too common in New Zealand also, and it is a point worth considering whether it would not be worth while to try field-peas on part of the rape break.

The advantages of this crop will not be exhausted by the fat stock turned off it, for the good effects of peas on succeeding crops and on grass are invariably most marked. As a grain crop in suitable localities peas usually pay well. They are not a crop, however, which will stand feeding off at any stage and afterwards produce a seed crop. Peas are a crop which no pig-raiser should neglect; and by getting them in as early as possible there will be more time available to devote to other pig crops, such as rape, mangels, pumpkins, &c., which will be due for sowing in the following months.

LIMING AND MANURING.

It is opportune to press the urgency of top-dressing pastures. Probably the most general need in this direction is for applications of lime. Free-working soils in the drier plain areas may fail to give any appreciable response to limings, but on all cold, heavy land there is hardly room to doubt that applications of lime would increase the value of the land many times the cost of the application. The soundest advice that can be given this month to farmers so situated is to get a supply of lime by hook or by crook, and see to its application as soon as possible. All things considered, ground limestone is the best form in which to apply lime, and an application of even 10 cwt. per acre will seldom fail to work wonders. Probably the greatest benefit would be derived from liming by applying from 10 cwt. to 1 ton on grass just before breaking up for rape or turnips. As the plough-furrow is deepened in subsequent cultivation by turning over the rape or turnip break, the lime becomes thoroughly distributed through the soil; and if a further similar dressing is then applied on the surface and harrowed in before sowing grass-seeds there should result a pasture which would gladden the heart of any farmer, whether his mainstay be cows or sheep.

While the importance of lime is stressed, let it not be thought that it is the one thing needful to remedy inferior crops or sickly grass. Phosphates are needed — superphosphates after liming, or, if liming has not been done, basic superphosphate, rock phosphate, Ephos phosphate, or phosphatic guano. None of these, however, will produce their greatest effect if applied to a soil lacking in lime.

With regard to the paddocks to be treated, those that are to be closed up later on for hay should not be neglected. Hay costs much less per ton to produce when it is the product of a heavy crop. Therefore lime and manure now, graze lightly during the

next month or two, and close up early, if you would get good cheap hay. Calf-paddocks certainly require to be dressed with lime, and in this case, for obvious reasons, preferably with ground burnt lime.

SEASONAL PREPARATIONS.

The lambing season and the beginning of the milking season are close upon us, and common-sense suggests that suitable pastures should be cleared of stock, thoroughly harrowed, and allowed to freshen for the purpose of starting off cows or lambs, as the case may be, in good style.

CARE OF DAIRY STOCK.

Amongst dairy herds some extra attention is advisable as the calving season becomes more imminent. Particularly is this the case with heifers coming to their first calving. It is unfortunate that with a definite milking season the dairy-farmer is often compelled to choose between the least of two evils—mating heifers at a rather immature age, or retaining them as heifers for an extended unprofitable period, during which they are liable to develop beef tendencies, and perhaps eventually to prove barren. The former course is the one invariably adopted, and every effort should be made to minimize the evil of early breeding by good treatment prior and subsequent to parturition. This cannot be too strongly emphasized. Roots and good clover hay, at any rate, should be forthcoming during July on all but the best pastures; and where roots and hay are not available the grass should be supplemented by an allowance of good oaten chaff.

This recommendation does not arise out of any theoretical consideration of the nutrition of dairy stock. It is a statement of fact that such treatment will pay handsomely in higher yields and better progeny. It has been proved by careful experiment that condition at calving-time in true milking-strains is essential for satisfactory production during the milking season. In the case of mature cows, however, especially with those which are deep milkers, high condition before parturition is well known to be conducive to milk-fever. The customary preventive of this trouble—1 lb. Epsom salts and 2 oz. ginger in a drench, given about a week before calving—should not be neglected in such cases.

Injudicious feeding of roots and green fodder to dairy cows during the winter and early spring is the cause of considerable losses annually. At this period large numbers of the animals are in an

advanced state of pregnancy, and thus especially liable to dietetic disorders. Most of these feeding troubles can be avoided by ordinary care in management. The safest and most economic method of feeding such crops to dairy cows is to cart them on to clean pastures and feed regular rations in conjunction with a liberal ration of dry feed—the dry feed first and always.

Cows that have run on close pasture during the night and are then given an unlimited supply of roots or green feed on practically empty stomachs will invariably gorge, with more or less bad results. But if given a half to three-quarters of an hour on hay first, this will not only take the sharp edge off the appetite and prevent gorging, but will also supply at the proper time the bulk necessary to allow the digestive system to deal with the other food to the best advantage.

Fresh-pulled mangels are dangerous at all times, and particularly so in the late winter and early spring when they are sprouting. While pitting or clamping improves any kind of roots, it is most essential in the case of mangels, which undergo chemical changes for a period after pulling, making them not only much safer to feed, but also improving their food value to an appreciable degree. When they have not been stored in the desirable manner they should at least be pulled and allowed to lie in the weather for ten days before feeding.

In the spring, when the pasture provides ample feed of the best and safest variety, dairy cows are in many cases used as scavengers by being shut into cultivation paddocks to clean up the surplus roots at a time when the latter are generally, at the best, in a dangerous condition for feeding. Every year numbers of farmers pay dearly for learning that this practice is false economy, and that it is better management to waste the surplus roots than to lose good cows in full profit.

When dairy cows are grazed on turnips or green fodder they should have access to the pasture and a plentiful supply of dry feed. They should also not be permitted to eat out the roots below the surface of the ground. During wet, cold weather, when the danger of loss from digestive troubles and premature parturition is greatest, cows should be shut off the roots, and the latter carted on to the pasture.

HORSES.

As the foaling season draws near, draywork and heavy chain work should be abandoned for in-foal mares. Every care should be taken to get teams into good fettle for the heavy work of spring; sore shoulders must have special attention.

THE ORCHARD.

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

ONE of the most important periods of the orchardist's year is now at hand. The majority of orchardists realize this and act accordingly, but there are still a large number, both commercial and private growers, who wholly fail to appreciate, or at least to take anything like full advantage of, the opportunities afforded them by the dormant season of putting their orchards into the order in which they should be.

Such growers no doubt recognize that they have a certain amount of routine work to do at this season, such as spraying, pruning, and cultivation, but at the same time ignore or fail to appreciate the connection which exists between the manner in which they do this work and its effect upon both their trees and crop the following season.

It is not sufficient to prune a tree simply because this is the pruning season, or because it is the custom of every fruitgrower—or, I should say, *nearly* every fruitgrower, as some do not prune at all—to cut more or less wood out of his trees during the wintertime. Pruning is a necessary and scientific work, but its benefits apply mainly according to the amount of intelligence exercised when the work is being performed.

Before commencing to prune a tree the whole scheme of things in regard to the tree should be clearly conceived—whether it be growth or shape that is required; inducing the tree to bear fruit; promoting growth in a tree stunted through overbearing or otherwise; improving the quality of the fruit, if necessary, by lessening the quantity it is likely to bear; and by considering the number of other matters which intelligent pruning is calculated to correct. After this has been satisfactorily determined every cut should be made with a definite object, and that object should be to correct all objectionable features and to bring about those which are desirable for the future benefit of both the tree and the crop in the shortest possible time.

The same applies to the control of orchard diseases. It is not sufficient to spray simply because there are diseases in the orchard, even though a popular spray is used, without first making sure that it is the right one for the particular disease in question. There are many sprays recommended for winter use at different strengths for the different pests and diseases, and unless some intelligence is exercised mistakes such as have been frequently made in the past will occur, resulting in the waste of time and material and subse-

quent damage to the tree from the unchecked disease. In spraying, as in pruning, the objects aimed at should be clearly understood; the right materials should be selected and carefully mixed, and applied at the correct strength, at the right time, and at a pressure sufficient to do the work thoroughly.

The same considerations apply to cultivation. Cultivation is not intended simply to hide weeds and rubbish and to make the orchard look pretty. The objects of cultivation, briefly stated, are to break up and aerate the soil, and to provide fresh plant-food and moisture for the tree to feed upon. This alone demands that the work should be thoroughly done.

DRAINAGE.

