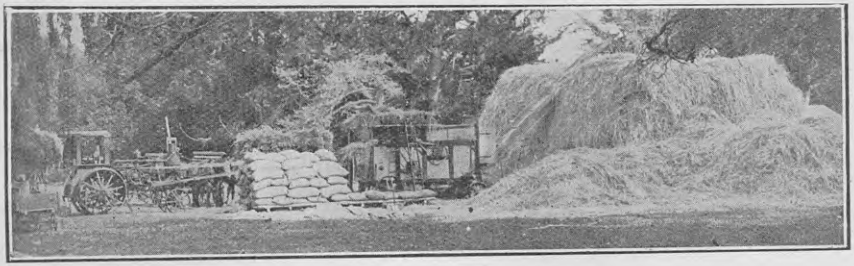

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MODERN SEED-TESTING.

THE NEW ZEALAND OFFICIAL SEED-STATION.

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THE idea of testing seeds before they are sown is not by any means a recent one, for in writings of the eighteenth century there is reference to the examination of seed. In 1869 the first seed-control station was initiated by Dr. Nobbe, in Saxony, and gradually seed-stations were instituted all over Europe. Among the most notable are those at Zurich (Switzerland) and at Copenhagen. These two stations may be termed the leaders of the world's seed-testing, and much valuable research work has been done there. In the British Isles Ireland has had a seed-testing station for twenty years, Scotland for about ten, and England for five years past. The United States of America and Canada have been testing seeds for many years; in the former country there is at least one station in every State, with the main station at Washington, while in Canada there are several large stations. Australia is also well provided in this respect. All these countries have some form of seed legislation, under which it is compulsory to have all seed tested, and necessary that it shall be of a certain standard of purity and germination before it is placed on the market.

THE NEW ZEALAND STATION.

In New Zealand a voluntary official seed-testing system, operated in connection with the Biological Laboratory of the Department of Agriculture, was initiated in 1909. A compulsory measure has been obviated largely through recognition by the local seed trade of the necessity of knowing the value of the seeds it handles, and to the desire of the merchants to keep the trade in New Zealand at a high standard. During the earlier period of the system only those samples of which the genuineness was suspected were forwarded for test, but at the present time practically the whole of the sales and purchases in the New Zealand trade are based upon reports issued from this Laboratory. In a sense, therefore, it may be said that the testing has become more or less compulsory, for the reason either that prior to making a sale a merchant must perforce procure a Government test before the intending purchaser will do business, or that the purchaser has the test made before he buys. Many local merchants carry out a large part of their own testing, but these tests are not usually recognized in the trade, being mainly for the firm's own information. Government certificates are necessary also in all export business, as nothing but an unbiased Government report is acceptable to overseas buyers. Most firms, too, when stock-taking have the whole of their stocks tested, in order that they may write off the worthless stuff and restock. It will be seen, therefore, that the activities of the seed-stations cover a wide field and do much towards maintaining a high standard in the trade. In addition to making germination and purity tests, researches in matters relating to seed-storage, loss of vitality in seeds, improved methods of testing, &c., are also carried out.

The inauguration of seed-testing by the Department was effected after a good deal of experimental work had been carried out. Seeds were at first tested free, but in 1916 fees of 1s. for germination and 2s. for germination and purity were fixed for merchants' samples. In 1921, owing to increased costs in operation and the necessity to make the service self-supporting, the fees were further increased to 2s. and 4s. respectively. Testing is still carried out free of charge for farmers, but few avail themselves of the service.

The following table shows the growth of the work of the seed-station from 1910 onward :—

Year ended March.	Number of Samples tested.	Year ended March.	Number of Samples tested.
1910	180	1917	2,700
1911	400	1918	3,859
1912	400	1919	6,261
1913	650	1920	8,165
1914	1,863	1921	8,800
1915	2,646	1922	9,400
1916	3,200		

For the ten months ended January, 1923, 7,500 samples have been tested, making an aggregate of nearly 61,500 samples dealt with since the establishment of the system.

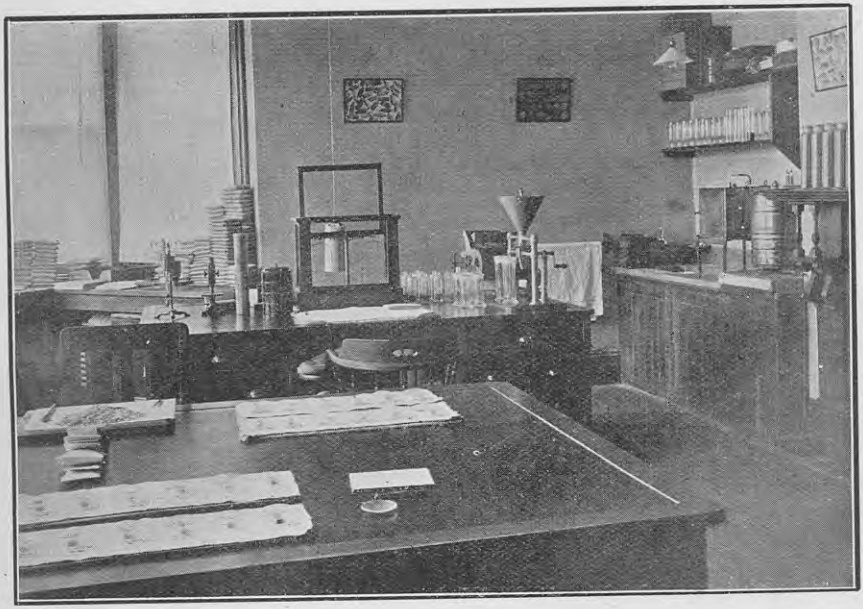

FIG. 1. INTERIOR VIEW AT THE AGRICULTURE DEPARTMENT'S SEED-TESTING STATION, WELLINGTON.

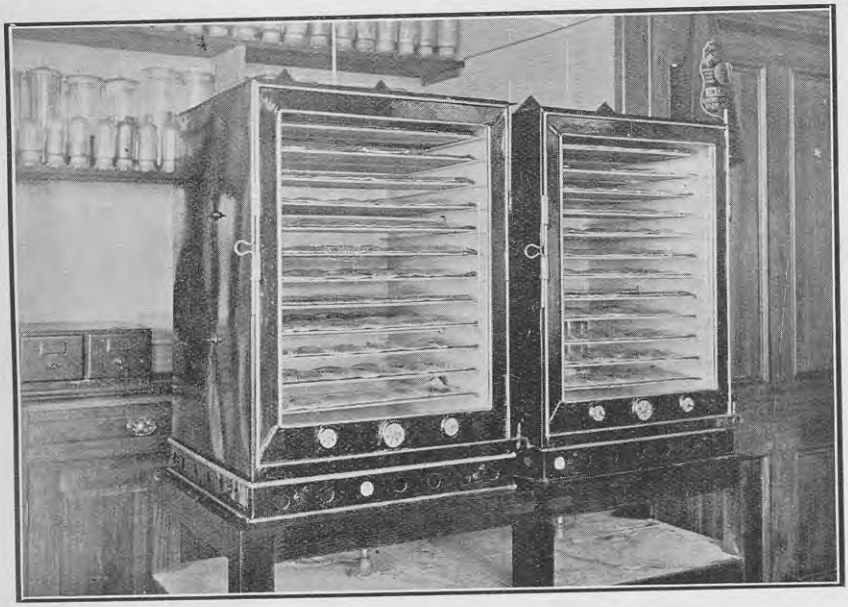

FIG. 2. LATEST TYPE OF WATER-BATH GERMINATOR.

This photo and the subsequent illustrations also refer to the Department's station.

[*Photos by N. R. Foy.*

METHODS OF SEED-TESTING.

The two methods of seed-testing—the Continental and the Irish—have been described previously in the *Journal;* in the former method only mature seeds are germinated, and in the latter both mature and immature seeds. There has been much discussion over the relative advantages of the two methods, the trend of opinion being towards the Continental. In New Zealand all testing is carried out on the Irish method, but the time may not be far off when, with one or two other countries, we shall have to fall into line and adopt the Continental system, in order that tests from all parts of the world may be uniform. Theoretically the Continental method is the more correct, its great disadvantage being the laborious and complicated methods of executing the tests, requiring more than double the operating force. The only case in which the Irish method is at present departed from at the New Zealand station is that of Waipu brown-top, which, as the lines usually contain a large percentage of empty glumes, is dressed until only full mature seed remains. The report on such a sample is given, for example, thus: Empty glumes, 40 per cent.; kernel, 50 per cent.; extraneous seeds, 10 per cent.; germination, 85 per cent.

THE NEW ZEALAND SYSTEM IN DETAIL.

As each sample is received it is given a number, and all the particulars concerning it are entered upon a special record card, one for each sample. Upon the card also is entered the dates on which the test is to be counted, and a space for the record of the purity analysis.

Process of Germination.

Germination tests are carried out in specially constructed germinators, of which there are three types—the all-metal water-bath germinator, which is enclosed at the sides, top, and bottom by a water-jacket; the glass, wooden-framed type; and the small water-bath type. All the more difficult testing, such as rye-grass, cocksfoot, dogstail, and fescue, is carried out in the first type, owing to its uniformity of temperature, correct degree of humidity, and the ease with which temperatures can be controlled. With the exception of the germinator for cereals, all the germinators are gas-heated. All the clovers, crucifers (swedes, turnips, &c.), cereals, peas, and vegetable seeds generally are germinated in the second type. It is proposed to gradually replace these with the first type. The small germinators are used for paspalum, Poa species, and any other seeds with which a high temperature is required.

The sample is well mixed and poured on to a sheet of stiff paper. From different portions of it are counted two lots of 100 seeds, which are placed on separate trays, these trays being placed in separate germinators. Thus all tests are made in duplicate, while four tests are made of Chewings fescue, cocksfoot, and Poas. The germinating-medium itself is simply coarse felt saturated with water and covered with two thicknesses of blotting-paper, the whole being placed on an asbestos tray. Each sample is covered by a 3 in. watch-glass raised at one side to allow of ventilation.

With the exception of paspalum, Poa species, cereals, and peas all seeds are germinated at a temperature alternating from 85° to 65° F.—85° for eight hours, and then allowed to fall to 65° for the remaining

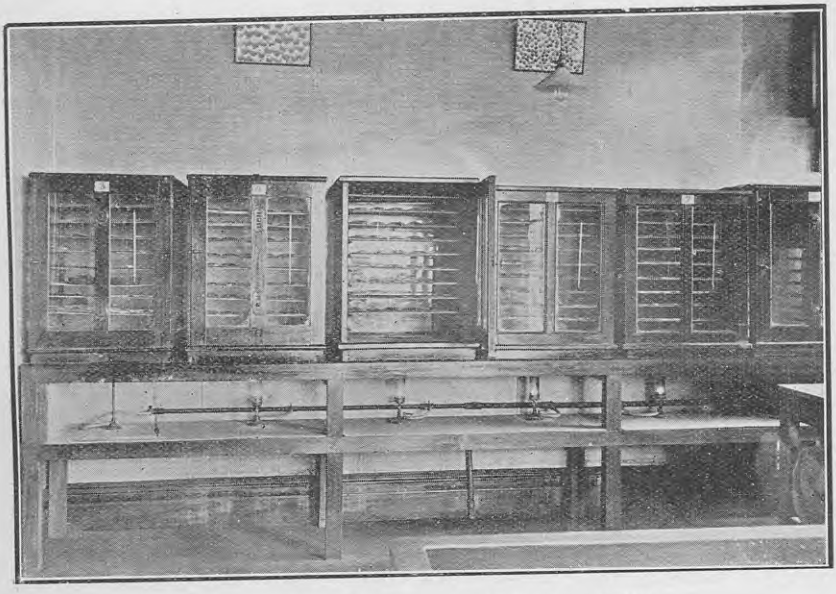

FIG. 3. WOODEN-FRAMED GLASS GERMINATORS.

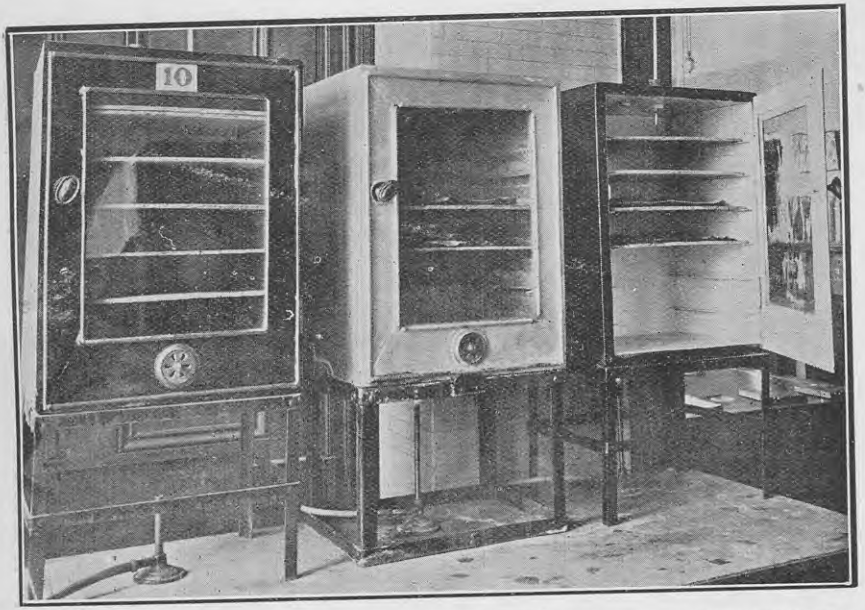

FIG. 4. SMALL WATER-BATH GERMINATORS FOR SPECIAL HIGH-TEMPERATURE TESTS.

[*Photos by N. R. Foy.*

sixteen hours. Paspalum and the Poas are germinated at 95° to 65°, peas at 75° to 60°, and cereals at ordinary room-temperatures. Peas and beans are soaked in water for sixteen hours before being placed to germinate, the latter being then germinated in damp sawdust.

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

—	First Count.	Second Count (Interim Report).	Third Count.	Fourth Count (Final Report).
	Days.	Days.	Days.	Days.
Crucifers, clovers ..	2	4	7	10
Rye-grass, Lotus spp. ..	3	6	10	14
Fescues, dogstail, mangolds	4	8	13	18
Cocksfoot, paspalum ..	5	10	16	22
Poa spp.	6	12	20	28
Pinus spp.	21	42	63	up to 84

The seeds that have germinated are counted off and discarded, and the number entered upon the record card.

Purity Analysis.

In the purity analysis the percentage of extraneous seeds is given by weight. The sample is thoroughly mixed, and a definite amount weighed by means of a special balance. The amount weighed for examination varies for different seeds, being as follows : For the larger seeds, such as rye-grass, cow-grass, &c., 2½ grams ; for the smaller seeds, such as crested dogstail, white clover, &c., 1 gram ; for seeds of the Brassicas, such as rape, 5 grams ; for oats, prairie-grass, &c., 10 grams.

The weighed amount is spread evenly over a squared surface and gone through carefully with an eyeglass. All extraneous seeds are picked out and weighed, and the percentage calculated. The remainder of the sample is then gone through, and any additional extraneous seeds picked out and their names entered, together with those found in the weighed amount, on the record card.

In the event of Californian thistle, clover dodder, or ox-eye daisy being found in a sample the number of seeds per pound is calculated and entered on the card.