This is a matter of the greatest importance to the health of an orchard. Many fruit-trees fail to thrive mainly owing to bad drainage. A thorough drainage scheme should be carried out before the trees are planted at all, but where this has not been done, or where additional drains are found to be required, they should be laid with as little delay as possible. Although existing drains should have been attended to earlier than this, it is better to be late than never. All open drains should be cleaned out, and broken or defective pipes in others renewed. Low-lying, badly drained parts of the orchard, easily discernible now, should be attended to straight away.

SPRAYING.

Where not previously attended to the following pests will require attention: Mussel scale, San Jose scale, brown, black, and red scale, &c., woolly aphis, mealy bug, and red mite.

Emulsified oil is the standard remedy for the whole of the above-mentioned sucking-insects, but the strength at which it should be applied varies slightly according to the class of tree affected. Pip-fruits require and will stand a stronger mixture without injury than stone-fruits, while citrus fruits require a still weaker mixture than stone-fruits. Moreover, some of the pests themselves succumb to a weaker spray than others. Mussel scale and red mite require a stronger mixture than San Jose scale or the other scales. Woolly aphis and mealy bug are about equal. With these more depends upon the force and thoroughness of the application than on the strength of the spray used. The best plan in spraying for the control of these insects is to base the strength of the spray upon that required to destroy the hardiest insect found affecting the tree.

July is the popular month for the application of oil sprays, excepting where two applications are being made for woolly aphis,

as referred to in last month's notes, in which case the first application is made as early as possible and the second toward the end of August.

The strength of the oil spray recommended for the control of the diseases mentioned is as follows:—

Mussel scale: Pip-fruits, 1–12; stone-fruits, 1–15 to 1–17.

San Jose scale: Pip and stone fruits, 1–15 to 1–17; citrus fruits, 1–20 to 1–25.

Woolly aphis and mealy bug: 1–15.

Red mite: Pip-fruits, 1–12 to 1–15; stone-fruits, 1–15 to 1–17.

UNRELIABLE ADVERTISING AND PACKING.

At the recent Patriotic National Apple Show held in Wellington Town Hall a case of apples was placed on exhibition by the Department of Agriculture bearing the following inscription: "Supplied direct from the orchard as 'A' grade Sturmers—Such unreliability disgusts buyers and kills trade." This case of fruit was forwarded to the Department by a buyer who bought it direct from the grower on account of an advertisement in the newspapers by a well-known orchardist, advising the public, among other things, to buy direct from the orchard if they wished to secure a reliable article less the middleman's charges. This matter is mentioned here with the object of warning growers who are engaged in this class of trade of the danger to their business which must follow unreliable advertising and packing. The fruit referred to, marked "A" grade, were small, badly spray-scorched, deformed, measly rubbish, scarcely fit to be termed "C" grade.

THE APIARY.

E. A. EARP, Apiary Instructor.

MOVING BEES.

If it is desired to move the hives to a new location the work should be carried out at the present season while the bees are dormant. Great losses are caused by beekeepers postponing moving until the spring. It is well to remember that in our climate, from one end of the Dominion to the other, the dormant condition lasts but a very short time, and full advantage should be taken of it, more especially when the bees are transferred only a short distance. In the latter case there will be an inevitable loss of bees unless

the weather-conditions are absolutely wintry. The risk in moving bees longer distances is not of course as great, because when they are moved from their old landmarks they will not desert their hives until they have taken an inventory of their new surroundings. However, in this there is another danger to be feared—namely, that by overheating the colonies a condition known as "scalded brood" may be produced, and result in the destruction of thousands of embryo bees. The wise beekeeper will therefore invariably choose the depth of winter for moving his bees either long or short distances.

DRY MATS.

During the winter months it is well to examine the mats at intervals in order to note their condition, more especially after heavy rain. Where mats are damp they should be removed and dry ones substituted. A supply of dry mats should always be kept on hand. In order to leave the colony undisturbed, carefully lift one end of the cover and examine the mat. If it has to be removed, see that the smoker is ready in case the bees are troublesome, but on no account use smoke unless the bees have to be driven down. Remove the wet mat as quickly as possible, replace it with the dry one, and cover the hive at once.

LEAKY COVERS.

If the mats are wet there must be a reason for it, in which case look to the covers. It is surprising how little attention is paid to covers. It is such a simple matter to make roofs waterproof that there is no excuse for any beekeeper exposing his bees to the danger of dampness in winter. More bees are lost through neglect in this direction than from any other cause during the cold weather, with the exception perhaps of actual starvation. Bees must be kept dry. Where the roofs are cracked do not attempt to tinker with them, but cover them entirely with some good waterproof material. Zinc or galvanized iron is the ideal covering, and some up-to-date beekeepers use sheet lead, the latter serving the double purpose of keeping the roofs dry, whilst its additional weight resists the onslaught of winter gales. However, if cost is a consideration, the thinner makes of rubberoid will serve the purpose admirably, and last for years with careful treatment.

PERMANENT SHELTER.

This is the season when it is most evident to the observant beekeeper that bees require plenty of shelter from high winds. The planting of shelter-hedges to protect the apiary should now be taken

in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected the bees can take exercise every sunny day during the winter months, and this exercise is very essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the beekeeper will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges giant privet and tagasaste are perhaps the best. These trees have been tested throughout the Dominion with good results. In the South yellow barberry holds pride of place as a hedge for beekeepers, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever trees are used, plant with the idea of forming a thick hedge, and do not set out to form a plantation. If tagasaste or giant privet are planted, see that they are protected from stock.

LIQUEFYING GRANULATED HONEY.

That honeys granulate and become solid in a certain time is well known to most beekeepers. This phenomenon has given rise to much speculation among consumers as to purity, and consequently producers of pat honey have had to educate the public, who formerly were suspicious that granulated honey was mixed with sugar. The crystallization of honey may be taken as a test for purity. Practically all the honey produced in the Dominion granulates, and the beekeeper may find it necessary to liquefy his honey when bottling. Many beekeepers are unable to procure small vessels in the extracting season, or their time is so much taken up attending to the bees that the honey is run off into larger vessels for the time being. Where the work of putting up the honey in retail packages has been postponed it may now be done. Liquefying is an important part of the producer's work, and must be carried out with great care, as neglect in this direction will lead to a poor article being put on the market and an injury to his trade. It must be understood that honeys brought to high temperatures become darker in colour and lose their flavour; besides, the higher alcohols which give honey its aroma are driven off. When honey is heated to 170° to 180° F. and over, decomposition of certain sugars sets in, and as a result an inferior article is produced. Such honey is

often seen for sale on the local markets, and is certain to deter the average person from eating honey altogether.

On no account should honey be liquefied by the direct application of heat, and it is extremely important that the temperature should not exceed 140° F. If it is necessary to liquefy bulk honey, this may be done by immersing the vessel in water which is brought gradually to 150°. At this temperature the honey will melt. Clover honey readily liquefies at about 140°. The process of liquefaction cannot be hurried, and if the mass of honey does not melt quickly, then it must be allowed to remain in the water from three to four hours. On no account apply greater heat. Too much stress cannot be placed on this point, as on it depends future sales and repeat orders. An ordinary washing-boiler is an excellent vessel to use where granulated honey is to be melted, but be sure that the tins are firmly soldered before immersing them. In order that the containers may not come in contact with the boiler it is advisable to place one or two small boards on the bottom of the copper. Place the tin to be heated on the boards, and exercise care in filling the boiler with water. When this has been done heat may be gently applied until the mass is dissolved. Liquefying honey is a tedious process at the best of times, but if good results are to be obtained the necessary amount of time must be spent on the operation.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

THE BREEDING-PENS.

No time should now be lost in mating up the breeding-pens, especially with the heavier breeds. True, there is time enough yet before commencing hatching operations as regards both the heavy and light breeds, but it is always advisable to have the birds mated well ahead, so that they may be well settled down before the eggs are required for hatching purposes. It will generally be found that August is the best month to hatch out the dual-purpose birds, such as Orpingtons, Rocks, and Wyandottes, and a month later for Leghorns, Minorcas, &c. It should always be remembered that it is more profitable to have the young stock brought out on the early rather than on the late side. Besides being more difficult to rear, the late-hatched birds seldom grow to the desired size. They

rarely develop into desirable breeding-stock, and as a rule lay smaller eggs and are more susceptible to disease than birds hatched at the right time. There are no chicks that do so well as those that are brought out just after the days commence to lengthen, and are well developed before the hot, trying summer-weather conditions prevail.

Great care should be exercised in selecting the breeders. The first essential is to have purebred stock, good specimens of the breed they represent, combined with laying type and the maximum points indicative of constitution. Of course, constitutional points must be given first consideration, for unless a bird possesses a strong constitution it cannot be expected that its offspring will have the necessary stamina to last out a long heavy-laying season, nor the same power of resistance to ward off disease. Now that it is proved and recognized that there is a special laying type the whole object of the breeder should be as far as possible to breed a uniform flock conforming to the correct type. It is true that fowls that have no special type or points indicative of purity of breed will at times produce good records. There are exceptions to every rule, but this does not disprove that in selecting the breeding-bird a definite type should be aimed at. A crossbred bird may have proved a prolific producer, but, not possessing the necessary fixity of type, she cannot transmit her laying-qualities with any degree of certainty. It may be said that like produces like, but this only applies where the parents are absolutely pure. One great weakness in utility poultry stock to-day is the great variation of type in individual breeds. Even in the egg-laying competitions few pens even of the popular White Leghorns conform to the same type, while it is also exceptional to find six birds in one pen uniform in this respect. It is well known with all classes of live-stock that to maintain purity of breed and to intensify desirable characteristics only purebred stock must be used for breeding. Many a common practice, such as treating phenomenal egg-records as the chief qualification of the breeding-pen, selecting on the pelvic-bone test, crossing the different breeds, or, in fact, anything which means the ignoring of breed characteristics, is certain to have a disastrous effect on the poultry stock of the country.

It is gratifying to notice that utility poultrymen are taking a greater interest in the poultry shows of the Dominion. These shows are practically the only means we have of preserving in a state of purity the many useful and beautiful breeds of poultry that are at our command. One of the greatest mistakes made in the past was to assume that because a bird was built on utility

lines it could not be a good specimen of the breed it represented. At the present time at most poultry shows of the Dominion there are separate classes provided for fancy and utility stock respectively, which means that the birds are judged on different standards. Now that fanciers and utility breeders have come to a much better understanding, with the common recognition of the fact that poultry can possess utility qualities and yet be desirable types of their respective breeds, it is to be hoped that in the near future the poultry shows will fall into line with the shows of other classes of live-stock—securing the adoption of one main class for each breed, judged on one standard, with the objective of combining beauty and utility in one bird. In order to become familiar with the various breed types of poultry, the novice cannot do better than study closely Ludlow's plates, together with the text describing their characteristics, in Lewis Wright's great work, "The Book of Poultry."

Having purebred stock and, if possible, a knowledge of their ancestry in regard to egg-laying performance, the first essential to be looked for in the ideal breeder is points indicative of constitution, such as a clean face free from wrinkles and feathers, bold, bright eye, short, stout beak, legs set wide apart, short shank, and tight feathering. These points only indicate constitution, and must be combined with points suggestive of laying-power, such as a deep and full abdomen of fine texture, a short keel, and an oblong body, full at crop and tapering from thighs to head, forming a wedge-like appearance. Summed up, and embodying both the above sides, the ideal breeding-bird should have a well-set-on head, a clean face free from wrinkles, a bold eye and medium-sized comb, be tightly feathered, have a fine texture of skin, have an oblong body on legs of medium thickness, the shank being short and the bone flat, set wide apart, well-developed crop, deep and full abdomen (which should be soft to the touch), and width across the back—a wedge-shaped appearance being thus presented from the top and side viewpoints. Generally speaking, the descriptive points outlined above apply to both male and female, apart, of course, from the usual sex differences. The male, however, should possess strong masculine characteristics by being stouter and more cobby than the female. The hen should be feminine in all respects. The feminine-looking male or the masculine female should never be bred from.

A serious weakness that is becoming far too common in many of the present-day utility stock is the lack of crop-development: that is to say, there is not sufficient width or depth from the point of

the shoulder downwards. A full crop in the breeding-bird is imperative, for birds deficient in this respect have not the capacity to hold the food necessary to produce the maximum egg-yield. Apart from this, breeding from stock with narrow breasts always has the tendency the weaken the lung-capacity and constitutional vigour. In both sexes the crop should be well rounded and stand out prominently in front of the wattles. As to size, it is always advisable to choose for the breeding-pen the hen of a slightly larger size than that of the ideal layer, for it is easier to lose in weight of stock than to increase it. A proportion of small birds will always come to vex the breeder, even when the large ones are bred from.

MANAGEMENT OF BREEDING-PENS.

The number of hens to one male depends entirely on the amount of range and the vigour of the male. On a free range good results may be obtained with one male to twenty or even thirty hens, but the number of hens must be considerably reduced when the space is confined. In the latter case six to eight of the heavy breeds, such as Orpingtons, Wyandottes, and Rocks, and ten to twelve of the lighter breeds, such as Leghorns and Minorcas, will be the maximum for the best results.

It cannot be too strongly emphasized that birds in a breeding-pen—which, by the way, should always be in a dry situation—must have good exercise. If the run is not large there should be ample litter provided in order to induce them to take exercise. Unless the birds are kept thoroughly fit, vigorous progeny cannot be expected.

The feeding of the breeding-birds is all-important. Solid food is essential. The best of grain only should be used, and the contents of the morning mash should not be of a forcing nature. Good fertility and stock can be obtained from the feeding of grain to the breeders night and morning, the grain being given in a manner that induces the maximum amount of exercise—that is, in deep litter. It is a mistake to provide too large a proportion of animal or other forcing food. At such a time birds cannot be oversupplied with green stuff, while ample fresh water and grit are details which must not be neglected. One big advantage in feeding grain in the litter is that overfatness is not induced in the hens.

MARKING DUCKLINGS.

A correspondent asks if there is any way of marking ducks without the use of leg-bands. The best method of producing a dis-

tinguishing mark for the determination of age, strain, &c., is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp penknife, the foot of the duckling being held on a piece of solid board during the operation. Disappointment will generally result from using the ordinary chicken-marker for ducklings. The holes will invariably close up, though apparently obliterated marks may often be distinguished by holding the duck's foot in the line of light.

DUCKLINGS DEAD IN SHELL.

Another correspondent wants to know the cause of a large percentage of ducklings dying in the shell during incubation. This trouble is generally due to insufficient moisture, or not applying it in a proper manner; while sometimes the condition of the breeding-stock may be responsible. The best system of applying moisture to duck-eggs is to spray water at a temperature of 103° on them every morning after the fourteenth day (with the mouth will serve the purpose). Do this after the eggs have been turned, and immediately place them back in the machine. Never cool after spraying. Spray in the morning and cool at night. Care must be taken that the ventilation vents are open, so that any excess of moisture can get away.

THINGS TO REMEMBER.

Learning how to prevent poultry diseases is of greater importance than learning how to cure them.

The first essential in preventing disease is selecting breeding-stock possessed of a sound constitution.

In planning out a poultry plant every provision should be made for saving of labour.

There is much to be lost and nothing to be gained by the practice of underfeeding the laying-hen.

It is always a wise policy to have on hand a reserve male for the breeding-pen.

Dirty and draughty houses, stale runs, and low feeding are an invitation to disease.

Avoid crosses as much as possible, and breed with purebred birds on each side when it is possible to do so.

Forcing the breeders for egg-production is generally followed by poor fertility of eggs, bad hatches, and loss of chickens at the brooder stage.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

JULY is practically the first month of spring in many parts, so far as garden-work is concerned. Local conditions vary so much in various places that it is impossible to state a date that will be suitable for all. Local knowledge must be the guide. It may be taken as an axiom that spring sowing and planting should commence as soon as the soil and other circumstances are suitable. An early start is an advantage, but not unless all conditions are right, for crops that hang fire, so to speak, seldom do well. With the proviso mentioned spring operations may commence, including the planting of cabbages, cauliflowers, lettuces, and onions from the autumn sowing; also the sowing of carrot, lettuce, onion, cabbage, cauliflower, radish, mustard and cress, and cucumbers for growing in frames or houses. Peas are now to be sown in any place, and continued fortnightly sowings should be made. Parsnips may be sown if required early, but on the whole it is better to leave these till later. Plant garlic, shallots, and chives. Turnips must not be sown till August. Rhubarb may now be planted. Fuller seasonal directions respecting the above-mentioned vegetables may be found in the *Journal* for June of last year.