Reports.

In every case after the second germination count a report is furnished to the sender. This gives the average germination after a specified number of days, and the percentage of impurities. The interim report is of special value for two reasons : Firstly, it gives the merchant (or other sender) some idea of how the line is shaping, and enables him to judge whether it is suitable for his purpose without his having to wait the full time for the final test. For instance, a sample of crested dogstail germinating 85 per cent. in the interim report will finish up with an approximate final of 95 per cent. Again, if a sample of rye-grass shows an interim result of, say, only 25 per cent. the merchant will know immediately that it is worthless. Secondly, the interim report gives a good indication of the vitality of a line. The degree of rapidity with which germination takes place is indicative of the vitality of the seed—a slow germination means low vitality, a rapid one high

FIG. 5. MAKING GERMINATION TESTS.

The nearest operator is counting seeds on to the tray, the other counting off germinated seeds.

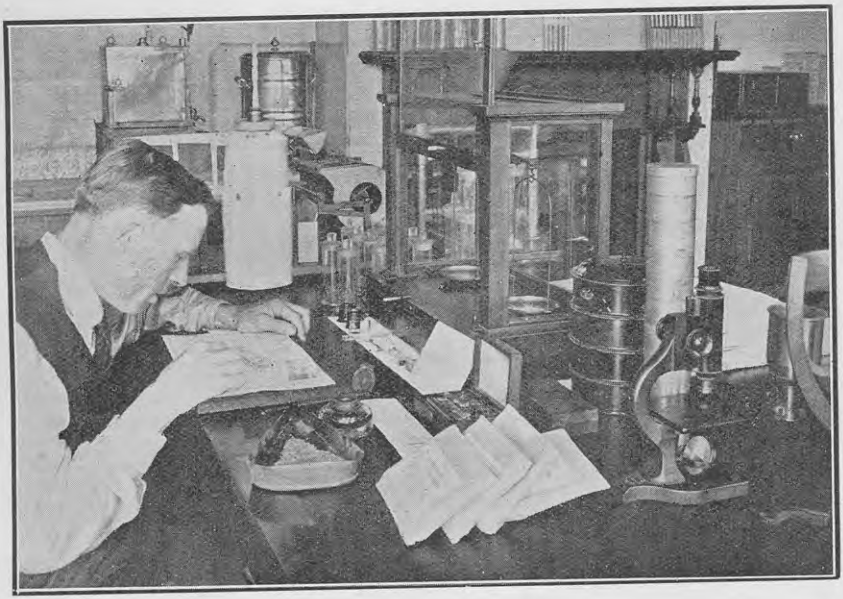

FIG. 6. MAKING A PURITY ANALYSIS.

[*Photos by N. R. Foy.*

vitality. Thus the final reports on two separate lines of rape may both be 92 per cent., with interim reports at 90 per cent. and 80 per cent. respectively. At the expiration of the testing-period final reports are sent out. These show the interim and final germination, each at a certain number of days, and in the case of purity tests the percentage of extraneous seeds and a complete list of the impurities.

Any peculiarity noted about the sample, such as the presence of mites, &c., is also reported. In the case of clover-seeds there usually remains after the test is completed a certain number of seeds that have neither germinated nor rotted. These are seeds the seed-coats of which are too hard to allow the water to enter, with a result that germination does not take place. These are termed "hard seeds," and as they are living seeds, with the possibility of softening and germinating in the soil, half of the number is counted as viable and included in the final result.

SOME DIGESTIVE DISORDERS OF CATTLE.*

VARIOUS LOCAL EXPERIENCES.

W. C. BARRY, M.R.C.V.S., Veterinarian, Auckland.

THE study of the complex mechanism of the bovine digestive apparatus received attention from the early workers in veterinary science, but, although various theories were put forth regarding the act of rumination, it was not until later years that the process was clearly understood. Much work yet remains to be done, and it must be admitted that to-day our knowledge is not yet complete on this interesting physiological function.

Before passing on to abnormal conditions, the various changes to which the food is normally subjected before it reaches the fourth or true digestive compartment of the ruminant may be briefly summarized.

The terminal part of the œsophagus (gullet) is prolonged into a structure known as the œsophageal groove, which runs over the inner wall of the reticulum (second stomach) and enters the omasum (third stomach) towards its lower aspect, terminating there. This œsophageal groove is not a complete canal, but has two strong lips, or pillars, controlling its movements. An opening at its end leads into the omasum. It communicates with the reticulum, and also with the rumen (first stomach), and by means of this groove remasticated food can be passed directly from the mouth to the third stomach, a contraction bringing the opening to that compartment in apposition to the end of the œsophagus.

The rumen is of enormous size, and in an average-sized beast will hold 20 to 30 gallons. Running through its walls are found strong muscular bands, the so-called pillars of the rumen. These enable it to bring about its contraction and churning movements, and have an important bearing on torpid conditions of this compartment.

* Substance of a paper read at the Meeting of the Australasian Association for the Advancement of Science, Wellington (N.Z.), January, 1923.

It is important to remember that in the pregnant cow the heavy uterus is in contact with the rumen towards the end of pregnancy.

The reticulum is small, its capacity being about 3 pints. It is situated below and in front of the rumen, resting almost in contact with the sternum. Its mucous membrane is arranged in the form of cells resembling a honeycomb. Its contents are always of fluid consistency. Foreign bodies which have been swallowed are often found here.

The omasum, better known as the "book," is roughly circular in shape, and has a remarkable interior arrangement. Running across its interior is found a series of leaves, from large size to very small, and numbering about a hundred. These leaves are covered with mucous membrane carrying papillæ. Its function is the triturating of the coarser part of the food before its entrance to the abomasum (fourth stomach). Normally its contents are always dry, as its contraction squeezes the fluid portion on to the true stomach. The omasum is remarkable in that its nerve-supply is different from that of the other three stomachs. Stimulation of the vagus (centre controlling nerves to the part), while producing contraction of the other three, produces no effect on the omasum. Incidentally, it may be mentioned that the omasum is blamed, on post-mortem, for a number of deaths for which it was not responsible.

The abomasum is the true digestive stomach, secreting gastric juice.

A few remarks on the passage of the food through these complicated stomachs will now be made. First of all, it must be remembered that all solid ingesta swallowed returns again up the œsophagus in the process of rumination or "chewing the cud." On its first journey down it enters the rumen coated by the liberal quantity of saliva secreted (it is estimated that the salivary secretion for twenty-four hours may be as much as 112 lb.). Here it is rotated and crushed by a churning movement. In time the food is brought back to the œsophageal opening, and by a reversed form of movement arrives again in the mouth to undergo a thorough chewing. Then, if masticated sufficiently, it is passed to the omasum, where the still coarse fibres are subjected to further milling. Rumination in a healthy animal occupies at least seven out of the twenty-four hours.

As regards the distribution of fluids swallowed, it would appear that the reticulum first fills, and then the fluid is poured into the rumen, where a large amount of liquid is required to keep the mass soft. I was first interested in this through being privileged to see some simple experiments in drenching beasts with coloured fluids previous to slaughter, and making *post-mortem* observations. It was noted that where the animal was killed immediately after the drench most of the coloured fluid was found in the reticulum, but if killed from twenty to thirty minutes later the coloration was evident throughout the first three stomachs. The practical application of this would indicate the necessity of giving medicine in a large quantity of fluid medium.

The rumen always contains a large amount of ingesta, without the presence of which rumination would cease. It acts as a constant stimulus to the organ to perform its contractile movements. This explains why a large percentage of the feed of ruminants must be of a bulky nature.

Some commonly-met-with disorders connected with the digestive system will now be considered.

CESSATION OF RUMINATION OR "LOSS OF CUD."

This trouble is merely a symptom, and may be due to any one of a number of digestive disturbances as well as other conditions. It is, nevertheless, a very important symptom, and should always receive careful observation before making a diagnosis in obscure cases.

"DROPPING THE CUD."

In this condition the bolus of food drops from the mouth before being properly masticated. It is usually due to some mouth affection or tongue injury, and is often seen in cases of actinomycosis. An examination of the mouth usually reveals the cause. One such case seen recently was found to be caused by a piece of bone becoming fixed between the molar teeth and wounding the tongue. When the cud is dropped during rumination the fact points to some form of indigestion, and the animal should receive a laxative, followed by twice-daily doses of 2 oz. of bicarbonate of soda mixed in thin gruel. Change of pasture is beneficial.

PICA.

This name has been given to the condition often seen in the cow, in which she chews various indigestible objects, such as pieces of wood, rags, leather, &c. It is a condition of depraved appetite, and is probably only a symptom of disturbance in certain metabolic (changing) processes. It is very often transient, passing off in a few days, but in cases where it persists the cow rapidly loses condition. Treatment consists of a change of feed, securing a properly balanced ration, also giving the cow a mash of bran containing salt daily for a few days, or placing rock-salt for her to lick.

In the foregoing mention of pica I am not referring to the condition which exists in various parts of the North Island of New Zealand, and to which the name of Waihi disease has been given. In this complaint cattle, together with other symptoms, show a partiality for chewing bones and wood. Both the etiology and cure of Waihi disease have been fully worked out, and it is known to be due to soil-deficiency.

TYMPANITES OF THE RUMEN.

This condition is also variously known as "hoven," "blown," "bloating," "dew-sickness," "tympanitic indigestion," &c., and is probably the most commonly observed gastric derangement of cattle. It occurs usually as an acute condition, but is occasionally seen in a chronic or recurring form. Diagnosis is easy. The left flank is enormously distended, due to gas-formation in the rumen, and is drum-like to the touch. The trouble is sudden in its development, and in acute cases may cause death in half an hour or less from asphyxia, due to interference with respiration.

The cause of tympanites, apart from mechanical obstruction of the œsophagus in choking, is due to the nature of the feed. Clover more often gives rise to it than does any other green feed. We are all familiar with the cases which occur when cattle are turned into a paddock of clover for the first time. This becomes especially

dangerous after rain, or if the stock are allowed on in the morning before the dew is off the grass. Further, the more empty their condition the greater is the danger of cattle gorging themselves. In such case rapid fermentation follows, which quickly gives rise to the gas-formation and "blown" condition. Any succulent green feed is liable to produce tympany; also roots or potatoes, particularly if in an unsound condition. We observed some cases recently where the ingestion of watercress appeared to be the only traceable cause. Also in poisoning by the celery-leaf buttercup (*Ranunculus sceleratus*), seen a few years ago in Canterbury, we noted tympany occurring as a well-marked symptom in many of the cases.

An interesting case was related to me by Mr. J. Lyons, M.R.C.V.S., which happened in his experience in England. He was asked to see a cow which had broken loose during the night and gorged herself on frozen turnips, and next morning was found in a badly tympanitic condition. He relieved the tympany with the trocar and canula. This occurred in the month of February, and the cow, after the attack, never recovered her normal health; rumination had ceased, and she apparently suffered from paralysis of the stomach-wall. She died during the month of July following, when Mr. Lyons made a post-mortem and found turnips still in the rumen, and, as it was not possible that they were consumed in the meantime, he was quite satisfied that they were the same turnips which five months previously had started the trouble.

Treatment depends on the gravity of the case. If there is much distress and danger of suffocation imminent it is advisable to puncture the rumen with the trocar at once. In less acute cases medicinal treatment is generally successful. Of remedies used I prefer oil of turpentine in doses of 2 oz., preferably given in a quart of raw linseed-oil.

Prevention lies in bringing stock on to green feed gradually, allowing them to graze at first only for a short period; also, if dry feed be given previously the danger is greatly lessened.

Abortion is caused occasionally in pregnant animals by tympany of the rumen. Chronic or recurring tympany is sometimes a symptom of tuberculosis, brought about by an enormous tubercular enlargement of the mediastinal glands. Many cases of tympanites are followed by paralysis of the stomach-wall, giving rise to impaction.

IMPACTION OF THE RUMEN.

This gives rise to varying symptoms, and undoubtedly is the cause of a number of deaths, besides producing marked unthriftiness in condition in stock, more particularly in certain districts and at certain periods of the year.

In its typical form it is the result of what may be termed a dietetic indiscretion. A large quantity of feed of a dry nature is consumed, feed which has not much tendency to ferment, and consequently very little or no tympany is present. For instance, the cattle may have gorged on chaff, or gained access to a straw-yard and packed themselves. Indeed, the exciting causes are very similar to those which give rise to impaction of the colon in the horse.

However, it is not this acute type that will be dealt with here, for the reason that in this country it is not often met with, but, rather, a form which arises slowly and often takes weeks or longer to manifest

itself, and, unfortunately, in some districts affected by long spells of dry weather and scarcity of water, is all too common. This form is seen in the late summer and autumn, is the result of grazing on dry, innutritious grasses, and, as already indicated, is influenced by an extra dry summer. The symptoms come on slowly, nothing being usually noticed until the animals have lost considerable condition, when the owner realizes something must be wrong. The appearance then shown is an unthrifty, hide-bound condition, and rumination is very irregular or has ceased altogether. In early stages a marked constipation is present, but later on diarrhœa sets in. There is not a marked distension of the rumen, and the "pit-on-pressure" symptom of acute impaction is not present. The temperature is not elevated unless gastro-enteritis supervenes. Brain symptoms, with apparent blindness, sometimes occur. The rumen is in a state of stasis, its muscular movements being suspended. This can be recognized by placing the hand on the abdominal wall over the organ. In short, the condition is one of paresis of the stomach-walls. We have seen a number of such cases in the North Auckland district. Certain grasses, notably danthonia, appear to help in its production. In such country, in the autumn, cattle are frequently existing on what is practically innutritious fibre, and the result can scarcely be wondered at.

As to treatment, almost invariably it is found that the owner, realizing the animal to be badly "bound," has dosed it repeatedly with Epsom salts, with the usual "no result"—or, rather, with the result later on of gastro-enteritis and death. The action of Epsom salts being chiefly on the intestine, it is worse than useless in this condition. The aim from the outset must be to endeavour to restore activity to the rumen by stimulant treatment. A combination of carbonate of ammonia (½ oz.), liquid extract of nux vomica (1 dram), and ginger (½ oz.) should be given three times daily in 3 pints of gruel. If these drugs cannot be obtained, raw linseed-oil may be given daily. A plentiful supply of drinking-water must be available, and it is good practice to give ½ lb. of ordinary salt in a quart of warm water, with the object of producing thirst. Also, a few ounces of salt mixed with treacle and given as an electuary three or four times during the day will have the same effect, and will stimulate salivary secretion.

Treatment is not always successful, as enteritis frequently sets in, ending in death. Animals showing recovery should have a change of pasture if at all possible. At any rate, some green feed must be provided, or treatment is useless. The practical method of prevention is, of course, to make provision for some green feed and plentiful water-supply in dry seasons.

IMPACTION OF THE OMASUM.

This never exists as a disease *per se*. It is found in combination with impaction of the rumen, the omasum passing into a state of inertia in sympathy with the first stomach. The contents of the omasum may also be found abnormally dry and caked in cases of inflammation of the abomasum or gastritis. The peeling of the mucous membrane of the third stomach is a *post-mortem* condition.

Where deaths have been attributed to impaction of the omasum it is extremely probable that those holding the post-mortem never looked further than the "book."

GASTRITIS AND GASTRO-ENTERITIS.