ASPARAGUS-CULTURE.

The preparatory steps which are necessary for the successful cultivation of asparagus must depend on the local conditions. It is a very strong-growing plant, and very deep-rooting. Only those who have had the unpleasant task of destroying a good bed of asparagus can form any idea of what a strong plant it is. It follows that unless the soil is in a condition to permit of deep rooting the plant cannot do really well; but, considering what a long-lived plant it is, and comparing the results to be attained, the labour involved in the preparation of the soil is, after all, not a great matter.

There may, however, be practically no preparation required. If the soil is a deep alluvial deposit, and, as is usual in such cases, the subsoil is sand and gravel, no trenching will be needed. It is neither necessary nor is it advisable in such cases to trench manure in deeply; it will wash down with rain. The soil being free, the roots can get down to find moisture and other food. If the subsoil is of any other character trenching is necessary, and

the deeper the better—no one is likely to trench too deep. It is useless to trench unless something is put between every layer to keep the soil open. Stable or farmyard manure is the best possible material to use, and the quantity should be liberal; it cannot be overdone; though it is possible to give more than is actually necessary, the overplus would not be in any way prejudicial to the plants. For keeping heavy soil open any or all of the following materials are useful: Burnt clay, road-sand, sea or river sand, remains of rubbish-fires, vegetable mould of any kind, old mortar rubbish from buildings, turf from the top of pastures. Sea-sand with broken shells in it should be avoided, or at least it should not be used in the top spit, as the sharp shell cuts the young grass.

The most suitable soil for asparagus is fairly strong loam overlying gravel. The same class of loam on clay is perhaps as good, but would require effectual drainage. Lighter soil would be equally good if in a place naturally moist. The class of soil first described is best for most places.

It may be as well to say here that plantations of asparagus are often made for commercial purposes on quite different lines to those outlined above. The land in such cases is prepared by the plough only; the beds are of an ephemeral character, and do not come within the scope of this article, which refers to smaller operations and private gardens.

It was formerly the practice to plant asparagus on raised beds. The practice has been so generally abandoned that it does not seem to me advisable to describe that method of planting. The plants are now put out on the flat, a method that is better than raised beds, inasmuch as it gives the roots a wider and freer run. Before proceeding to plant the ultimate aim should be determined. There are three things to choose between—namely, good heads of ordinary type, giant heads, and giant heads blanched. Blanched heads are secured by a covering of soil. These are most appreciated on the Continent of Europe, and are required by canning-factories. Heads are made green by allowing them to make their growth in the air clear of the soil; the lower portion of such heads are blanched. Green heads are said to have more flavour than white, and are preferred by most British people.

Good heads are grown by planting in rows 30 in. apart, the plants being 15 in. asunder in the rows. Giant heads are secured by planting at greater distances apart—rows 4 ft. apart, plants at least 3 ft. asunder. The distances last mentioned may appear extravagant, but this is not really so in the end. After a few years the plants will practically fill the space, the roots become

very strong and the heads correspondingly large. Blanched heads are secured by moulding up the rows in the two last-mentioned beds.

Beds may be established either by sowing seeds in a nurse-bed the year before planting, to secure the necessary plants; by purchasing plants to save a year; or by sowing seed where the plants are to grow. The latter method would involve some extra labour in tending the young plants during the first season, but would be more expeditious than raising plants to be transplanted, as the transplanting checks the plants to some extent. Lacking plants, the wisest plan would be to purchase them.

Planting should be done in spring just as the plants are beginning to grow. It is dangerous to plant before the roots are active; there is naturally some damage to the roots in lifting, and if the plants remain dormant long after planting the damaged roots are likely to die back.

To plant, throw out a trench with a long-handled shovel. The trench should be about 6 in. deep. Along the bottom of the trench rake up a little ridge 3 in. high. Set the plants on the ridge as on a saddle, with the roots outspread on each side; then throw in the soil. This method is for beds treated in either way described. When planting be sure to press the soil down very firmly on the roots before completely covering them with the soil. The crowns should be covered to a depth of about 3 in. If long blanched heads are required the rows should be 4 ft. apart, as blanching is done by throwing a ridge of soil from the intervals over the rows of plants. The ridges are broken down in winter before pruning is done, and thrown up again before growth begins in spring. Though planting will not be done for some months, it is important that the soil be prepared well in advance, so that it may settle down and be in good working-order for planting.

Stable manure is the most valuable fertilizer or plant-food, and should be used as freely as possible. Bonedust is a valuable and lasting fertilizer; apply 2 lb. per rod at the same time as stable manure is applied—that is, when preparing the soil for new beds or immediately after cutting down an established bed. After growth has well started give a dressing of common salt—2 lb. per rod—or the same quantity of sulphate of ammonia, or 1 lb. of nitrate of soda. The same may be repeated some weeks later during showery weather.

No heads should be cut till the third year from planting. Cutting heads from an established bed continues for about ten weeks. After that everything that grows should be left to mature, as the next crop will be in proportion to the amount of growth so matured.

THE FLOWER-GARDEN.

Planting of all descriptions of trees and shrubs, also the division and planting of herbaceous plants, may now be done. All the primrose family may be planted; old clumps are the better for being broken up and planted as separate crowns. Violas may be divided in a similar manner. Seedlings of every description of hardy plants that have been raised under glass may, after the necessary hardening-off, be planted out. Seedling pansies should be put out in rich ground; planted at this time they usually give the best flowers of the season.

Perhaps the most important work in the flower-garden at this season is rose-pruning. This subject was fully dealt with in the *Journal* for the same period last year. Briefly put, whatever class the rose belongs to, all worn wood should be cut out, also thin twiggy wood and immature growth. Hybrid perpetuals and hybrid teas should be pruned to form a bush with an open centre, and the branches should not be crowded. Leading branches should be shortened according to strength, usually to about 6 in., leaving a few inches more in the case of strong growers. Shorten side shoots to two or three buds.

Climbing-roses of most classes are best treated by a frequent renewal of the main rods. The long, gross rods that they are accustomed to make should be laid in almost entire, merely removing the immature tips. These rods will throw out sprays of flowers from every joint. The following season the resulting shoots, or laterals as they are termed, should be spurred back to two buds, and every shoot should flower. The next winter these rods should be cut out.

Wicheriana roses, of which Dorothy Perkins is one, should be thinned out, and the laterals shortened back somewhat. This work is best done at the end of summer, but it may be carried out now.

EGYPTIAN PHOSPHATE-DEPOSITS.

THE Department has received a communication from Mr. W. E. Kingsford, a business man of Cairo, and president of the British Chamber of Commerce in that city, regarding phosphate-deposits in Egypt. Mr. Kingsford submits the following propositions to the Department: (1) To act as its buying and shipping agent for whatever phosphates are obtainable from companies now working mines; (2) to take up on its behalf a prospecting license, with eventual lease of mine approved; (3) to negotiate on its behalf with existing licensees a working arrangement for taking over their rights in a mine not yet worked owing to lack of capital. Mr. Kingsford has been informed that the Government does not at present propose to take any steps in the matter, as it is considered more a question for private than for Government enterprise; but that publicity will be given to his proposals for the information of any person or association in New Zealand who might be interested in the matter of phosphate-supplies from abroad.

ONE OF THE POSTER DIAGRAMS IN THE DEPARTMENT'S WINTER SHOW EXHIBIT, 1916.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

SALTING DOWN BUTTER.

"AVOCA," Streamlands :—

Would you be good enough to inform me how butter may be salted down to keep, say, four to six months.

The Dairy Division :—

Where no refrigerator is available, the butter should be salted with from ¾ oz. to 1 oz. of salt per pound, and a little butter-preservative added, amounting to, say, ½ to 1 per cent. A parchment-lined white-pine box, or an earthenware jar with a glazed surface, make very good receptacles for holding the product. The cream should be held for sufficient time to develop a nice mild acid flavour before churning, and care should be taken to extract all the buttermilk by churning the cream at a low temperature and washing the grains of butter with cold water. When packed the butter should be placed in the coolest position possible and kept free from exposure to the air.