Inflammation of the abomasum and intestines is usually caused by some severe irritant. The most commonly occurring cases are due to parasites. It is also seen in certain cases of poisoning, both vegetable and mineral. Also, as previously mentioned, it is frequently the termination of severe disturbance of the anterior compartments, due to dietetic causes.

The symptoms are an alternation of constipation with profuse diarrhœa, which latter may be blood-stained. The animal usually moves but little, and grunts, indicating severe pain. A high temperature is almost always present, and the presence of fever helps to differentiate the condition.

Treatment must be according to cause. If dietetic, a dose of linseed-oil should be given, followed by demulcents such as oatmeal, gruel, or linseed. Doses of chlorodyne are also useful, but the condition is a most difficult one to relieve.

REDWATER.

The complaint receiving this name in New Zealand is purely dietetic in its etiology, and, as such, is worthy of mention in dealing with digestive troubles. Turnips fed in quantities in winter when there is a scarcity of green feed are very prone to produce it, more especially if no hay is available to balance the ration. We investigated a mortality occurring among stock last winter in which the condition was undoubtedly produced in this way.

Redwater would also appear to be induced by a certain class of pasture, and is met in cows either a few weeks before or after calving. A few months back we were asked to inquire into the cause of death of five cows which had died during a period of eight or ten days. When I arrived at the farm all carcases had been buried, and I was unable to make a post-mortem. However, one affected cow still remained alive, and her symptoms, added to the history of the other cases obtained from the owner, led me to the opinion that the deaths were due to redwater. Some days later the owner sent us word that three more deaths had occurred. Mr. J. Lyons visited the farm, and had an opportunity of making a post-mortem. He informed me that he had rarely seen redwater in such an acute form. Death had occurred in twelve hours from the time of the animals being first noticed ill. The kidneys were enormously enlarged, the centre of the organ containing over a pint of broken-down blood. The bladder was empty, as if the ureters (tubes leading to the bladder) had become blocked. The farm in question is situated in what is practically swamp country, and the ingestion of luxuriant, rank feed (tall fescue) after protracted rains no doubt was the causal factor. The condition resembles cases which occur in fen districts in England, locally known as "moor-ill."

I am not aware if the metabolic change is actually understood. Probably auto-intoxication has something to do with it. In the milder form it usually responds to treatment with salines and correction of dietetic errors. In the cases mentioned above, a change on to short, sweet pasture, with liberal hay, ended the trouble.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

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

LEGUMINOSAE.

THE flora of New Zealand is remarkable in containing so few genera, species, and individuals of that great family *Leguminosae*—the pea or pod-bearers—although it is the second largest family of flowering-plants, containing over four thousand genera and seven thousand species. Cheeseman (1906), indeed, considered ("Manual," p. 107) the paucity of legumes to be one of the most remarkable peculiarities of the flora. There are practically no native plants analogous to the clovers on the main islands of this Dominion, the alpine *Swainsonia*—the only approach to a herbaceous legume—being so rare as to be negligible. The family is represented by a comparatively small number of leafless broom-like shrubs, the well-known kowhai (*Sophora tetraptera*), and the kaka-beak *Clianthus puniceus*).

The kowhai is the one instance in the native flora of a suspected poisonous legume. Its affinities in other countries are certainly suspected—namely, *Sophora sericea* and *S. secundiflora* in America. The former is supposed to be one of the plants which cause "locoism" in horses. It may here be remarked that a number of poisonous plants in the wild pastures of America are termed "loco" weeds, the symptoms they occasion being termed "locoism." Regarding the New Zealand species of *Sophora*, which will probably be split up by future systematic botanists into a number of species, the only evidence the writer has as to the poisonous nature of the tree is that two persons were made very ill by eating food with a spoon made of kowhai wood. Lauder Lindsay, in his paper on the "Toot Plant," mentions it as suspicious.* Colenso (1868) states ("Essay," p. 38) that it was used as a purgative medicine by the Maoris. Wounds were dressed with the bark, which had been steeped in water. He notes that the bark is intensely bitter. Goldie (1904) states that the inner bark of the kowhai was used for pakipaki (itch) by the Maoris.

ROSACEAE.

The piripiri (*Acaena* sp.), which by its clinging burrs annually causes such trouble in lowering the value of wool, is the only plant of which anything can be said of those species belonging to this large family. The latter, however, is but poorly represented in the Southern Hemisphere. The leaves of *Acaena sanguisorbae* are used as a substitute for tea, according to Maiden ("Useful Plants," p. 4), by Australian settlers. An infusion of the plant has been found useful in preventing scour in

*Dr. Hulme (Provincial Surgeon of Otago) informed Lindsay that he suspected the wood and seeds of poisonous properties (*Brit. and Foreign Med. and Chir. Rev.*, July, 1865).

calves by settlers in the Strathmore district of Taranaki. According to Hooker ("Handbook"), it has been used medicinally by the South Island settlers, while the Maoris used it medicinally in various ways (Goldie).

SAXIFRAGEAE.

The bark of *Weinmannia racemosa* and *W. sylvicola*, the kamahi or tawhero of the Maori, contains much tannin. Up to 20 per cent. has been found to be present by modern methods of analysis in the Chemical Laboratory of this Department. The bark was very largely used by the early settlers for tanning leather. Goldie states that the bark was used medicinally by the Maoris.

MYRTACEAE.

Leptospermum scoparium, the manuka or tea-tree of the settler, is a common plant throughout New Zealand. The leaves have been used as a substitute for tea. *Metrosideros* is the genus to which the ratas and pohutakawa belong. The bark of these trees, although thin, contains a large percentage of tannin, and was used medicinally by the Maoris for various disorders (Goldie).

PASSIFLOREAE.

The fruit of the native passion-flower, *Passiflora tetrandra*, is very much relished by rats, and contains a large amount of an easily expressed oil, which is worth chemical investigation. The Maoris used the oil medicinally (Goldie).

UMBELLIFERAE.

Hydrocotyle asiatica must be regarded as a suspicious plant. Grandpré found that in small doses it is an energetic stimulant, and in large doses a narcotic producing stupor, headache, and, in some persons, vertigo with a tendency to coma. Mr. R. H. Meade, Government Veterinarian at Palmerston North, reported in May, 1922, a case of suspected poisoning in sheep by this plant at Akitio, on the Wellington east coast. The symptoms he noticed were vertigo, stupor, and falling down and struggling at times, the animals remaining in this state for about a fortnight before death. On post-mortem the livers were found creamy-looking and atrophied, and the kidneys diseased, but the carcase fat and well nourished.

The genus *Hydrocotyle* is one of world-wide distribution. In America these plants are called "water pennyworts." In England the only indigenous species is *H. vulgaris* ("marsh pennywort"). It is significant that the other trivial names are "sheep-rot" and "white rot," from its supposed poisonous effect on sheep. Long (1917) ("Plants Poisonous to Live-stock," page 93) states that it is reputed to have caused inflammation of the digestive tract and hæmaturia, and to contain a toxic substance, vellarin.

RUBIACEAE.

There are some forty species of *Coprosma* in New Zealand, which range in size from tree-shrubs to herbs. The genus belongs to a family which has given many valuable plants to mankind. In medicines may be mentioned quinine and ipecacuanha; in dyestuffs the madder and other dyes; in foodstuffs the coffee-plant—all of which are obtained from plants of this family.

It has been suggested that the New Zealand species of *Coprosma* should be examined for caffeine; Skey (1869) did so with a negative result (*Trans. N.Z. Inst.*, Vol. 1, p. 152). J. C. Crawford (1876) (*Trans. N.Z. Inst.*, Vol. 9, p. 546) recommended the ground and roasted taupata (*C. Baueri*) seed as a substitute for coffee, stating that it has then a splendid coffee-aroma, and that when made into coffee the result seems thoroughly satisfactory. J. T. Armstrong (1891), "On Economic Plants," states that the leaves of the karamu were used as a substitute for China tea, and that the decoction is a good febrifuge.

There is no doubt as to the excellence of this genus as a source of dyes. Those species which have the inner bark coloured yield with hot water dyeing-solutions which give perfectly fast colours on wool, with and without mordants, and equal in permanence to those given by the madder (see the writer's papers in *N.Z. Journal of Science and Technology*, 1918, Vol. 1, p. 3, and this *Journal*, 1918, p. 363; also Perkin and Everest, "Natural Organic Colouring-matters," 1918, p. 578).

There is no group of New Zealand plants which, from a scientific point of view, offer a more alluring field for investigation to the plant chemist than the genus *Coprosma*. Not only are the species closely allied, but they exist in comparative abundance throughout New Zealand, and there is considerable evidence that different chemical compounds found vary with the species. Hence chemistry might be of value in determining the relationship of the species to one another.

The fruit of several species was eaten by the Maori. Colenso (1868) states that the root of *C. acerosa*—a littoral species—was used as an alterative by the Maoris ("Essay," p. 39). The roots of this species, which is found growing on sand-dunes, are of great length, and could easily be unearthed from the loose sand.

COMPOSITAE.

This, the largest family of all flowering-plants, contains, so far as is known, very few poisonous plants in New Zealand. *Brachyglottis rapanda* (rangiora, wharangi, or pukapuka), a characteristic shrub of the North Island, is no doubt poisonous. Baber (1886) (*Trans. N.Z. Inst.*, Vol. 19, p. 320) states that this shrub is seldom eaten by cattle or sheep, but horses are fond of it. Its effects are staggering of the legs and falling; it is often fatal; after death, the body is much distended. The popular remedy is to keep the animal moving. Skey (1881) (*Trans. N.Z. Inst.*) failed to isolate any active principle to which the poisonous nature could be referred. He made the interesting discovery that the resinous matter which exudes from the trunk and branches of the tree gives with alcohol acidified with hydrochloric acid a rich deep-blue colour—a reaction which has been verified by the present writer.

Colenso (1868) (*Trans. N.Z. Inst.*, Vol. 1, p. 38) states that the leaves, which are large and have a white under-surface, were used by the Maoris as a protection for wounds and old ulcerated sores. The poison of poisonous wild-honey may be due to the fact that the honey has been gathered from *Brachyglottis*, as large quantities of pollen-grains from the plant have been found in poisonous honey (Annual Report of Department of Agriculture, 1908, p. 428).

(To be continued.)

THE RABBIT PEST.

POTENTIAL INCREASE AND MIGRATION.

D. MUNRO, Inspector of Stock, Wanganui.

THE present article is contributed in the hope that my experience may be of use to settlers, particularly those situated in districts where rabbits have not yet become permanently established, and who have therefore not had the opportunity of becoming acquainted with the peculiarities and possibilities of the rabbit.

One might suppose in this country, where the rabbit nuisance has driven numbers of men off the land and has been responsible for such a great national loss, that every settler would be conversant with the subject, and at least have sufficient knowledge to effectively prevent the pest from making further encroachment on clean territory. This, however, is not the case. It is remarkable to find how little is known concerning the rabbit in districts where it has not actually become a nuisance, and I believe that it is largely due to this lack of knowledge that the pest is still permitted to spread on to new country. I am firmly convinced that if those settlers in infested areas who have had experience of the rabbit nuisance could be given the opportunity which settlers in clean or comparatively clean districts still enjoy they would go to the very limit of their resources rather than allow the pest to gain a footing. Yet in districts where there are only a few small scattered colonies one frequently hears the statement made (generally by men who have no knowledge of the subject) that rabbits will never do any harm in their particular district, the reasons given being that there is too much grass, the country is too rich or too wet, the subsoil too hard to burrow in, the country too closely settled, &c.—all reasons which I heard thirty years ago in districts which are to-day rabbit-infested areas. There is no part of New Zealand in which it is either too wet, too dry, too hot, or too cold for the rabbit to prove a very serious nuisance if given the opportunity of becoming established. It would be a very doubtful recommendation to any country to say that it will not carry rabbits.

An argument which is frequently put forward in such districts, and one which appears to carry a good deal of weight with some settlers, is that odd rabbits have been seen for many years, but that they have never increased to any extent—facts which they consider to be ample proof that for some reason or other the country is not suitable for rabbits, and that there is therefore no cause for alarm. There appears to be an impression prevalent in the minds of settlers inexperienced in the ways of the rabbit that for an invasion the pest is going to advance in massed formation of battalions and divisions. I have heard it said by settlers in infested districts that for several years there were only a few rabbits, and then quite suddenly they came on in thousands. Such statements, no doubt, are largely responsible for the mistaken idea that the pest suddenly migrates *en masse* to new country. If such were the case one would naturally expect to find a corresponding diminution on the country from whence they came, but

a diminution of this nature is never to be found. These odd pairs which appear in new country, and which to the casual observer may not be a matter of any great concern, do and always will constitute a very real and serious danger to the district in which they are allowed to exist. The slow progress made by the pest in the earlier stages of colonization gives a certain degree of confidence to the inexperienced settler, and misleads him into the belief that the country cannot be suitable. There may not be any appreciable increase for several years, but at any moment the pest may overcome certain forces which have been operating against it, and from then on will increase at an alarming rate. Such is the early history of the rabbit in almost every district in New Zealand where it has ultimately become established.

This process or period of colonization is necessarily governed to a very large extent by the opposition offered. In the early period of the rabbit in New Zealand there was little or no opposition offered to its increase. The natural enemies were few in number—stoats, weasels, and ferrets had not then been introduced—consequently the colonizing process was more rapid. Now, and for many years past, there have been and are thousands of these animals in every district in which the rabbits have sought to extend operations. The pioneers are therefore met with a much greater degree of resistance, and it may take several years before they have reached that point when they are able to satisfy all the demands of their natural enemies and sportsmen and yet have a surplus to carry on freely the process of reproducing their kind. This point may be reached as the result of several causes or by a combination of causes. Principal among the forces acting against the rabbit in the earlier stages is the natural enemy—stoats, weasels, and ferrets—all animals which are particularly susceptible to distemper, a disease which to them almost invariably proves fatal. Cats are also susceptible to this disease. It is quite possible, therefore, that as a result of an epidemic among the natural enemy, combined perhaps with a particularly favourable season, the rabbits are able to reach that point just mentioned when they have gained the balance of power—a point which will mark the beginning of the rabbit nuisance in the district concerned unless the settlers very quickly take a hand in the game.

POTENTIAL INCREASE OF RABBITS.

In order to fully appreciate the danger of the pest it is necessary to realize the extent to which rabbits are capable of increasing in a given time, and I have worked out a propagation chart showing in detail what may be considered a reasonably conservative estimate of the increase from one pair in one, two, and three years. Many authorities may be quoted in support of the figures on which I base my calculations: among others, the "Encyclopædia Brittanica"; "Treasury of Nature" (Samuel Mander); "Veterinary Posology" (Banham), p. 251; "Veterinary Obstetrics" (William), pp. 41, 43, and 47; Fleming's "Veterinary Obstetrics"; and Harmsworth's "Encyclopædia" (this latter authority stating that one pair of rabbits left undisturbed for three years would breed to over thirteen millions). All these authorities agree on the main issue—*i.e.*, the period of gestation, average litter, &c.

It may be also mentioned that personally I have had over thirty years' practical experience in dealing with the pest, during which period I have had the best of opportunities of studying the habits and peculiarities of the rabbit. My experience has not been limited to any one locality; during thirty years of departmental service I have had occasion to deal with the pest in many districts in both Islands, and in all classes of country. Moreover, I have had the benefit of exchanging opinions on the subject with hundreds of practical rabbiters and settlers full of experience.