KILLING WILLOWS WITH SULPHURIC ACID.

"POHARA," Tahuna :—

I have a number of willows growing in a large creek. Will you kindly inform me of best method of killing the trees? Can poison be used?

The Horticulture Division :—

Willows can be destroyed by the use of sulphuric acid. Bore a few holes with an auger in the base of the tree, fill with sulphuric acid, and plug. The holes should be bored on an angle so as to better retain the liquid.

BUDDING OF FRUIT-TREES.

"SUBSCRIBER," Mount Albert, Auckland :—

I would be glad of a little information regarding budding fruit-trees. I have tried peaches on several occasions, both early and late, but with very little success. I generally find that as soon as the wet autumn rains come the buds which up to then had looked very promising have all been destroyed by "gumming" of the tree. What would be the best time for the Auckland District to bud peaches, apples, pears, and lemons?

The Horticulture Division :—

You should experience no great difficulty in budding peaches successfully, provided that the work is carefully done and the proper bud used. The bud must be a healthy mature leaf-bud, either single or the centre one of a triple set. Care must be taken in removing the wood from the shield of bark when preparing the bud for insertion, otherwise the wood will be torn out of the bud, which will then

fail to grow, and the subsequent result will be practically the same as that described by you. After inserting the bud the edges of incision should be held in place by lightly binding with raffia—the material generally used for this purpose. January and February are generally recognized to be the most suitable times for budding the classes of fruit mentioned, but the work can be successfully performed over a longer period. Budding generally is more likely to be successful if carried out shortly after a moderate fall of rain.

MILLET AS GREEN MANURE.

G. L., Te Puke :—

Is millet of any value to plough in for green manure ? How does it compare with other things for that purpose—say, barley ?

The Fields Division :—

Pound for pound barley contains a little more nitrogen and ash than millet, but as the latter would produce a greater bulk of green material it would equal, if not surpass, barley for green-manuring purposes. Of course, barley could be grown during winter for the same purpose when millet could not.

ARTICHOKES.

D. G. GORDON, Taoroa, Taihape :—

Could you give me information as to growing Jerusalem artichokes, and their value as pig-food ? What kind of soil do they need, and are they subject to frost or blight ?

The Fields Division :—

The two varieties of artichokes principally grown are the white and the purple-skinned. There is practically no difference between them. They provide good feed and shade for pigs, the pigs helping themselves to the tubers. Artichokes grow well even on gravelly or sandy soils that otherwise might be waste ground on the farm. The soil requires to be well worked, however. The tubers are planted out like potatoes in hills about 2 ft. apart in drills 3 ft. apart. Place one set in each hill. Potash manures give best results. We would advise a little superphosphate (about 1 cwt. per acre) and wood-ashes (3 cwt. to 4 cwt. per acre). The tubers can be planted in the early spring (August or early in September). They respond to systematic intercultivation as do potatoes. As far as is known, they are not usually affected with a blight of any kind.

LUCERNE ROOT-FUNGUS.

T. P., Ohaupo :—

Some sort of blight or decay has made its appearance in my lucerne. It starts in a few plants and gradually spreads, the tops turn yellow and die off, and the roots rot, so that when they are pulled they break off a few inches below the surface. The paddock was laid down in December, 1913, with 1 ton of lime per acre. The first affected patch appeared about twelve months ago. As soon as I noticed it I spread lime very thickly over it, and dug it in right back into the good lucerne, which checked it for some time, but it has gone on spreading this summer and several more patches have appeared. I am sending a sample of soil and decayed roots.

The Biology Section :—

The lucerne specimens forwarded are attacked by a fungus root-disease known as Rhizoctonia, which forms a dense mass of minute interweaving threads, mainly about the roots, upon which it lives parasitically. The roots of many other plants are attacked by this disease, notably beans, beet, carrot, cabbage tribe, and potatoes. Acidity of soil through poor drainage favours its spread, but the

application of lime in your case should have neutralized such an acid condition. Freshly decayed vegetable-matter also fosters this fungus. If the affected patches are small enough they could advisedly be well watered with a solution of sulphate of iron, using 1½ lb. to 3 gallons of water. This is destructive to the fungus threads in the soil, where they may otherwise persist for many years. Several applications of this wash may be found necessary. Where the affected patches are small they should have a trench dug round them a foot or two beyond where any diseased plants show, and the soil should be thrown on the inside of the trench. In addition to spraying with iron sulphate a dressing of burnt lime at as high a rate as from 1 to 2 tons per acre may be applied. Where this disease appears in lucerne great care has to be exercised in cultivation, and in no case should the cultivating-implement be allowed to pass over the affected patches. If this is allowed to occur wholesale infection of the field is likely to result. Plants that are quite dead should be dug out and burnt on the affected areas themselves. When the disease is general over a lucerne-field there is no practical method of control.

MOLASSES AND STOCK-FEEDING.

W. F. PANNETT, Scargill :—

Will you kindly afford me some information as to the nutritive value of molasses? Last winter I used five or six casks, and I find it very useful as an adjunct to chaff. I save the husk or chaff of wheat and mix molasses with it, and find the stock eat it well. I have never been able to obtain the results of an analysis showing its food-value, or any statements as to how much should be fed in a given time.

The Live-stock Division :—

The constituents of molasses are as follows (per cent.): Water, 92·0; albuminoids, 2·0; carbohydrates, 4·4; ash, 1·6. Molasses, when diluted with warm water and sprinkled on hay or mixed with chaff, stimulates the appetite, but is of itself of no great food-value. It should be used with discretion, as cases are on record of serious digestive troubles through encouraging animals to eat indigestible food by adding molasses.

ERADICATING WILD BUTTERCUPS.

"SUBSCRIBER," Makuri :—

I have a 5-acre paddock of newly cleared land on a river-flat. I had a good crop of rape on it last season, and there is still a lot of feed on the land. The wild buttercup has had possession of the land for years. Can you advise me the best way to get rid of it? I thought of laying the paddock down in Western Wolths grass in the spring for fattening bullocks.

The Fields Division :—

The most feasible way to deal with the wild buttercup would be to plough up the land between now and early spring, and cultivate with spring-tooth cultivator and tine harrows from, say, the end of August up to near the end of November. Cultivate fairly frequently during that period, then seed at the rate of at least 30 lb. Western Wolths and 4 lb. cow-grass per acre, using about 1 cwt. basic superphosphate and 1 cwt. blood-and-bone manure per acre. The systematic cultivation, together with the liberal grass-seeding, should beat the weeds.

TREATMENT OF ROOTS FOR PIG-FEED.

T. C., Ngaruawahia :—

Does it pay to boil swedes and mangels for pigs? I pulp them before boiling. Would the results be as good if I mixed the pollard dry with the raw pulp—same amount in each case?

The Live-stock Division:

It does not pay to boil swedes or mangels for pigs. Raw swede or mangel pulp mixed with pollard is excellent pig-feed, quite equal to boiled feed. This does not apply to potatoes, which must be cooked for pigs.

LUCERNE IN ORCHARDS.—POISONOUS HONEY.

G. S. CLARKE, Kihikihi:—

Be good enough to inform me (1) whether lucerne would be injurious grown in between young fruit-trees, about 6 ft. from line of trees; (2) how honey should be treated to prevent (possible) poisoning.

The Horticulture Division:—

(1.) Lucerne could be grown for a time between young trees on the lines suggested without injury to the trees, provided the 6 ft. strip of soil between the lucerne and the trees were kept well worked.

(2.) Poisonous honey is gathered from two sources in New Zealand—viz., ranunculus (*rivularis*), a swamp-weed, and rangiora (*Brachyglottis repanda* and *B. rangiora*) shrubs. Honey gathered from these sources contains a volatile poison, which, in the process of ripening by the bees, is evaporated. Honey is ripe after having been capped by the bees, so that if no honey is extracted until capped there is no danger of injurious results.

CONTROLLING THE KEA PEST.

"SUFFERER," Oamaru:—

Will you kindly inform the writer the most efficacious manner of treating the kea pest? Our station in Central Otago suffers very much from these birds. So far we have tried shooting them. Some stations, I believe, go in for poisoning, but the latter method is objectionable because the dogs run the risk of being poisoned by the carcases left for the keas.