The authorities named deal more particularly with the rabbit in European countries, but, like many noxious plants, birds, and animals, the rabbit has under the more congenial climatic conditions enjoyed in New Zealand and Australia speeded up very considerably in the matter of reproduction. There is no doubt that the number of litters which a doe will produce in a season is to a large extent regulated by climatic conditions, a dry warm season being, of course, most suitable. This point is well demonstrated in New Zealand, where climatic conditions vary a good deal. In the southern part of the South Island, where the winter months are more severe, there is a distinct break in the breeding seasons of from three to four months. In Southland, Otago, and South Canterbury there is practically no breeding from the beginning of May to the middle of August; but in parts of the North Island, particularly on the coastal country, where the winter is usually very mild, it is not uncommon to find numbers of nests and young rabbits all through the winter months. Under ideal conditions it is easily possible for a doe to have ten litters in the year (the period of gestation being twenty-eight to thirty days), and from records kept over a lengthy period I have found that the average number in the litter is six. In the early spring months the average is approximately seven, but after November, when the young does come into bearing, the average litter will be found to drop to about six. I have seen on two occasions a litter of fourteen, and litters of ten to twelve are not uncommon. During last spring I noted that in this district (Wanganui) the main breeding season commenced about the last week in August; quite a number of nests were found and destroyed, and after the first week in November the majority of young does destroyed were found to be in an advanced state of pregnancy or had already given birth to a litter.

Assuming, then, that the average litter is six, that each doe will produce in the year eight litters of equal sexes, and that the young does will breed at fifteen weeks, the total increase for the year from one pair would be 534. This total is contingent upon there being no casualties; but, allowing that from all causes 50 per cent. of this increase will become casualties before the beginning of the second year, the second breeding season would thus commence with a total of 267, plus one of the original pair = 268. Of this number half—134—are does, each producing an increase of 534 in the season: $534 \times 134 = 71,556$. The casualties during the second year and succeeding years would be less than in the first year, as the requirements of the natural enemy would not increase in proportion; but, allowing that the casualties still remain at 50 per cent., the third year would start with half of the previous year's increase: 35,778, plus 134 (with which the second season started) = 35,912. Half of these are does, or 17,956 does, each giving an increase of 534 in the year: $17,956 \times 534 = 9,588,504$.

To this must be added the number at the beginning of the season—35,912—showing a total of 9,624,416 at the end of the third year.

It will thus be seen that it is reasonably possible for one pair of rabbits to increase in three years to between nine and ten millions. This is a fact which it would be well for every settler to fix very clearly in his mind. The figures stated present an interesting problem. It is estimated that six or eight rabbits will eat or destroy as much grass as would graze one sheep; but, allowing that ten rabbits equal one sheep, it is evident that one pair of rabbits is capable of reducing in three years the stock-carrying capacity of our lands to the extent of a million sheep. This affords some indication of the enormous annual loss which the rabbit pest may represent.

CONTROL WORK.

In infested districts the main efforts for the destruction of rabbits are generally made in the winter months, when the skins are of most value, and the approximate cost of their destruction then is not less than 3d. per head. The cost of destroying 534 rabbits at 3d. per head equals £6 13s. 6d. It would therefore have paid the settler to have spent this amount in destroying the parent pair at the beginning of the season; the feed saved would represent a profit on the transaction. This point is mentioned merely to illustrate the importance of control work at the proper season of the year. Poisoning, which is undoubtedly the best and cheapest wholesale method of destroying the pest, should be carried out as early as possible in the season, and so allow as much time as possible between the poisoning and the beginning of the next breeding season. During the interval every possible effort should be made to clean up those rabbits which will not take the poison. When a general poisoning is necessary it is essential, in order to obtain the best results, that the rabbits should not be disturbed by trapping, dogging, or shooting for at least two or three months before the poison is laid. It has been my experience that where rabbits are hunted right up to the time of poisoning the results are never as good as when they are allowed to settle down for, say, two or three months before.

In a later issue of the *Journal* I propose to deal briefly with the various methods of destroying rabbits, and with other related matters which may be of interest to settlers, particularly those in districts where the pest has not yet become permanently established.

FINAL TESTS WITH "RADIO" MANURE.

THE third year's experiments with this proprietary manure at Motuihi Island, Auckland, had to be discontinued for reasons of economy, but further top-dressings were carried out during 1922 at the Albany Experimental Area. There was an increase in the weight of hay cut from the "Radio" plots over and above the check plots, but, as was pointed out in connection with the previous trials, the increase was doubtless due to the superphosphate and lime which this manure contained, as the coal-dust in each and every case depreciated the value of the other ingredients. It is clear, reviewing the trials, that "Radio" would be a better fertilizer if the coal-dust were left out. Coal-dust apparently has no value as a fertilizer. Reports on the first and second year's experiments were published in the *Journal* for March, 1921, and January, 1922, respectively.

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LEAF-CURL, BLADDER-PLUM, AND CHERRY-CURL.

THEIR APPEARANCE, CAUSE, AND CONTROL.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

(1.) LEAF-CURL, *TAPHRINA DEFORMANS* (FCL.) TULASNE. Synonyms: *Exoascus deformans* (Berk.) Fcl.; curl, curly-leaf, leaf-blister, peach-blister, peach-curl.

LEAF-CURL occurs throughout the world wherever the hosts are grown. It is common on peaches and nectarines, but is not confined to these hosts, as in New Zealand it has been found on almonds and apricots, being not uncommon on the latter host.

It is essentially a climatic disease. In dry seasons its effects may be slight, but if during the blossoming-time of the host the weather conditions are such that a cold and wet period is followed by a warm, mild, and humid one, then infection is usually severe. This severity varies according to the susceptibility of the host, as in a season favourable to the disease certain varieties may suffer very little, whereas others may be completely defoliated. For instance, the peach variety Paragon is very susceptible, and the disease may on th host persist throughout the growing season. The following varieties, too, are susceptible: Alberta, Kia Ora, Briggs's Red May, Carmen, Kalamazoo, Mamie Ross, Triumph, Wiggins, American Pound, and all varieties of nectarines. Those less susceptible are Hobbs's Royal, Charlotte, Hales's Early, and Saunders.*

This data as to the relative susceptibility of different varieties has little value, however, as a variety more or less immune in one country may be very susceptible in another. For example, in Australia the peach varieties Briggs's Red May, Early Crawford, and Solway are all resistant, whereas in North America they suffer severely. Seedling peaches are generally susceptible, as is shown by the virulence of attack by this disease on the old "Maori" peach at one time so common throughout the North Island of New Zealand.

ECONOMIC IMPORTANCE.

Leaf-curl may reduce the crop in several ways, or it may cause a total loss, according to the severity of attack. (1.) Following infection, the foliage may be partially or even entirely destroyed, and as a result a second crop of leaves be produced. This results in a weakened tree, which becomes more susceptible to attack from other diseases. It is doubtful, moreover, whether a full crop will be borne the following season, as when defoliation has been severe little growth is made, and in consequence, owing to the fewer number of fruit-buds formed, the crop is a light one. (2.) Again, as a result of defoliation the tree may fail to set any fruit; or, should they set, fruits do not reach maturity,

* Data supplied by Mr. W. H. Rice, Orchard Instructor, Hastings, of the varieties variously affected in Hawke's Bay.

but remain small and stunted, and are often disfigured by large cracks. (3.) Laterals may be killed outright, and loss of fruit (otherwise borne on these laterals) consequently follow. (4.) Where infection occurs year after year the tree eventually may be killed outright.

FIG. 1. LEAF-CURL ON PEACH. HALF NATURAL SIZE.

[Photo by W. D. Reid.

On nursery stock defoliation may be followed by the death of the trees, or, at least, growth will be poor and weakly. Then, too, trees thus infected are certain to carry the disease from the nursery to the locality where they are to be planted.

APPEARANCE AND EFFECT ON THE HOSTS.

Leaf-curl infects leaves, shoots, blossoms, and fruits. Infection occurs shortly after the leaves have unfolded from the bud, when they appear somewhat curled and blistered. The midrib becomes swollen

and curves inwards at its extremity, and the petiole becomes thickened and distorted. This is accompanied by gradual change in colour of the attacked parts. At first green, these change to yellow, and may later become deep-red. At the same time the leaves become much distorted, broadened, and thickened, and are at this stage much folded (Fig. 1), convoluted, and very brittle. On the upper surface of these blistered areas a delicate bloom may be seen, due to the appearance of the fructifications of the causative organism. Finally, infected leaves die and turn brown, and either fall to the ground or remain

FIG. 2. LEAF-CURL ON NECTARINE FRUITS. NATURAL SIZE.
Infected fruit is scabbed and slightly larger than normal (lower left).
[*Photo by G. H. Cunningham.*

attached to the lateral, forming small bunches, which doubtless afford suitable shelter for insect pests and possibly the spores of other fungi. Following infection and death of these leaves, others are produced which generally escape attack; but at times, especially if the season is cold and wet, these may in turn be infected, when smaller and less conspicuous blisters are formed; and in exceptional cases leaf-curl may persist on certain varieties during the whole of the growing season.

Infected shoots become somewhat thickened, and often curved and distorted; they also change in colour, often becoming light-green or even yellow. As infection frequently occurs while they are quite small

and partly grown the shoots become stunted, so that the leaf-buds are much closer together than normally ; consequently, when leaves are produced they appear so compacted together that the shoot assumes a rosetted form. Infected shoots become weakened, and in many instances may be killed outright. Die-back of the tips of laterals is a common manifestation of leaf-curl. When blossoms are infected the petals become variegated, and are usually larger in size and much crinkled ; more frequently, however, the blossoms die and fall to the ground.

Young fruits when infected become much distorted, owing to the portions becoming greatly enlarged. Such fruits seldom remain long on the tree, as they become scabbed and cracked, and soon fall. Maturing fruits are commonly attacked—this phase of the disease being more common than is generally recognized—and as a result swollen irregularly shaped areas, usually bright-coloured, appear on the surface. These areas are much wrinkled (Fig. 2), and on peaches often appear as if polished, owing to the absence of those hairs which normally cover the surface. They are conspicuous on the fruits of the nectarine, as the bright coloration gives a false impression of maturity. Fructifications may develop on these areas, appearing as a delicate bloom ; they are unusual, however.

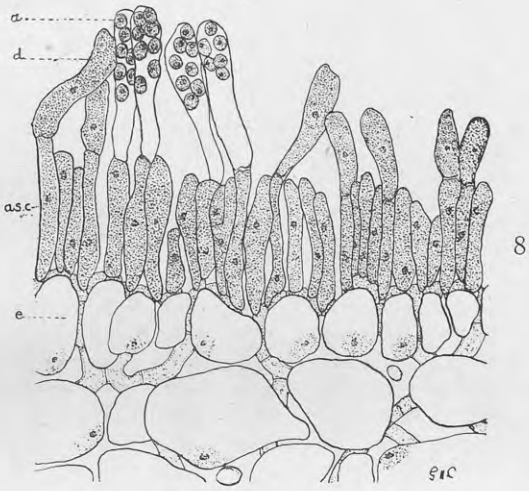
LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Leaf-curl is caused by *Taphrina deformans* (Fcl.) Tul.,* a fungus that differs from those discussed in previous articles of this series published in the *Journal* (see July and August last), in having only one spore-stage (Fig. 8) in its life-cycle. It differs again in that the asci are exposed at maturity and not enclosed in a receptacle, and so is, by mycologists, considered to be a more primitive form.

The leaves become infected shortly after they emerge from the bud, the hyphæ of the fungus growing between the leaf-cells ; the cells are not killed at this stage, but are stimulated to further growth. The hyphæ absorb their necessary food-substances from the leaf-cells, which in consequence become greatly altered ; the chlorophyll (green colouring-matter) is absorbed, and the cell-walls become thickened, so that the leaf changes colour and increases in size, becoming broader, thicker, and much blistered. From the leaves hyphæ may grow down the petiole (leaf-stalk) into the shoot to which the leaf is attached, which in turn is infected, and as a result becomes discoloured and swollen. As a rule the current season's shoots only are infected, but on rare occasions the fungus penetrates into the tissues of one-year-old shoots.

Following penetration of the leaf-tissues large hyphæ develop just below the epidermal cells of the upper surface. From these arise hyphal branches which penetrate between the cells of the epidermis and lie immediately below the cuticle, and there form a closely woven mass of mycelium. From this the asci arise as upright cells beneath the cuticle, and, as they develop, a blister becomes formed owing to the

* This organism is so widely known as *Exoascus deformans* that the writer hesitates to use any other name. Unfortunately, no satisfactory classification of this group exists, so that until one is forthcoming he believes it advisable to retain this and the two following species under the original generic name *Taphrina*.



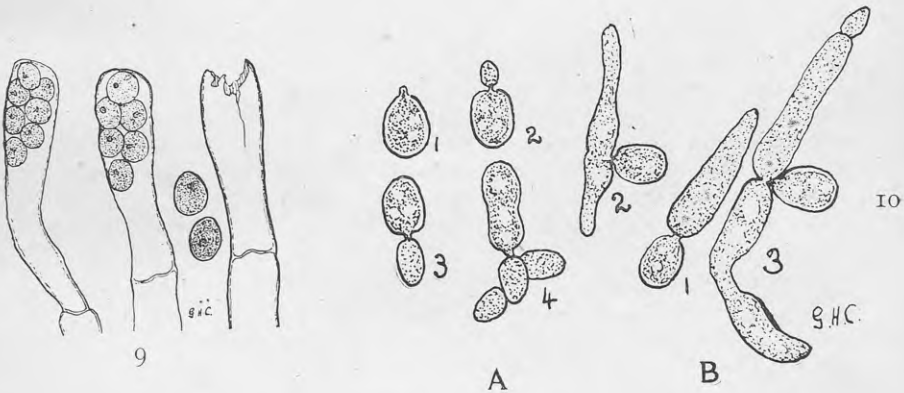


FIG. 8. SECTION THROUGH BLADDER-PLUM. × 500.
(*a*) Asci; (*d*) immature ascus; (*e*) cells of epidermis.

FIG. 9. ASCI AND ASCOSPORES. × 1,000.
Empty ascus on right.

FIG. 10. ASCOSPORES GERMINATING. × 1,000.
A. Ascospores producing conidia (buds). B. Ascospores producing hyphæ.
[*Original.*

cuticle being raised; this becomes ruptured, and the asci are seen closely packed together (Fig. 8). A mature ascus is cylindrical in shape, is flattened at the apex (Fig. 9), and contains eight one-celled colourless spores (Fig. 9).

Finally the ascus becomes ruptured at the apex and the spores are liberated. On germination, these ascospores may either produce

a short germ-tube (Fig. 10, *b*), or give rise to numerous minute conidia by budding (Fig. 10, *a*). Budding may occur in the ascus either before spore-discharge, or upon the leaf-surface after, when the upper surface of diseased leaves becomes coated with these conidia, appearing as if covered with hoar-frost. With the production of these spores our knowledge of the life-history ceases. It is not known where the spores remain until they cause infection the following spring, or the method of infection, or the part played by mycelium located in the shoots in the perpetuation of the disease. But from field observations a fair idea as to the subsequent behaviour of the organism may be obtained. Thus it appears that in the majority of cases infection of the leaves as they unfold from the buds is due to spores—whether ascospores or conidia (buds) is unknown—carried over the summer and winter months in bud-scales and crevices in the bark; and that perennial mycelium plays a minor part. This assumption is based on the readiness with which the disease may be controlled by spraying, as a single application at the proper time results in almost complete control. Such a condition could not be obtained if infection were due to perennial mycelium, as the spray would not destroy the mycelium which is protected by the tissues of the shoot. In consequence it is assumed that the spores are lodged in bud-scales and bark-crevices, and that they infect the young leaves as they emerge from the bud, so that a spray applied before the buds unfold destroys these spores, and this prevents infection. The fact must not be lost sight of, however, that perennial mycelium does play a part in infection, as in certain instances where trees have been carefully sprayed slight infection may persist; or, again, with certain varieties, notably Paragon, this disease cannot be effectively controlled by spraying alone. Infection may be severe, and persist throughout the whole of the growing season. This would tend to show that with this variety, at any rate, mycelial infection is a serious factor, and control in such a case calls for additional treatment.

(2.) BLADDER-PLUM, *TAPHRINA PRUNI* (FCL.) TULASNE. Synonyms: *Exoascus Pruni* Fcl.; plum-pockets.

Bladder-plum is world-wide in its distribution, occurring wherever the hosts are grown. In New Zealand it is confined to the plum, but in North America it has been recorded on *Prunus virginiana*, and in North America and Europe on the bird-cherry, *Prunus Padus*. All varieties of cultivated plums appear liable to infection, but in New Zealand it appears, as a rule, only on the so-called Japanese plums, although English plums are occasionally infected.

ECONOMIC IMPORTANCE.

As this disease is confined to plums, it may be claimed that its importance is slight, owing to the fact that plums do not figure among the more important commercial fruits. Nevertheless, to those growing these fruits its attacks may prove serious enough, for where infection is severe the greater part of the crop may be lost. As leaves, too, are attacked, partial defoliation and consequent debilitation of the tree may follow. Furthermore, shoots may be stunted, and in cases of severe infection killed outright.

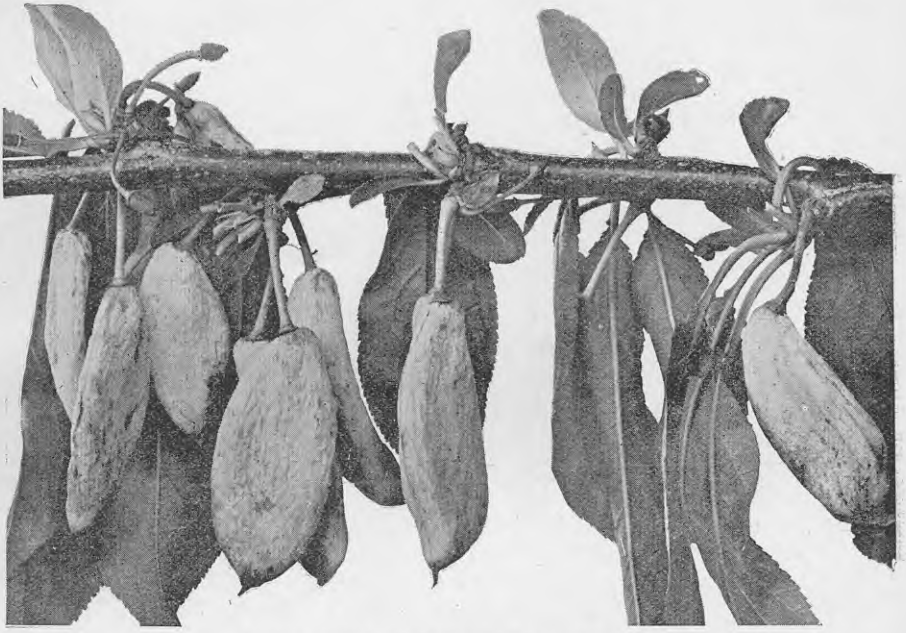


FIG. 3. BLADDER-PLUM ON JAPANESE PLUMS. NATURAL SIZE.
[*Photo by W. D. Reid.*

FIG. 4. BLADDER-PLUM ON ENGLISH PLUMS (EVANS'S EARLY). NATURAL SIZE.
Normal plum on left. Dark spots on infected fruits are red in nature
[*Photo by G. H. Cunningham.*

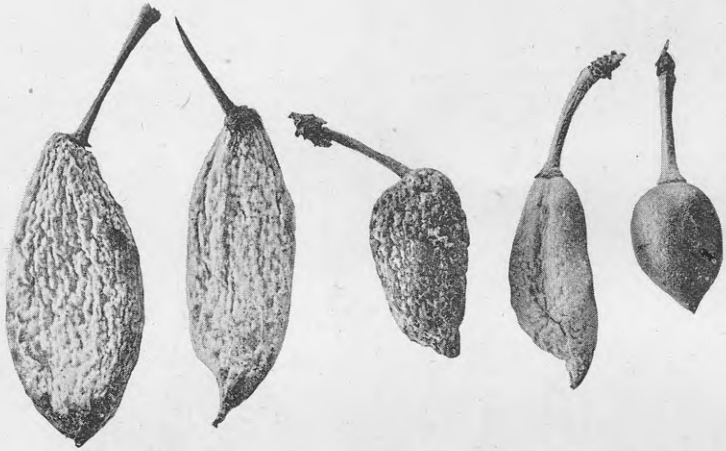


FIG. 5. BLADDER-PLUM (JAPANESE VARIETY). NATURAL SIZE.
Showing gradual development from normal fruit (on right) to severely infected fruits.

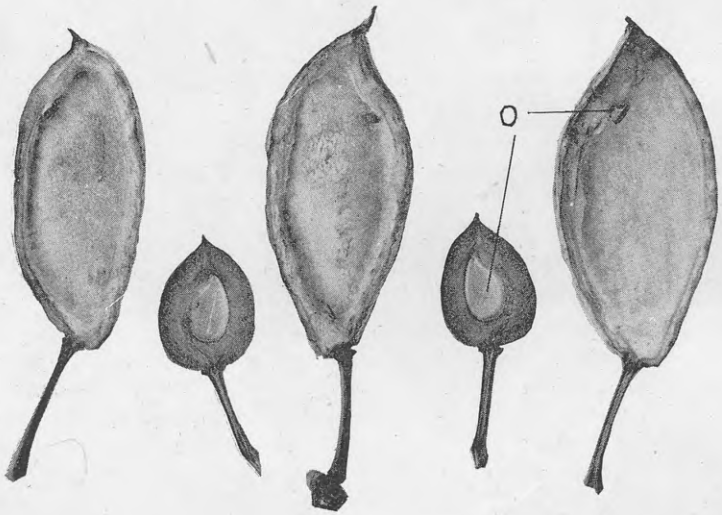


FIG. 6. BLADDER-PLUMS IN SECTION. NATURAL SIZE.
Normal fruits between the three infected specimens. Note remains of ovule (*o*), and compare it with normal ovule.

[*Photos by W. D. Reid.*

APPEARANCE AND EFFECT ON THE HOSTS.

Bladder-plum infects leaves, fruits, flowers, and shoots, but is most noticeable on the fruits about three weeks after blossoming; these become greatly enlarged, and after a time fall to the ground.

These enlarged fruits are at first somewhat globose, eventually becoming greatly elongated, and more or less curved and twisted (Fig. 3). They are spongy in texture, and when cut open are seen to be quite hollow, the stone and ovule (seed) not being developed (Fig. 6). They change in colour from green to white; at first somewhat smooth, they soon become much wrinkled. Finally they turn brown and die. Infected fruits on English plums present a slightly different appearance. Infected fruits do not become larger than normal ones, but differ mainly in colour, being white blotched with red (Fig. 4). They are quite soft and hollow, however.

The leaves become infected shortly after they unfold from the bud, when they appear blistered and yellow or even red, resembling leaves of peaches infected with leaf-curl. They, too, after a time change to brown and fall to the ground.

Shoots are invariably attacked, when they appear lighter in colour and much swollen. They frequently become stunted, when the leaf-buds remain close together, and give a rosetted appearance to the branch; or they may be much twisted and killed for part of their length. Following the death of these laterals, small and weakly secondary laterals grow out immediately below the dead areas; these in turn become infected, and produce a further crop of diseased fruit the following season.

Blossoms are sometimes killed outright shortly after they emerge from the bud, but this is an uncommon manifestation, and doubtless occurs only when climatic conditions are favourable to the active development of the causative organism.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Bladder-plum is caused by *Taphrina Pruni* (Fcl.) Tul., a fungus included in the same genus as that causing leaf-curl. In fact, the life-histories of both, so far as is known, are similar.

The hyphæ of the fungus are perennial in infected shoots, and in the spring grow through the pedicel into the developing fruits, where they ramify through the mesocarp (fleshy part of the fruit) and stimulate this portion to excessive growth. Consequently, within a few days infected fruits become doubled or trebled in size (Fig. 5). Growth of the stone and ovule (seed) is prevented; consequently, infected fruits are soft throughout and quite hollow (Fig. 6). Shortly after infection fructifications appear as a delicate bloom on the surface of these "bladder-plums." Doubtless leaves and developing shoots are infected in a similar manner, although infection may occur equally well from spores lodged in the bud-scales and bark-crevices. This would, in part, appear to be borne out by the fact that the effects of the disease can be somewhat reduced by one spray application; but that perennial mycelium plays a part in the perpetuation of the disease is obvious when one considers the fact that the latter cannot be entirely controlled by spraying as in the case of leaf-curl.

The mycelium continues to traverse the young shoots as they develop, so that once a branch has become infected the disease will persist in infected shoots until such time as they are removed.

(3.) CHERRY-CURL, *TAPHRINA MINOR* SADEBECK. Synomyms: *Exoascus minor* (Sad.) Sacc.; cherry leaf-curl, cherry leaf-blister.

This disease would appear to have a limited distribution, so far having been recorded only from Germany and the south of England. In New Zealand it has been found only at Havelock North (in Hawke's Bay) and Roxburgh (in Central Otago), and is confined to a single orchard in each of these localities. In the orchard at Havelock North four cherry-trees are infected—two of the variety Black Tartarian, one Early Purple Guigne, and one unknown variety.* In the Roxburgh orchard three trees of an unknown variety are infected. Although in New Zealand the disease has been found only on the cherry (*Prunus cerasus*), in Germany it has been recorded on an additional host,

FIG. 7. CHERRY-CURL ON UPPER AND LOWER LEAF-SURFACES. NATURAL SIZE.
[*Photo by G. H. Cunningham.*

the ground-cherry (*Prunus Chamaecerasus*). Doubtless this limited distribution is more apparent than real, and the disease mistaken for leaf-curl, as in many publications the cherry is cited as a host of this disease. It differs considerably from leaf-curl in microscopic characters, however, as well as in inability to infect any host other than the two mentioned.

APPEARANCE AND EFFECT ON HOST.

In New Zealand the distribution of cherry-curl is so limited that the disease is scarcely worth more than brief mention here, yet should it spread it may prove to be quite a serious disease of cherries.

* Data supplied by Mr. W. H. Rice, Orchard Instructor, Hastings.

Fortunately, there appears to be little danger of its becoming widespread. The disease has been known to exist for several years in the two local orchards concerned, and yet has not spread to trees in adjoining orchards nor to adjacent trees in the same orchards.

Cherry-curl infects leaves and shoots. On leaves brightly coloured blistered areas appear (Fig. 7) which so resemble those formed by leaf-curl as to be readily mistaken for it. The leaves then turn brown and fall off. A peculiar feature of the disease is that it does not attack all leaves on a branch, but merely one or two here and there. Then, too, as a rule the whole leaf is not attacked as in the case of leaf-curl, but the infected areas are limited to one half of the leaf, and in consequence the leaf-tissues and petiole are often curved so that apex and base point in the one direction (Fig. 7). Infected branches in a season or two become stunted, make little new growth, and produce few or no blossoms, due no doubt to the effects of partial defoliation.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Cherry-curl is caused by *Taphrina minor* Sadeb., a fungus belonging to the same genus as that causing leaf-curl, its life-history being similar to that of the latter organism. The mycelium of the organism hibernates in the dormant buds and in the cuticle of infected shoots, so that when growth commences in the spring the leaves become infected as they emerge from the buds. The mycelium extends into young shoots as they develop, and then penetrates the tissues of the forming buds. Following infection, the mycelium penetrates between the cells, causing them to become enlarged, and so the blistered areas are formed. On the under-surface of these blisters the asci appear, and in them the spores are produced. Although the young shoots are infected, they do not appear to become distorted and discoloured as is the case with leaf-curl, possibly because the mycelium does not penetrate farther than the cells of the epidermis. Spores produced on diseased leaves do not appear to be capable of spreading infection, as the disease in the localities mentioned has not spread to adjacent trees. Moreover, although these infected trees have been regularly sprayed, the disease appears year after year, these two facts clearly indicating that it is perpetuated by perennial mycelium alone. Such being the case, cutting-out of infected branches would appear to be the only preventive treatment that can be recommended. This presents a certain amount of difficulty owing to the danger of causing excessive gumming, but if cutting-out of branches was performed as soon as growth commenced in the spring this danger would be obviated.

One other disease of the cherry, witches-broom, *Taphrina Cerasi* (Fcl.) Sadeb., caused by a species of fungus belonging to the same genus as leaf-curl, is worthy of mention here. It causes large, tufted masses of laterals to appear on the host. Fortunately, so far as the writer is aware, it does not occur in New Zealand.

GENERAL CONSIDERATIONS.

It has been shown in the foregoing matter that leaf-curl, bladder-plum, and cherry-curl may be spread either by ascospores (or their resultant conidia or buds) or by perennial mycelium overwintering in infected shoots and buds. In the case of leaf-curl these spores appear

to winter over in bud-scales and bark-crevices, and to infect the leaves and fruits as they emerge from the buds. It appears from the ease with which leaf-curl on most varieties is controlled by spraying that infection is due almost entirely to these overwintering spores. With certain varieties, however, perennial mycelium plays an important part in the perpetuation of leaf-curl.

The case of bladder-plum differs somewhat, as it is probable that extensive infection, especially fruit-infection, is due to perennial mycelium situated in the shoots. This belief appears to be strengthened by the increasing difficulty of control, for it must be admitted that more than 75 per cent. of clean fruit cannot be obtained by spraying alone.

With cherry-curl, again, spraying has little effect on its control; and as it appears year after year on the same trees, and does not appear to spread (in New Zealand) to adjacent trees of the same variety, it is obvious that here the organism is perpetuated solely by perennial mycelium.

It may thus be seen that although perennial mycelium plays a minor part in the spread of leaf-curl (if those varieties are excepted in which the disease persists despite spray treatment) it is an important factor in the spread of bladder-plum, and is (in New Zealand) entirely responsible for the spread of cherry-curl.

CONTROL.

(J. A. Campbell, Director of the Horticulture Division, Wellington.)

For the control of leaf-curl and bladder-plum the following spray treatment is recommended: 5–4–50 bordeaux or 1–15 lime-sulphur, applied when the buds begin to swell, but before they open. When the regular schedule for brown-rot control is followed, the first spray will also control leaf-curl.