The Live-stock Division:—

Shooting and poisoning are both recommended by those who have had experience with the kea pest. In this connection we may quote the remarks of two reliable sheep-farmers with many years' experience on kea-infested country. One says, "I consider that paying a fair price per head is the best way of getting quit of them." The other, who also does a great deal of shooting, states, "The best means I find of getting rid of keas is by poisoning with strychnine a sheep they have just killed. I have got as many as forty dead round one sheep."

CONTROL OF GRASS-GRUB.

J. A. RAYNE, Carterton:—

I have a paddock which I have just sown down in grass and Cape barley. I notice that the grubs have started in it. Could you recommend anything to eradicate them?

The Fields Division:—

There is, unfortunately, nothing that could be applied to the land that would be feasible on a large scale. In general, we would advise breaking up your field often and growing temporary pastures until you rid the land of this troublesome pest. As clovers do not appear to be so readily attacked, make use of these as much as possible. Practise a short rotation. If you keep pigs or turkeys, turn them into the ploughed field, as they are good destroyers of the white grub. You should make a practice to grow temporary crops, making free use of clovers in them. The object is to keep the soil stirred up as much as possible. Do the ploughing in the autumn or early winter as far as possible, so as to expose to the frost.

After two or three years of a succession of temporary crops the land may be sown down with a permanent grass mixture, but not until the grubs have practically disappeared is it advisable for such mixture to be sown. Where the grub is bad only in patches a good heavy application of kainit to these spots has been recommended. Rolling the land heavily is also said to have some effect. Apterite or Vaporite has been used also as a spray for crops attacked by the white grub. These remedies may be of service to you where the grub is confined to small areas later on, but meantime the short rotation, embodying the use of temporary pastures of clover crops ("catch" or otherwise) with grain and root crops, is your best method of combating this difficult pest.

WOODLICE IN HIVES.—CROSS-MATING OF BEES.

"INQUIRER," Dannevirke :—

1. Can you tell me how to prevent "slaters" (woodlice) from entering and destroying comb in hives? The hives are about 9 in. off the ground.

2. I have the two races of Italian bees—Leather and Golden. Will the cross-mating of these two be in any way detrimental to the breeding of pure Italian stock? Are they looked upon as hybrids, and will it affect their ability to gather nectar?

The Horticulture Division :—

1. "Slaters," or woodlice, become prevalent in hives situated in damp places. Keep surrounding grass cut away and dry mats over the frames. A good unleakable cover should be on all hives. These insects do not usually cause material damage apart from being a nuisance and undesirable.

2. A cross between the Golden and Leather coloured Italians would not affect the honey-gathering qualities of either race, and they are not termed hybrids. Hybrids are a cross between the Black and Italian races.

METHOD OF APPLYING LIME.

CHARLES MCKENZIE, Ngaere :—

Would you kindly tell me through your *Journal* if it would kill seed to plant it with ground or burnt lime—I mean to run them both through the drill at the same time. Might not the lime when it gets on to the damp soil cause too much heat and so kill the germination?

The Fields Division :—

The sowing of seed and burnt lime together is not a desirable practice, because of the caustic action of the lime and so much of it coming in close contact with the germinating seed. You had better sow the lime separately, working it thoroughly through the soil when working up your land for the seed-bed. You could apply the lime on top of the ploughed ground and work it in with the disk and tine harrows.

WATTLE AND OTHER HEDGES.

"HEDGE," Makikihi :—

Could you inform me what kind of a fence wattle makes for a vegetable-garden, also for a road boundary-fence that has to be trimmed?

The Horticulture Division :—

Wattle will stand cutting, and can be made to serve either purposes mentioned by you, but for purely hedge purposes there are other plants preferable, such as Lombardy poplar for a boundary-fence, and *Pittosporum crassifolium*, broadleaf privet, or elaeagnus for the vegetable-garden. To provide a hedge quickly for the latter purpose tagasaste is very suitable.

ERADICATING RATSTAIL-GRASS.

O. M. C., North Auckland :—

Would you be so good as to advise what is the best method of treating limestone land that has been allowed to run to ratstail ?

The Fields Division :—

If your land is ploughable the method of eradication is first to plough shallow and let this lie for some time, particularly during a dry period of the year, then cross-plough deeper and work away with spring-tooth cultivator and tine harrows until you have brought all the grass to the surface, where it can dry out and die. To put the finishing-touch on this summer fallowing, seed heavily with rape or white mustard, to smother the grass. If the land is not ploughable it is practically impossible to eradicate the ratstail. The only feasible method that might be tried is to burn off the grass at the right time and broadcast a mixture of Kentucky blue-grass, cocksfoot, *Poa trivialis*, white clover, cow-grass, *Lotus angustissimus*, alsike, hard fescue, and a little Chewings fescue and *Danthonia pilosa*. Seed fairly liberally and when rain is imminent. Turning a good flock of sheep on to the sown area immediately afterwards should cause the seed to be trampled in and manured somewhat, thus giving the grass every chance of taking hold.

NOTICES.—The name of "Subscriber," Dannevirke, is required before his query regarding *C. macrocarpa* seed can be answered. The name, of course, will not be published.

A letter without signature of any sort, inquiring as to manurial advice, has been received from Enfield. It cannot be dealt with in its present form.

GRASS-SEED AND SMALL BIRDS.

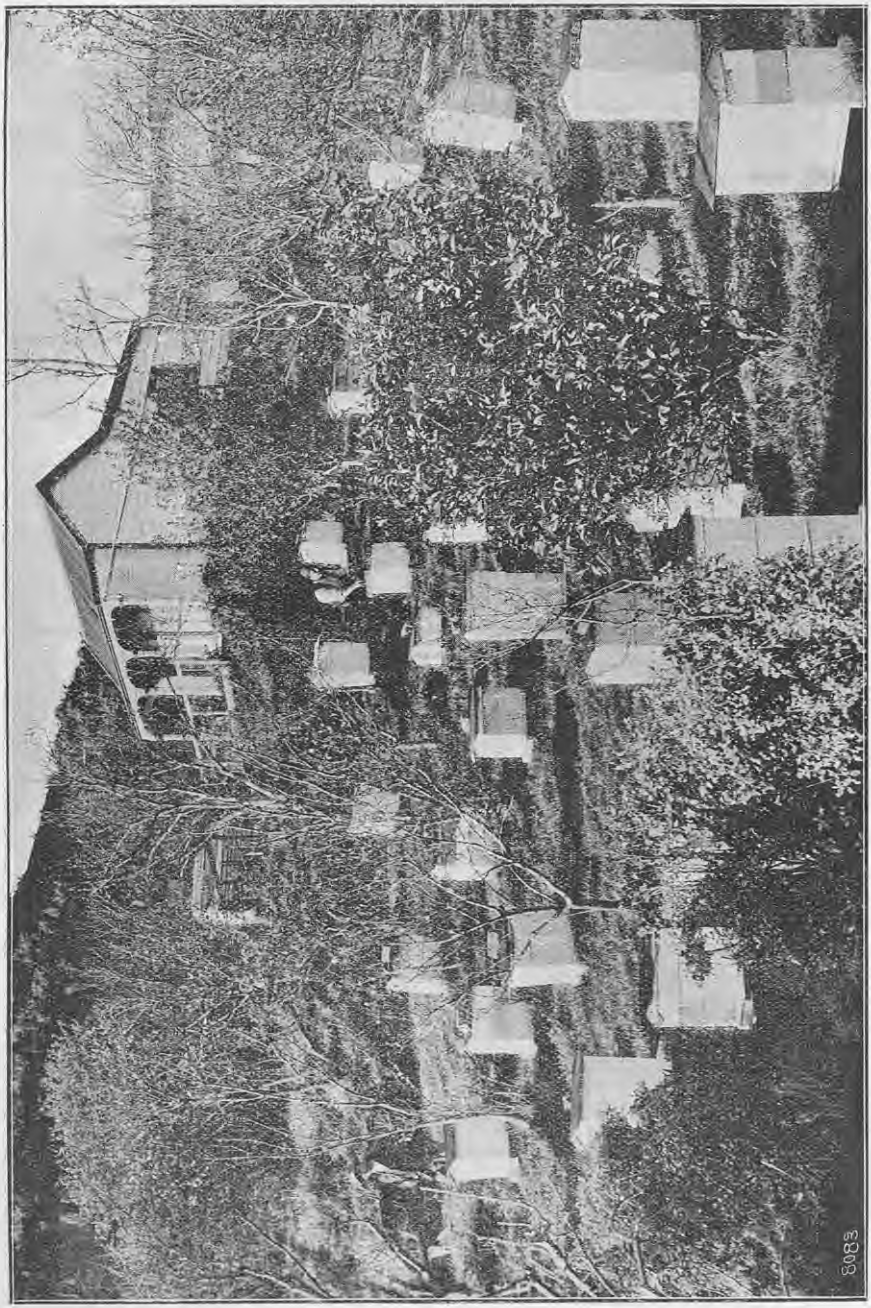
Mr. J. H. Fleming, of Ongarue, sends particulars of a method for protecting surface-sown grass-seed from small birds, at small cost, as follows: Mix kerosene and turpentine in the proportion of 1 pint of turps. to 1 gallon of kerosene. When sowing tip about half a bushel of seed into the sowing-bag, then pour half a pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used. Mr. Fleming says that he has overcome the nuisance by this means, and adds that in his case the birds now have all the worry.