The spray treatment should be supplemented by cutting out infected shoots. This would apply to those varieties on which leaf-curl persists despite spraying, to all varieties of plums infected with bladder-plum, and to cherries infected with cherry-curl. Cutting-out could be practised at any time during the growing season (except with cherries), as the disease would be conspicuous and consequently readily located. In the case of cherries, cut out infected branches shortly after growth has commenced in the spring, and so obviate gumming. Paint wounded surfaces with coal-tar as soon as made, using a stiff brush. Shoots and branches need not be cut back to a greater distance than 2 in. below the point of visible infection, as the mycelium does not readily grow downwards into larger shoots.

SUMMARY.

(1.) Leaf-curl, bladder-plum, and cherry-curl are caused by *Taphrina deformans*, *T. Pruni*, and *T. minor* respectively.

(2.) Leaf-curl infects leaves, shoots, blossoms, and fruits, causing leaves to become enlarged and distorted, shoots to become swollen and frequently killed, blossoms to become large, crinkled, and variegated, and fruits to become cracked and blotched. It attacks almonds. apricots, nectarines, and peaches.

(3.) Bladder-plum infects leaves, shoots, blossoms, and fruits, causing leaves to become blistered, shoots to become distorted, buds to fall, and fruits to become swollen and quite hollow. It is confined to plums.

(4.) Cherry-curl infects leaves and shoots, forming distorted and dead areas on the leaves, and stunting the shoots. It is confined to the cherry.

(5.) Leaf-curl usually may be controlled by one spray application applied just before the buds open. Where infection persists through the season, spraying should be supplemented by the cutting-out of infected shoots.

(6.) Bladder-plum can be only partially controlled by spraying, so that cutting-out of infected shoots should be practised.

(7.) Cherry-curl cannot (in New Zealand) be controlled by spraying. Cutting-out of infected shoots is the only treatment that can be recommended.

(8.) Each disease is confined to the hosts mentioned, and cannot infect any other host.

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THE REGRASSING EXPERIMENTS IN CENTRAL OTAGO.

REPORT BY SPECIAL COMMITTEE.

THE report here published relates to the research work concerning which a series of articles by Dr. L. Cockayne has appeared in the *Journal* under the main title of "An Economic Investigation of the Montane Tussock-grassland of New Zealand." Dr. Cockayne supplies the following note, which serves to further explain the incidence of the report :—

Before commencing the regrassing experiments in Central Otago Mr. J. L. Bruce (Department of Agriculture) and myself, after consultation with Mr. R. K. Smith (Morven Downs, Tarras) and Mr. D. Middleton (Northburn Station, near Cromwell), had the good fortune to persuade these two experienced runholders to form, along with us, a small committee. On 2nd November, 1922, this committee and a few runholders and others interested in the experiments, at my invitation, paid a visit of inspection to the experiment plots on the Dunstan Mountains, when every plot was visited and examined. Before the inspection I invited the committee—myself, of course, standing out—to supply a report for the Director-General of the Department of Agriculture giving their

candid opinion concerning the results of the experiments. This they kindly consented to do, and their views, as embodied in the report, may be noted. I wish to take this opportunity of thanking the members of the committee for their advice and encouragement at all times, and especially the local members, Messrs. Smith and Middleton, to whom I can never be sufficiently grateful for their welcome assistance and many kindnesses. [Previously I had given in three articles in the *N.Z. Journal of Agriculture* (June, July, and September, 1922) a full account of the regrassing experiments, dealing with the problem to be solved, the methods used for its solution, and the results of the experiments up to May, 1922. Those interested will find in these articles many details which could not be supplied by the committee.]

The accompanying photo, apart from its more special purpose, gives a good idea of the type of country on which the experiments are being carried out.

THE COMMITTEE'S REPORT.

As a result of a report by Dr. L. Cockayne, F.R.S., on the mountain grasslands of New Zealand, the Department of Agriculture recognized the importance of investigating the possibility of arresting the depletion which is taking place over a large area in Central Otago, and accordingly he was authorized to carry out the experiments under review in this report. The importance of the investigation can be realized when it is pointed out that in Central Otago almost total depletion has taken place over extensive areas of country ranging up to 2,500 ft. altitude, while from that level up to 3,500 ft. depletion is rapidly proceeding under present conditions. The total area affected can be broadly estimated at three-quarters of a million acres.

The complete history of the experiments has been recorded by Dr. Cockayne in a series of articles which appeared in the June, July, and September, 1922, issues of the *New Zealand Journal of Agriculture*, so that the report of this committee need deal only with the general results found to exist when its members made an inspection on 2nd November, 1922—two years and eight months after the plots were fenced, and two years and five months after the first sowing was made. The fact of the inspection taking place so soon after the enclosing and sowings requires noting, as also the fact that the years 1920–21 were both unfavourable seasons, being dry and windy and having long periods of frost in winter. As for the climate of the six months previous to our visit, there were continuous frosts throughout the winter, while the one rain falling on the frozen surface merely led to erosion, and no water reached the subsoil. The three months of last spring, too, were absolutely rainless. The plots, then, were visited under extremely unfavourable conditions.

Briefly stated, the experiments consist of fifteen plots ranging from, say, 800 ft. above sea-level to 2,600 ft., and situated on the north-western spurs of the Dunstan Mountains, where practically complete absence of vegetation occurs up to close on 3,000 ft. These plots were carefully fenced during the summer of 1919–20, and the first surface-sowing took place in the late autumn of 1920.

The most striking results noted at the inspection were: (1) The establishment of surface-sowing, which in most cases equalled the raked method, in so short a period at every elevation and aspect (except the worst wind-swept ridges) of certain valuable permanent pasture plants and grasses, especially lucerne, yarrow, sheep's burnet, chicory, cocksfoot, tall fescue, Chewings fescue, *Poa laxa*, perennial

PARTY OF INSPECTION ON THE NORTHBURN RUN, 2/11/22.

The party is standing in experimental plot 12, about 2,600 ft. altitude. Among the vegetation is seen rejuvenating blue-grass and tall blue-tussock, and sown yarrow and cocksfoot. The white patches on the depleted slopes in background are scabweed. Dr. Cockayne on extreme right.

[*Photo by W. D. Reid.*

rye-grass, and couch-grass; (2) that survival or regeneration of native grasses and other plants has taken place *slowly* on exposed ground originally swept bare of roots, &c., but *rapidly* on more sheltered ground; this regeneration is taking place at all altitudes, but it is most marked in the highest plots; (3) that outside the netted plots the most complete depletion exists, so as almost to suggest absolute sterility of the ground.

In comparing this state of affairs with the recovery of plant-life inside each plot the following conclusions only are possible; moreover, they are backed by years of experience, so that we are convinced—(*a*) that under present conditions depletion is proceeding rapidly in all the dry area of Central Otago; (*b*) that no improvement is possible without subdivision, exclusion of rabbits, and a regular system of spelling the country; (*c*) that immense improvement can be effected in a comparatively short time by surface-sowing *if rabbits and sheep are excluded* and the country spelled systematically; (*d*) that by spelling without surface-sowing great improvement will take place, but progress will be slower.

As a result of these experiments we consider that it has been demonstrated beyond doubt that the pastoral land of Otago and New Zealand generally can be economically developed to the advantage of the State and the individual by improved methods of husbandry. The necessary reform would mean capital expenditure by the land-holder for fencing to exclude rabbits, together with further fencing to subdivide his holding in order to facilitate summer spelling, &c. It means also understocking for a number of years in order to eventually greatly increase the carrying-capacity of his land and the quality of his stock. As an inducement to do this the holder must have an incentive in the shape of absolute ownership of all the improvements he effects, both visible and invisible, together with absolute security of tenure.

Although the experiments have already taught a good deal, there is still much to be learned, and we emphatically urge that the work be continued and vigorously prosecuted. Only the possibilities of comparatively few plants have been tested so far. We understand that Dr. Cockayne proposes to bring into this country seeds of many other pasture-plants from various parts of the world likely to be of value for the work, especially those growing in lands where the conditions are similar to those of Central Otago (*e.g.*, parts of Patagonia), and we are strongly in accord that every encouragement and assistance should be given to his efforts in this regard.

In conclusion, we wish to put on record our appreciation of the extremely valuable work that has been carried out by Dr. Cockayne and his assistant, Mr. W. D. Reid, of the Department of Agriculture. Their energy and enthusiasm in this matter have been beyond praise.

D. S. MIDDLETON.
R. K. SMITH.
J. L. BRUCE.

Fiji Lemon-weevil.—Steps are being taken to have this insect (which was described in last month's *Journal*) declared under the Orchard and Garden Diseases Act, and to add it to the Fifteenth Schedule of the Act.

TOMATO-DISEASES.

BLACK-STRIPE AND ITS CONTROL.

W. H. TAYLOR, Horticulturist, Wellington.

THAT enormous losses caused by diseases are experienced every year is known to all who are interested in tomato-culture. That these losses are largely the result of errors in practice, and are preventable, is a dictum not so readily accepted. That, however, has been the constant opinion of officers of the Department of Agriculture, and advice given has been based on this belief. Of course, a mere academic opinion unbased on practice is not entitled to unqualified credence, but this has not been expected nor necessary. The advice given has been founded on facts ascertained by practice, and confirmed year after year.

There is one thing that appears to have escaped notice, or if it has been noticed it has not conveyed the lesson it should—namely, that when an epidemic of disease occurs in a district there are always some growers whose plants are not affected, while with others the infection is in varying degrees of intensity. Why is it, where natural conditions are practically the same, that the amount of infection should vary so much? The answer must be that it is due to different treatment. The tomato-plant is naturally a very strong-growing subject; even on poor soil it makes a great growth. It would be reasonable to expect that, knowing this to be the case, growers would refrain from the use of manures and fertilizers that can do nothing but encourage green growth, yet that is exactly what many do not do. It will be contended that a good crop cannot be got from a weak plant. This is granted; but is there danger of getting weak plants on the good soil that is invariably employed for the tomato crop? Even if this danger existed, a more moderate amount of growth-producing manure or fertilizer should be used, and this be supplemented with a fertilizer that directly affects the fruit—namely, sulphate of potash. This latter fertilizer steadies the growth, and makes the tissues stiffer; it carries on growth over a longer period; and it directly affects the growth of fruit and its quality, making it firmer.

Recently a serious outbreak of black-stripe disease in the Hutt Valley (Wellington) was investigated. A plantation where a liberal amount of stable manure had been ploughed in is apparently doomed to extinction. A light dressing of sulphate of potash had been given, but evidently not enough to counteract the growth-producing and softening effect of the manure, the plants being very green and sappy-looking. On the same property another plantation had been given a similar dressing of stable manure, and, in addition, a fairly heavy dressing of blood-and-bone and a heavy dressing of sulphate of potash. In this case there was no black-stripe, the potash evidently having been sufficient to stiffen the plants, which, however, had a very gross overfed appearance, showing evidence of waste of money, and presenting an unthrifty appearance. Another property near-by was inspected where the plantations of tomatoes are more extensive, there being four lots on different parts

of the property. Among all these thousands of plants there was not the slightest sign of disease. No stable manure is used here, the fertilizers used being blood-and-bone and sulphate of potash.

Surely this is convincing evidence; and, further, it may be noted that the owner of this property is considered to be one of the best tomato-growers in the Hutt Valley, and that he has never in many years' practice had any more than trifling losses from disease of any kind. The evidence is clear that stable manure is bad for tomatoes, unless a crop such as cabbages is taken before the tomatoes are planted. Also blood manure is bad, being solely nitrogenous; but blood-and-bone is safe, the bone being a phosphate, and the blood-content being of a different character to pure blood.

One of the difficulties that have to be contended with in a propaganda of this kind is that it can be said that the very things we hold should not be done are often done and no ill effects follow. That, however, is an aspect of the case that has not at any time been overlooked. The effect of high feeding or of the use of the wrong material may not be felt in a dry season, because only a part of it becomes available. It is when heavy or unseasonable rains occur—and that may be at any time—that bad effects are experienced. The rainfall or muggy weather is then blamed, and the real cause is not recognized.

Quite recently reports from other countries have come to hand which support the views we have long been promulgating. One of these on "Black-stripe of Tomatoes," by Dr. R. E. Stone, O.A.C., Guelph, in the *Canadian Horticulturist*, may be here usefully reproduced (slightly abridged), as follows:—

Character of the Disease.—The first symptoms of the disease are a decided curling and twisting of the upper leaves and youngest portion of the stem, together with a hard, harsh, leathery feel of the older leaves. Suddenly brown sunken lines appear in the young vigorously growing stems, and these lines increase in width until the whole upper part of the stem may appear brown. At first the browning seems to be on the surface only, but becomes deeper-seated, and in bad cases involves wood-ring. At the same time that these streaks appear on the stem brown angular spots appear on the leaves between the veins, and these brown spots increase in size until the whole leaf is involved. Brown streaks also appear on the veins and leaf-stalks. The fruit sets very sparingly, often not setting at all on the first three or four trusses. The fruits that do set are commonly scabby, deformed, and of poor flavour and colour. So far, the disease has been noted in plants that had been growing very rapidly. Such plants very generally had thick, sappy stems and very large sappy leaves. If the bases of the stem were hard and small the trouble became much more serious.

Experimental Work.—Preliminary experiments showed that the trouble bore some relation to the soil, and it was thought that steaming the soil might prevent the disease, but this has proven unsatisfactory. Since the disease very frequently appeared on tomato-plants grown on soil that had never produced tomatoes before, and since it was always very bad on plants grown in very rich soil, it appeared that the plants were not properly fed, and that the disease might be controlled by the use of proper fertilizers. It was found possible to produce the disease at will by using fertilizers very rich in nitrogen, such as barnyard manure in excess, and ammonia or nitrates. If acid phosphate or potash was used in addition the plants made healthy growth. Even in those cases where the plants already showed a large amount of winter blight it was found that by applying acid phosphate and potash the plants recovered and made healthy growth within ten days after the application. Furthermore, the fruit set as the disease showed, and a fair crop was borne. When acid phosphate and potash were applied at the time of transplanting, or before the disease appeared, the plants were strong, vigorous, and healthy, and set a crop nearly twice as heavy as plants in the same house not receiving such fertilizer. It thus becomes evident that the trouble lies in improper feeding of the plants.

Recommendations.—(1.) Avoid the use of too much manure or nitrogen-containing fertilizer, such as ammonia and sodium nitrate. (2.) Add acid phosphate or bone-flour, 3 oz. per plant, and potassium sulphate, ¼ oz. per plant, either before transplanting or just as the blooms appear. (3.) Avoid overwatering and then allowing to become too dry. (4.) Keep the plants growing evenly by keeping the temperature uniform and watering at frequent intervals, but not too much at a time. (5.) Do not allow the plants to dry out so as to check the growth. (6.) Do not attempt to force plants that have been checked.