FORTHCOMING AGRICULTURAL SHOWS.

Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 20th to 23rd June.

South Taranaki Winter Show Company (Limited): Dominion Dairy Show at Hawera, 4th to 8th July.

A Commonwealth Proclamation last year prohibited the importation of citrus plants from any part of the world into Australia, but the prohibition did not extend to citrus fruits. The latter provision has now been modified, to the effect that citrus fruits may be imported only from countries in which the disease citrus-canker or Japanese canker does not exist.



A HILLSIDE APIARY IN THE GISBORNE DISTRICT.

COMMERCIAL INTELLIGENCE.

LONDON WOOL-SALES.

FOLLOWING are the High Commissioner's cabled market reports regarding the fourth series of London wool-sales:—

30/5/16.—The wool-sales have opened with strong competition and a large attendance of buyers. Merinos and fine crossbreds are 1d. per pound higher; medium and coarse crossbreds are firm at the closing prices of last sales. The total net quantity of New Zealand wool available is 28,500 bales.

8/6/16.—The wool-sales have closed firm for all kinds of wool. There has been an active demand by Home buyers. Prospects for all wools at next series are favourable. Estimated values now are: Fine crossbreds, 1s. 10d. to 2s.; medium crossbreds, 1s. 5d. to 1s. 8d.; coarse crossbreds, 1s. 3d. to 1s. 6d.; superior merino, 1s. 9d. to 1s. 11d.; medium merino, 1s. 5d. to 1s. 8d.; inferior merino, 1s. 1d. to 1s. 4d. The total net quantity of New Zealand wool held over is 5,000 bales.

IMPORTATION OF LIVE-STOCK.

IN accordance with the regulations under the Stock Act, 1908, for the prevention of the introduction into New Zealand of diseases affecting stock, the following places have been appointed as the ports from which the kinds of live-stock mentioned must be shipped when intended for importation into the Dominion:—

Name of Country.	Kinds of Live-stock.	Ports appointed.
United States ..	Horses, mules, and asses ..	San Francisco.
Canada	Horses, mules, asses, and cattle	Vancouver.
France	Asses	Havre and Marseilles.
Spain	,, ...	El Ferrol.
Portugal	,, ...	Lisbon.

In the case of the United Kingdom, London, Liverpool, and Glasgow are the ports appointed by the regulations for the shipment of live-stock to New Zealand.

The following veterinarians have been appointed in the countries mentioned for the inspection of live-stock intended for exportation to New Zealand:—

UNITED KINGDOM: The Veterinary Officer attached to the office of the High Commissioner for New Zealand, or any veterinarian nominated by the High Commissioner, for the ports of London, Liverpool, and Glasgow.

CANADA: Any veterinarian in the employ of the Canadian Government for the Port of Vancouver.

UNITED STATES: Any veterinarian in the employ of the United States Government for the Port of San Francisco.

FRANCE: Any veterinarian nominated by the British Consul-General at Havre or Marseilles for these ports respectively.

SPAIN: Any veterinarian nominated by the British Consul at Corunna for the Port of El Ferrol.

PORTUGAL: Any veterinarian nominated by the British Consul at Lisbon for that port.

NEW ZEALAND EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,461*
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	*1915*	*257,953*	*433,831*	*34,780*	*655*	*148*	*17,065*	*21,615*	..	..	*2,923*	*4,968*	*808*	*2,636*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
,,	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
,,	*1914*	*53,386*	*49,200*	*2,353*	..	*15,885*	..	*3,337*	..	*5,896*	*7,288*	*1,143*	*57*	..
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
,,	*1914*	*291,432*	*128,016*	*49,104*	..	*81,842*	*30,487*	*8,938*	..	*68,660*	*38,121*	*2,042*	*1,650*	*1,683*
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
,,	*1914*	*136,346*	*27,577*	*48,302*	*27*	*98,729*	*70,048*	*37,604*	*15*	*24,289*	*35,783*	*885*	*110*	*1,377*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
,,	*1914*	*192,952*	*149,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. N.Z. Short-berried.	Wheat. N.Z. Long-berried.	Oats. N.Z. Sparrowbills.	Oats. N.Z. Danish.
1916.							d.	d.	d.	d.	d.	d.															
March 11	..	..	..	..	..	..	7⅞	7⅞	8¼	*8¾	..	..	182/0	163/0	99/0	99/0	103/0	47/0/0	45/10/0	57/0/0	46/10/0	44/10/0	56/0/0	..	..	..	..
„ 18	..	..	..	..	..	..	7⅞	7⅞	8¼	*8¾	6½	5½	181/0	163/0	102/0	103/0	105/0	..	46/0/0	56/10/0	46/5/0	44/5/0	55/0/0	..	..	..	..
„ 25	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	178/0	163/0	102/0	103/0	106/0	..	..	55/0/0	..	45/5/0	..	..	..	..	..
April 1	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	172/0	163/0	103/0	103/0	107/0	47/10/0	45/10/0	..	46/10/0	44/10/0	..	..	..	..	..
„ 8	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	174/0	163/0	103/6	103/6	107/0	49/0/0	47/0/0	54/0/0	47/10/0	45/10/0	53/0/0	..	..	..	..
„ 15	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	175/0	163/0	105/0	105/0	107/0	49/10/0	47/10/0	53/0/0	50/0/0	47/0/0	..	..	..	..	..
„ 20	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	173/0	163/0	105/0	105/0	108/0	49/10/0	..	55/0/0	48/10/0	46/15/0	51/10/0	..	..	..	..
„ 29	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	169/0	163/0	107/0	107/0	109/0	49/0/0	47/0/0	..	..	..	..	..	..	..	..
May 6	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	6½	6	170/0	164/0	110/0	110/0	112/0	50/0/0	48/0/0	..	48/10/0	46/10/0	54/10/0	..	..	..	..
„ 13	..	..	..	..	..	..	8⅛	8⅛	9	9	..	..	172/0	165/0	113/0	113/0	115/0	50/0/0	48/0/0	56/0/0	49/0/0	47/0/0	55/0/0	..	..	..	..
„ 20	..	..	..	..	..	..	8⅛	8⅛	9¼	9¼	..	..	172/0	169/0	114/6	113/6	115/9	49/10/0	47/10/0	55/0/0	48/0/0	46/0/0	54/0/0	..	..	..	..
„ 27	..	..	..	..	..	..	†8⅛	..	†8½	..	8	7¼	172/0	169/0	113/0	112/0	116/0	49/10/0	47/10/0	53/10/0	48/0/0	46/0/0	53/0/0	..	..	..	..
June 3	..	..	..	..	..	..	†8⅛	..	†9¼	..	..	..	174/0	169/0	108/0	105/0	105/0	49/10/0	47/10/0	53/10/0	48/0/0	46/0/0	53/0/0	..	..	..	..
„ 10	..	..	..	..	..	..	†8⅛	..	†9½	..	7⅛	6¾	176/0	170/0	110/0	106/0	105/0	49/10/0	47/10/0	53/0/0	48/0/0	46/0/0	51/0/0	..	..	..	..

* New season's. † Specified in cable as "New Zealand."