It is necessary to understand what are the effects of sulphate of potash. That it steadies growth, makes growth firmer, and improves the quality of fruit is recognized. It is possible, however, by using an excess amount to stop growth altogether. The difficulty is to decide what is an excess. Quite evidently this is largely ruled by the amounts of other fertilizers applied, and the purpose of the potash. Thus, if a large amount of animal-manure or a nitrogenous fertilizer has been applied, and the potash is given to neutralize the nitrogen, then an excess amount might be not only safely used, but actually necessary; but no one could say what the actual amount should be. It is, however, quite obvious that both the nitrogen and the potash would largely represent wasted money, as one would be merely to nullify the injurious effects of the other, that ought not to have been used. In cases where an excess of nitrogen has not been used it will be different. In such cases an excess of potash might be positively harmful, having the effect of arresting growth. The amount per plant mentioned in the foregoing article—¼ oz. per plant—would, presuming plants to be set 18 in. by 3 ft. apart, amount to 151¼ lb. per acre. The largest amount I have ever seen advised is 2 cwt. per acre, and this is doubtless sufficient when the fertilizer is properly balanced, but certainly nearly double that would not do harm, though the additional amount might not pay.

The last issue of the *Journal of the Royal Horticultural Society*, England (Vol. 47, parts 2 and 3), contains a valuable article on "Tomato-diseases," by W. Bewley, D.Sc., Director of the Lea Valley Experimental and Research Station, Cheshunt, Hertfordshire. The following extract dealing with black-stripe will be of interest:—

"Stripe" disease is produced by *Bacillus lathyri* Manns and Taubenhaus, which is also responsible for "streak" of the sweet-pea and other leguminous plants. The organism is carried in the soil and water, and also in the leguminous weeds that surround so many nurseries. In the glasshouses it is readily spread from plant to plant by the workers engaged in pruning and tying, and it is highly probable that certain sucking-insects are instrumental in this way also.

Experiments conducted at Cheshunt have shown that there are considerable differences in the relative susceptibility of different varieties of tomatoes to this disease. The relation between manurial treatment and the incidence of the disease has also been studied, and it has been shown that increasing amounts of nitrogen without potash produced an increasing susceptibility to the disease, while increasing amounts of potash without nitrogen gave a corresponding increase in resistance to it. Where potash and nitrogen were used together there were indications that the potash counteracted the effect of the nitrogen. These results are fully confirmed by observations on commercial nurseries, where it has been found that plants growing rapidly and making large amounts of soft sappy growth are readily attacked by "stripe," while slow-growing harder plants are free from disease. Watering with sulphate-of-potash solution or dressing with the solid compound has almost invariably caused "striped" tomato-plants to grow away clean.

In view of the transmission of the disease from one plant to another by means of the pruning-knife, it is necessary to sterilize this instrument after pruning a diseased plant and before passing to a healthy one. This may conveniently be effected by wiping the blade of the knife with a rag soaked in 2 per cent. lysol or similar disinfectant.

COW-TESTING ASSOCIATION NOTES.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

IN last month's *Journal* were given some general figures regarding the amount of herd-testing being done in New Zealand this season as compared with last. Complete statistics of all associations operating this season are being collected, but will not be available until later.

On going into the production of individual associations in the last few seasons it is gratifying to note in how many instances average-yield improvement has been effected. Following are butterfat figures gleaned from records compiled at the Dairy Division's headquarters :—

1919–20.	1920–21.	Increase for Season.	1921–22.	Increase for Season.
lb.	lb.	lb.	lb.	lb.
214·19	240·12	25·93	251·57	11·45
219·93	231·13	11·20	261·45	30·32
211·28	228·31	17·03	238·44	10·13
242·87	257·01	14·14	276·82	19·81
163·25	186·32	23·07	261·89	75·57
177·58	190·74	13·16	215·70	24·96
243·44	255·61	12·17	306·38	50·77
237·29	249·38	12·09	385·49	136·11

The fact of such marked increases as these obviously means that individual herds in many cases have been much improved. The following table records a few of the many interesting examples of this upward movement :—

Season 1920–21.			Season 1921–22.			Increase per Cow.
Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	
		lb.			lb.	lb.
15	232	267·13	15	280	366·03	98·90
11	235	201·63	11	283	290·00	88·37
19	235	216·75	12	264	331·44	114·69
17	238	199·30	16	247	273·40	74·10
50	202	179·50	50	244	271·95	92·45
9	203	190·30	8	266	318·44	128·14
29	229	254·61	25	242	332·75	78·14
10	240	267·80	12	284	349·16	81·36
35	264	255·67	37	266	337·71	82·04
13	222	239·14	12	279	325·38	86·24
24	271	300·08	24	268	404·29	104·21
15	254	293·42	15	273	404·22	110·80
33	251	275·75	33	273	398·03	122·28
23	228	194·14	25	247	292·09	97·95
35	271	319·06	31	260	385·89	66·83
28	255	196·70	31	245	258·63	61·93

The foregoing figures clearly reveal the fact that New Zealand dairy-farmers who are testing their herds are working on sound

lines. The benefit derived is more than a personal one; it spreads from the herd-owner to the dairy company, and from the company to the whole country. If all dairymen would follow the example of the more progressive, it would not be many years before New Zealand might attain an average cow-yield second to none. The Department recognizes that the cow-testing association is one of the chief factors for economic success in the dairying branch of the agricultural industry.

(To be continued.)

HONEY AND ATMOSPHERIC MOISTURE.

R. WATERS, Biological Laboratory, Wellington.

FOR a long time past there has existed uncertainty as to what happens when honey is exposed to the atmosphere. In some countries it is reported that the honey parts with its moisture and therefore increases in specific gravity. The experience of New Zealand beekeepers in the handling of their honey has by no means been uniformly good—in fact, large quantities of honey are believed to have attracted moisture on exposure to the atmosphere, and thus to have suffered in quality through the lowering of the specific gravity.

The purpose of these notes is to set out briefly the results of a series of experiments, conducted by the writer, which aimed at securing some information as to the factors which determine whether honey will attract or part with moisture when exposed to the atmosphere. The following is a summary of the results:—

EXPOSURE OF HONEY TO ARTIFICIALLY CONTROLLED CONDITIONS IN THE LABORATORY.

1. Honeys of high specific gravity part with relatively little moisture in a dry atmosphere at 67° F. Thus, in five days eighteen hours a perfectly dry atmosphere increased the specific gravity of a 1·426 line of honey by only 0·002; in nineteen days it produced no further increase than this.

2. Honeys of low specific gravity part with relatively more moisture in a dry atmosphere at 67° F. Whereas in nineteen days a perfectly dry atmosphere increased the specific gravity of a 1·426 line of honey by only 0·002, yet in only six days twenty-three hours the specific gravity of a 1·403 line of honey was increased by 0·021. Thus, in a dry atmosphere the higher the specific gravity the more retentive is the honey of its moisture, while the lower the specific gravity the more freely does the honey part with its moisture. These two results merely confirm what one would naturally expect to be the case.

3. A dry atmosphere at 67° F. is not in itself very efficient in extracting excessive moisture from honey. Thus, a 1·384 line, even after twenty-one days' exposure to a continuously dry atmosphere at 67° F., increased in specific gravity to only 1·405—not high enough for export (that is, 1·420). Seeing that a high specific gravity causes

honey to hold its moisture more tenaciously than a low one, it would be naturally inferred that high specific gravity would likewise attract atmospheric moisture more strongly than low specific gravity. There seems to be some good evidence as to the relative attraction exerted towards atmospheric moisture by honey of high as against honey of low specific gravity. If, for instance, high specific gravity in honey exerted only the same degree of attraction to moisture as low specific gravity, then a line exposed to a saturated atmosphere for a long time, and consequently daily decreasing in specific gravity, should nevertheless daily attract the same amount of moisture. Therefore, on this assumption, if a 1·428 honey in six days twenty-three hours decreased 0·023 in specific gravity, then in thrice the time it should decrease thrice the extent—that is, 0·069. This, however, is not found to be the case, for in twenty-three days it decreased only 0·055 in specific gravity. Another independent experiment also showed that the attraction exerted towards atmospheric moisture decreased with the specific gravity of the sample. In other words,—

4. Honeys of high specific gravity attract relatively more moisture from a saturated atmosphere in a given time, while—

5. Honeys of low specific gravity attract relatively less moisture from a saturated atmosphere in a given time.

6. The samples in this experiment attracted moisture from the saturated atmosphere much quicker than they parted with it in the dry atmosphere. Thus, a 1·426 sample decreased more in specific gravity (0·023) in six days eighteen hours at 81° F. than a 1·384 sample in a dry atmosphere at about 67° F. was able to increase (0·021) in twenty-one days.

EXPOSURE OF HONEY TO A NATURAL ATMOSPHERE CONTINUOUSLY NIGHT AND DAY.

In nature a constantly saturated or constantly dry atmosphere is not met with, therefore the foregoing does not directly foreshadow what would take place under natural atmospheric conditions. It does however, show something regarding the behaviour of honey under certain constant atmospheric conditions. The following deals with the effects of natural atmospheric conditions upon honey:—

1. Under certain natural conditions honeys exposed continuously night and day in the shade not only fail to increase in specific gravity, but actually attract water and so decrease in specific gravity. Further, the longer they are thus exposed the more water do they attract.

2. Honeys exposed to a constantly saturated atmosphere attract more moisture than when exposed to a natural atmosphere; for a natural atmosphere only occasionally and for relatively short periods of time actually attains to saturation-point, even in the dampest month of the year.

3. Other conditions being equal, it may be safely assumed that the drier the atmosphere the less moisture will honey attract in a given time; in fact, an atmosphere may be so dry that honey not only fails to attract any moisture, but actually yields up some to the atmosphere. The following lends some support to this conclusion: In a constantly saturated atmosphere at 81° F. a 1·426 honey sample decreased in specific gravity by 0·023 in six days eighteen hours, whereas

in a natural atmosphere ranging in relative humidity from 69 to 100 a 1·426 sample decreased by only 0·003 in nine days. Furthermore, in the relatively very dry atmosphere of the desiccator at about 67° F. a 1·426 honey sample actually increased in specific gravity by 0·002 in five days eighteen hours.

4. It follows, therefore, that in atmospheric humidity there is a point somewhere at which honey would neither lose nor gain water—a point at which the atmosphere and honey would attract moisture with equal force; in such a state of equilibrium there would be no interchange of moisture. Conversely, it follows that if honey is left exposed to the atmosphere it will slowly make its way to this point of equilibrium with its surrounding atmosphere, and when it has reached this point it will then follow, though not keep pace with, the humidity fluctuations of the atmosphere. The higher the temperature the closer it will keep pace with the humidity of the atmosphere, for evaporation is quicker at high than at low temperatures.

EXPOSURE OF HONEY TO A NATURAL ATMOSPHERE DURING ONLY THE BEST DRYING-HOURS OF THE DAY.

The foregoing has shown the effects of exposing honey continuously night and day in the shade. As, however, the relative humidity commonly drops as the temperature rises during the hours of sunshine, exposed honey would therefore commonly collect more moisture during the period from the evening through the night till next morning than it would during the hours of light. The following conclusions relate to the exposure of honey only during the best drying-hours of the day—namely, during the hours of sunshine:—

1. Exposure in the shade: Honey of a specific gravity of 1·421 to 1·426 exposed with a large surface in the shade to an atmosphere with a relative humidity ranging from 70 to 90 hygrometric degrees and a temperature ranging from 50° to 60° F. will attract atmospheric moisture and decrease in specific gravity at the rate of 0·001 every two or three days. The rate of decrease in specific gravity will, of course, be slower the lower the specific gravity falls or the lower the initial specific gravity of the honey.

2. Exposure in the sun: Honey of a specific gravity of 1·414 or less, protected from the atmosphere when the sun is not shining, but exposed with a large surface in the radiant heat of the sun to an atmosphere with a relative humidity ranging from 70 to 90 hygrometric degrees and a temperature ranging from 60° to 80° F., will part with its moisture and increase in specific gravity at the rate of 0·001 every eight or nine hours. The rate of increase in specific gravity will, of course, be slower the higher the specific gravity becomes or the higher the initial specific gravity of the honey.

3. Under the same conditions of relative humidity (that is, 70° to 90°) exposed honey may be either damaged by attracting water or improved by parting with it, according to whether its temperature at the time is low or high. For at 50° to 60° F. a good honey decreased in specific gravity 0·001 in two or three days, whereas at 60° to 80° F. poor honey increased in specific gravity at the rate of 0·001 every eight or nine hours—in fact, eventually became high enough in specific gravity for export.

LIMING AND MANURIAL TRIALS WITH RAPE AT MARTINBOROUGH.

SECOND YEAR'S RESULTS.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

IN the *Journal* for April last an account was published of liming and manurial experiments with rape, which were being conducted at Martinborough, in the Wairarapa district. The results of the first season's trials may be summarized briefly as follows: (1.) The local Martinborough lime on unmanured plots gave results 83 per cent. higher than those from plots which were neither limed nor manured. (2.) The average of all plots unmanured but limed was 75 per cent. higher than that of plots neither limed nor manured. (3.) The use of Mauriceville lime without manure increased the yield by 100 per cent.—that is, it doubled the return obtained from unlimed plots without manure. (4.) Ephos phosphate used with lime gave results 9·3 per cent. higher than those from Ephos without lime. Allowing 7 per cent. for margin of error, this still indicates that Ephos with lime, in the wet spring of last season, was, if anything, slightly more efficacious than Ephos alone. (5.) Gear superphosphate (which contains a small percentage of nitrogen in addition to water-soluble phosphate) gave 19·4 per cent. better results with lime than when used alone; or, again allowing 7 per cent. for experimental error, an increase of 12·4 per cent. (6.) Nauru ground-rock phosphate, used alone, showed results neither better nor worse than when used with lime. (7.) All limed and manured plots gave results from 90 to 100 per cent. better than those from plots untreated either with lime or manure. Among the manurial plots themselves there was little or no difference.

The experiment was continued this year with slight modifications in the manurial treatment. The limed plots remained as before, and no further lime was applied this year. The manurial trial plots, each 1 acre in area, were as follows: (1) Control (no manure); (2) 1 cwt. Nauru ground-rock phosphate with 1 cwt. Nauru superphosphate per acre (in lieu of Ephos used last season); (3 and 4) two consecutive acre plots, each treated with 2 cwt. Nauru ground rock per acre; (5 and 6) two consecutive plots, each treated with 2 cwt. Nauru superphosphate per acre; (7) 2 cwt. Gear rape-manure per acre.

This season rape and grass were sown in combination, the ultimate object of the experiment being to test the effect of liming and manuring on the establishment of ordinary permanent pasture on this class of soil. Towards the middle of December the rape crop, chiefly owing to the dry weather, showed signs of going off. Weighings were therefore taken on 18th and 19th December, so as to allow of the lambs being turned into the paddock.

The weather record for Martinborough shows that the months of October, November, and December, 1922, were comparatively dry. The rainfall and number of wet days for these months were: October, 0·98 in., 8 days; November, 1·20 in., 11 days; December, 1·22 in., 10 days. The total rainfall in 1922 was 24·53 in., with 157 wet days.