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of May, 1916:—

Port of Shipment.	Horses.		Sheep.		Cattle.		Pigs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Eastern Pacific.
Auckland	3	10	..	284	..	3	14
Gisborne	..	..	..	..	..	..	..
Napier	2	1	..	..	..	..	..
Wellington	2	..	100	..	..	..	..
Lyttelton	7	..	..	..	..	..	..
Dunedin	1	..	170	..	..	..	..
Bluff	..	..	..	..	..	..	..
Totals	15	11	270	284	..	3	14

Auckland also exported 19 crates of poultry and 24 mules to eastern Pacific.

The following are particulars of horses shipped: Thoroughbred, 2 stallions, 4 mares, 2 geldings, 1 colt; Clydesdale, 1 stallion, 1 mare; draught, 2 stallions, 1 filly, 6 medium and 4 light draught mares; 2 pony stallions.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of May, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
	MOTUIHI ISLAND (AUCKLAND).				
1	Fox-terrier ..	Male ..	London ..	Mrs. H. F. Wilton	Auckland.
1	Crossbred terrier	,,	,, ..	,,	,,
	SOMES ISLAND (WELLINGTON).				
2	Berkshire boars	Male ..	Sydney ..	Symons Bros. (agent, N.Z. Express Co.)	Thorndale, Taranaki.
1	Cocker spaniel ..	,,	Plymouth ..	Captain J. G. Williams, Government House	Wellington.
	QUAIL ISLAND (LYTTELTON).				
	Nil.				

HEMP AND TOW GRADING RETURNS.

MAY.

Hemp.—The total number of bales graded was 10,841, as compared with 9,463 for the corresponding month of last year, an increase of 1,378 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 143,436, as compared with 83,049 for the previous twelve months, an increase of 60,387 bales.

Tow.—During the month 2,268 bales were dealt with, as compared with 2,535 for the corresponding month of last year, a decrease of 267 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 39,393, as compared with 22,616 for the previous twelve months, an increase of 16,777 bales.

Stripper-slips.—The number of bales graded was 303, as compared with 99 for the corresponding month of last year, an increase of 204 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 6,458, as compared with 1,414 for the previous twelve months, an increase of 5,044 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF MAY, 1916.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	23	1,033	1,568	373	41	1	3,039
Napier ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	667	1,085	298	5	16	..	2,071
Wellington ..	..	13	501	2,448	367	42	8	..	3,379
Picton ..	..	72	26	..	..	..	..	..	98
Blenheim ..	..	..	199	65	23	4	..	..	291
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	131	173	153	15	..	..	472
Bluff	..	..	166	445	722	137	21	..	1,491
Totals ..	..	85	1,713	5,249	3,131	576	86	1	10,841
Percentages of totals	..	0·78	15·80	48·42	28·88	5·32	0·79	0·01	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	271	623	137	1,031
Napier	..	..	..	..	..
Foxton	214	57	4	..	275
Wellington ..	58	13	49	..	120
Picton	..	40	..	..	40
Blenheim ..	52	125	..	..	177
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	86	30	1	117
Bluff	..	87	393	28	508
Totals ..	324	679	1,099	166	2,268

Stripper-slips.—Foxton: Second grade, 150; condemned, 1. Wellington: First grade, 14; second grade, 96; condemned, 5. Blenheim: Second grade, 28. Dunedin: Condemned, 3. Bluff: Second grade, 6.

LIST OF THE

DEPARTMENT'S PUBLICATIONS IN STOCK.

BULLETINS: NEW SERIES.

1. Foul-brood in Bees.
2. Butter-making on the Farm.
3. Parasitic Gastritis of Sheep.
5. Ensilage and Fodder Crops.
7. The Stock Act.
8. A Lecture on Brood Mares.
9. Some of the Common Ailments in Foals.
10. Acidimeter and its Use.
11. The Grape-vine.
12. The Waipoua Kauri Forest.
14. Orchard and Fruit-garden.
16. Dairy-cow Advancement.
17. Cool Storage of Fruit.
20. Contagious Abortion and Failure of Conception in Dairy Cows.
21. Impure Seed.
22. Phormium Tenax.
23. Casein.
24. Fruit by Post.
29. Soft-cheese Making.
30. Pig Breeding and Management.
33. Tomato-culture.
34. Lucerne.
35. Testing of Dairy Herds.
37. Cultivation of Mangels.
39. Bees: Feeding and Feeders.
41. Handling Apples for Market.
42. Home Separation.
43. Tomato-culture Experiments.
44. Dairy-farming.
45. Fibres and Fibre-production.
46. History of the Humble Bee.
48. Phosphates.
50. Top-dressing of Pastures.
51. Milk-testing and Cream-testing.
52. Forage Plants and Animal Nutrition.
53. Fruit-markets and Fruitgrowing in South America.
54. Rock Phosphate in New Zealand.
55. Bee-culture.
56. Box Method of testing Soils.
57. Principal Spraying-compounds.
58. Preservative Treatment of Farm Timbers.
59. Fruit Varieties for Export and Local Markets.
60. Calf-rearing.

LEAFLETS FOR FARMERS.

2. Bathurst Burr.
23. Nasal Bot in Sheep, Grub in the Head.
27. Anthrax.
28. Ox-eye and Dog Daisy.
39. Recipes for Phosphorized Pollard for poisoning Rabbits.
46. Celery-leafed Buttercup.
58. Blood-poisoning in Sheep after Shearing and Lambs after Docking.
60. Mortality of Sheep on Turnips.
69. Directions for forwarding Specimens.
72. Unsoundness in Horses.
73. Tarweed.
74. Sheep's Burr, Australian Burr.
77. Manuring of Mangels and Turnips.
78. Diseases of Field Crops and Forage Plants.
79. Sand-binding Grasses.
80. Root Crops.

LEAFLETS FOR GARDENERS.

12. Black Aphis, Black Fly.
18. Bladder-plums, Pocket-plums, and Mock-plums.
27. Cineraria-fly.
33. Verrucosis of Lemon.
34. Gooseberry-rust.
47. Peach and Nectarine.
51. Cherry-leaf Scorch.
52. Pelargonium-spot.

MISCELLANEOUS BULLETINS.

13. Gum-tree Scale.
14. Diseases of Swede Turnips.
20. Eelworms.
1. Pseudo-tuberculosis in Sheep.
12. The Sheep-maggot.
13. Bovine Contagious Mammitis.
15. Two Diseases of Pregnant Ewes.

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14. Pasteurization of Skim-milk and Whey.
Annual List of Dairy Factories, &c., 1915.
Potato-blight.

Demonstration Area at Auckland Exhibition, 1913-14 (Grasses, Forage Plants, &c.).

ANNUAL REPORTS.

Annual Report of Department, 1909, 1910, 1911, 1912, 1913, 1914, 1915.

ANY OF THE ABOVE MAY BE OBTAINED GRATIS ON APPLICATION.
PLEASE QUOTE NUMBERS AND SERIES.

INDEXES of JOURNAL OF AGRICULTURE.—Volumes I to XI (1910 to 1915): Price, 3d. each.

Address: The Secretary,
Department of Agriculture, Industries, and Commerce,
Wellington, N.Z.

"The writer is quite convinced that for the eradication of weeds we use the disk harrow too much and the cultivator too little.

"The cultivator serves the double purpose of stirring the soil to a good depth and dragging the weeds to the surface, where they can be effectively dealt with by the tine and chain harrows."—Primrose McConnell, *Journal of Agriculture*, 20th January, 1915.

State Assistance in Tree-planting by Farmers.

WITH a view to encouraging farmers to plant trees for shelter, forest plantations, post timber, firewood, and other purposes on their farms, the Forestry Branch of the Lands and Survey Department is now prepared to supply suitable trees to farmers who wish to improve their farms in the manner referred to. Fruit-trees or trees for planting on town lots are not supplied.

In the North Island applications for trees should be made to the Superintending Nurseryman at Whakarewarewa, and in the South Island to the Superintending Nurseryman at Tapanui, who will supply price-lists and other particulars.

WANTED TO PURCHASE: Three second-hand or new **Weighing Platforms and Scales,** suitable to farm use. For further particulars apply to

THE DIRECTOR OF THE FIELDS DIVISION,
DEPARTMENT OF AGRICULTURE,
WELLINGTON.

CONTENTS — JUNE, 1916.

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