The results from the 49 plots comprised in this season's experiment, expressed in tons of rape per acre, are shown in the following table :—

Manure.	Control (no Lime).	3 Tons Martinborough Lime.	2 Tons Mauriceville Lime.	Control (no Lime).	1½ Tons Martinborough Lime.	1 Ton Mauriceville Lime.	Control (no Lime).
Control	3·21	4·50	5·46	4·17	5·78	6·42	4·50
Nauru rock and super ..	6·42	10·92	11·25	7·71	9·64	9·64	6·75
Nauru rock	6·10	10·28	10·92	6·42	7·71	8·03	7·07
Nauru rock	6·42	9·64	10·60	8·03	9·00	9·00	6·42
Super	6·42	10·92	11·25	7·71	9·64	9·64	6·75
Super	7·70	10·60	10·60	8·35	9·32	9·64	7·07
Gear rape	7·71	8·67	9·00	6·42	6·75	7·32	6·75

On the control plot, where no manurial treatment was employed, the average yield from unlimed plots was 3·96 tons, while that from limed plots was 5·79 tons—a difference of 1·83 tons, or 46 per cent., as compared with one of 75 per cent. last year. The average yield from plots treated with Martinborough lime was 5·14 tons, and that from those with Mauriceville lime 5·95 tons—a difference of 0·84 tons, or 16 per cent., as against one of 17 per cent. last year. It will therefore be seen that for the last two seasons the difference in the effects of the uncrushed Martinborough lime and the crushed Mauriceville product has been both slight and constant.

In the manured plots 1 cwt. Nauru ground rock mixed with 1 cwt. Nauru superphosphate on unlimed plots gave an average yield of 6·96 tons, while on limed plots the average was 9·77 tons, a difference of 2·81 tons, or 40 per cent. On the two 1-acre plots treated with Nauru ground rock the average yield for the limed portions was 9·06 tons, and for the unlimed 6·75 tons, a difference of 2·31 tons, or 34 per cent. Last season, as we have seen, no such difference showed itself, but as the soil in the whole paddock is sour, and has a somewhat impermeable subsoil consisting of an ironstone pan at a depth of 12 in. to 18 in., some such result might be expected, though hardly in so pronounced a fashion. However, the great benefit derived from lime is evident throughout the experiment. Superphosphate with lime gave 2·41 tons per acre, or 33⅓ per cent. more than when used alone. The margin here is much wider than that shown last year. An increase of one-third in the weight of a crop should serve as an irrefutable argument in favour of the use of superphosphate after lime, rather than alone, on such soil in the Martinborough district. Where Gear rape-manure was used with lime the yield was at the rate of 7·76 tons per acre, while the manure used alone yielded at the rate of 6·96 tons, a difference of 0·8 tons, or 10 per cent. This still leaves a margin of 3 per cent. if 7 per cent. is allowed for experimental error. There is therefore here, as on the other manured plots, a slight indication in favour of the use of lime.

Comparing the manurial plots apart from liming considerations, both in actual and percentage yields (the control plot being represented by 100), the following results are obtained: Control (no manure), 4·88 tons per acre (100); Nauru ground rock with Nauru superphosphate, 8·37 tons (172); Nauru ground rock, 7·91 tons (162); Nauru superphosphate, 8·44 tons (173); Gear rape-manure, 7·36 tons (151).

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

THE following list, comprising the records of cows which received certificates during January, 1923, is supplied by the Director of the Dairy Division, Mr. W. M. Singleton:—

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Perfection of Rosy Creek	Messrs. A. and J. O'Donnell, Hawera	2 66	247·1	365	11,394·8	658·64
Golden Sun Lass ..	Messrs. A. and J. O'Donnell, Hawera	2 74	247·9	365	11,514·0	640·78
Holly Oak's Annie ..	Sutton and Co., Masterton	2 50	245·5	365	10,921·2	586·06
Peaceful of Rosy Creek	Messrs. A. and J. O'Donnell, Hawera	2 58	246·3	365	10,811·7	575·35
Fair View Solid Gold	T. Linn, Mangatoki ..	2 19	242·4	365	8,022·0	472·09
Rosy Creek Daisy ..	C. P. Crowley, Kaponga	2 21	242·6	339	7,698·3	441·09
Uarda's Model ..	J. Penny, Mangatoki	1 338	240·5	346	7,052·95	434·41
Beechland's Sherry ..	Moreland and Son, Te Rapa	2 34	243·9	365	6,532·7	397·91
Silverhope's Nelly ..	J. Fulton, Whangarata	2 71	247·6	324	6,103·3	348·08
Russie	F. E. Day, Tamahere	2 37	244·2	365	6,355·3	326·51
Iva	F. E. Day, Tamahere	2 34	243·9	365	6,844·9	321·14
Nona	F. E. Day, Tamahere	2 11	241·6	365	6,476·1	314·63
Cowslip's Vixen ..	W. T. Williams, Pukehou	2 8	241·3	365	5,594·5	301·18
Vita's Beauty ..	F. E. Day, Tamahere	2 0	240·5	365	6,304·7	293·58
Senior Two-year-old.						
Joyful's Queenie ..	J. G. Robertson, Eltham	2 329	273·4	365	8,865·0	549·02
Heatherlea Maid ..	H. J. Lancaster, Levin	2 223	262·8	365	9,455·3	532·99
Howcroft's Luck ..	E. H. Linnell, Midhirst	2 120	252·5	330	6,148·2	321·54
Three-year-old.						
Rosy Creek Merry Lady	A. B. Robertson, Hawera	3 308	307·8	365	8,901·7	480·64
Waipiko Mabelle ..	C. G. C. Dermer, Cheltenham	3 4	277·4	365	8,979·5	442·08
Beechland's Violette	Moreland and Son, Te Rapa	3 343	311·3	363	8,733·9	378·85
Four-year-old.						
Beechland's Marguerite	Moreland and Son, Te Rapa	4 43	317·8	353	9,188·7	507·52
Frances	A. L. Dermer, Stanway	4 342	347·7	303	7,696·2	484·40
Gallantry	A. B. Robertson, Hawera	3 362	313·3	365	9,425·1	399·55
Mature.						
Springbank Sweet Joan	A. B. Robertson, Hawera	6 0	350·0	365	10,916·5	559·64
Fairy Queen's Hope..	A. B. Robertson, Hawera	7 2	350·0	365	9,918·6	520·73
Keithdale's Treasure	J. Fulton, Whangarata	5 100	350·0	365	9,180·9	507·11

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Bainfield Cowslip ..	W. D. Hunt, Invercargill	2 40	244·5	365	11,202·9	438·91
Ashlynn 49th ..	R. A. Wilson, Turakina	2 47	245·2	351	12,075·8	438·36
Pontiac Gretna Zena	R. A. Wilson, Turakina	1 335	240·5	339	11,064·6	404·56
Ashlynn 66th ..	R. A. Wilson, Turakina	1 334	240·5	364	9,741·9	376·75
Taumata Netherland Pietje Pontiac	Mrs. Budd, Wellington	1 328	240·5	325	11,729·45	345·38
Brookdale Rosella Pontiac	R. A. Wilson, Turakina	1 331	240·5	300	8,127·6	250·80
Senior Two-year-old.						
Ailsa of Friesland Park	A. S. Elworthy, Timaru	2 324	272·9	364	10,930·2	399·25
Foxbro Queen Pietertje	E. F. Walford, Aongatete	2 322	272·7	319	11,080·3	377·16
Junior Three-year-old.						
Kittie Maid of Maplehurst	R. A. Wilson, Turakina	3 14	278·4	365	18,580·7	574·48
Royal Johanna Pontiac	Bloomfield Farm Company, Wellington	3 15	278·5	365	12,641·9	414·60
Mature.						
Lakeside Rasel Queen	J. Stables, Riverlea ..	6 88	350·0	365	15,343·7	620·12
Lady Paul Pietertje ..	R. Melvin, jun., Masterton	5 357	350·0	365	14,955·5	607·98
Sir de Kol Mentor Lass	R. J. Potter, Pukerau	7 363	350·0	365	15,191·1	583·38
Dominion Canary Duchess	T. A. Stephens, West Plains	6 356	350·0	362	13,984·0	501·08
Monavale Evergreen Paxton	S. Clements, Hamilton	5 51	350·0	310	12,861·3	471·95
		MILKING SHORTHORNS.				
Mature.						
Sandy 3rd of Cornwall Park	J. Pease, Matatoki ..	10 295	350·0	365	11,288·5	473·26
		AYRSHIRES.				
Two-year-old.						
Bright Smile 4th of Greenbank	W. Moore, Masterton	2 21	242·6	365	13,799·0	519·62

Second-class Certificates.

		JERSEYS.				
Glenmore Girlie ..	A. C. Lovelock, Woodville	1 284	240·5	365	6,406·1	392·44
Eringa Joyce ..	A. Keith, Masterton ..	1 346	240·5	365	7,580·2	371·97
Roslyn Gay Bon* ..	J. Harris, Bombay ..	1 271	240·5	349	5,645·3	293·14
		SHORTHORNS.				
Sunnyside Bonnie Jean 8th	Sunnyside Mental Hospital, Christchurch	5 310	350·0	360	12,796·9	487·23

* Published incorrectly in November, 1922, *Journal* as a first-class certificate.

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

Early Autumn Ploughing.

STUBBLE and land that has grown early soft turnips should be ploughed as soon as possible. If the land is required early next spring it will be good policy in many districts to put it into a catch-crop for feeding-off, as, apart from the food furnished, the weeds are thus controlled and the fertility of the land built up. On the other hand, where winter fallowing is commonly practised or desired for any special reason, the longer the ground is turned up to the weather the better heart will it be in during the following season. The value of a winter fallow, especially where the climatic conditions are fairly hard, is very great, allowing, as it does, for the mellowing action of frosts and rain, and assisting in the complete decay of stubble and weeds left from the preceding season's crops.

Winter and Spring Forage Crops.

The sowing of forage crops for winter and spring feed should be continued in March. If the crop is to be cut and fed out in the early spring Green's Ruakura or one of the white oats, such as Garton's, will give the heaviest weight of material. If, on the other hand, the crop is to be fed down several times and then let go for a hay or grain crop Algerian oats or Algerian oats and tares are better. If oats alone, a sowing at the rate of 2½ to 3 bushels per acre may be made, and when tares are included sow 2 bushels of oats and 1 of tares. Peas are sometimes substituted for tares, but, as a rule, they do not stand the winter and early spring feeding. Any good phosphatic manure, at the rate of 2 cwt. per acre—say, half super and half Nauru—will be found suitable.

Pasture-establishment.

The sowing of pastures, both temporary and permanent, should be pushed along, so as to give the clovers a chance of establishing before the cold weather sets in. In cases where rape has been fed off early, and is not good enough to keep for a second feeding, grass may be sown to advantage. Every care should be exercised in the cultural operations. Owing to the fact that the grass crop is the most common one grown it has been comparatively neglected in this respect. A fine, well-packed tilth, with moisture near the surface, is the ideal. If no roller is available consolidation may be obtained by driving a flock of sheep backwards and forwards over the field. For average soils and conditions a good permanent mixture is somewhat as follows: Cocksfoot, 14 lb.; perennial rye-grass, 16 lb.; timothy, 4 lb.; crested dogstail, 2 lb.; red clover, 4 lb.; white clover, 2 lb., per acre.

In the Auckland Provincial District considerable areas of ploughable land are being brought in each year from the virgin state, and sown down to grass for the first time after a root crop. Such land may be roughly classified into two types—light and heavy. Much of the light country is of volcanic origin and responds remarkably to top-dressing. Generally the light country, if reasonably level, will hold rye-grass fairly well, if regularly top-dressed with phosphatic fertilizers. The heavier soils, especially the gum-land soils of the better type, dry badly in the autumn, and perennial rye-grass quickly disappears. Cocksfoot, crested dogstail, and timothy hold fairly well, and for average conditions—south of Auckland City—when sowing a pasture for the first time, and the land is intended for dairying, a mixture of somewhat the following composition should be used: Italian rye-grass, 4 lb.; cocksfoot, 15 lb.; crested dogstail, 4 lb.; perennial rye-grass, 8 lb.; Poa pratensis, 1 lb.; timothy,

2 lb.; white clover, 2 lb.; red clover, 2 lb.; Lotus hispidus, 1 lb., per acre. Such a mixture will hold fairly well on the better-class heavy land, and the necessary spring feed can be provided by temporary pastures of Italian rye-grass and red clover sown in February or March.

Mowing and Harrowing of Pastures.

After wet seasons like the present one pastures which have been carrying dairy stock throughout the summer will often have a patchy, rough growth, and a good plan, where conditions permit, is to put the mower over them. Dry or store cattle will readily eat the cut stuff, and the tripod or chain harrows can then be used to the greatest advantage. If this is done during March, and the field closed for a few weeks, fresh growth will be provided for later use. This method utilizes rough feed that would otherwise be wasted and trodden down, and prevents the smothering-out of many grasses. The harrows should break up and spread all animal-manure that has been dropped during the summer months. The manure being evenly spread gives the maximum results, encouraging growth before the cold weather sets in. Grass and clover seeds that have fallen will germinate more freely when given light and air, and better growth of seedlings is promoted. In this way the pasture becomes renovated at comparatively small cost.

Top-dressing and Liming.

Top-dressing of pastures in March is fairly common in districts where winter milking is practised. By top-dressing early with a quick-acting phosphatic fertilizer a good autumn growth of grass is obtained, which considerably lessens the need for supplementary winter feeding with roots, provided a reasonable provision of hay has been made.

In many localities the land will later on become too wet for carting, and where such is the case those paddocks requiring liming should be treated in good time. The question of the use of burnt lime or carbonate of lime (crushed limestone) is largely governed by the factor of available supply. In south Otago and Southland, where liming is so essential, a dressing of 1 ton of burnt lime per acre is a good standard.

Lucerne.

Young stands of lucerne, sown earlier this season, will in most cases have been cut once, and will be ready for cutting again about the end of March. As soon as this second cut has been removed the land may with advantage be given a good harrowing with the tine harrows or light cultivator. This should be sufficiently severe to destroy most of the weeds and thoroughly loosen the surface of the land, thus causing a vigorous growth of lucerne. A good working at this period will generally save a great deal of trouble in subsequent years.

March is also a good month for renovating lucerne-fields that have been neglected, as usually the weather is dry enough to destroy the grass and weeds that are cultivated out. If there is much grass the disk harrow can be used to cut it up, but the disks must be run as straight as possible. After disking, the sods may be thoroughly broken up by means of the tine harrows and cultivator. Where the stand is old and thin and nearing the end of its life it is good practice to sow a few pounds of Italian rye-grass or a bushel or two of oats after this cultivation. The rye-grass or oats will provide good early feeding and occupy the land, which otherwise may grow weeds or useless grasses.

Established stands of lucerne may be grazed from now on till the end of the growing season. Young stands will be better not grazed at all during the first year.

Where it is considered that a lucerne-stand requires lime this is best applied in autumn.

Irrigation Farming.

In Central Otago settlers practising irrigation must make provision to carry out the final watering of their land in March, as the supply of water from the races will be cut off at the end of the month. This especially applies to the soaking with water of uncultivated ground intended to be broken up during the winter. There is no doubt that by this means ploughing is made easier and more satisfactory. A start should be made to break up new land, and this operation not left until later on in the winter, when, in all probability, the ground will be frozen so hard that ploughing will prove out of the question.

The Hay Crop.

Although it has been an excellent season for pastures, the hay crop suffered badly from the wet weather, and much of the hay that was saved was got in in bad condition. A wet season upsets the ordinary method of saving hay, but if extra help had been available much of the hay could have been got in in better condition. In Scotland, where the farmers are used to wet weather at haymaking, they cure the hay in very large cocks well and carefully built to turn the rain. Hay can be cocked in this way when still fairly green, and will cure and dry in the cock without heating. To turn the rain a cock must be carefully built up from the bottom like a small stack; it is useless to expect one run together with hay-sweeps to turn any water.

—*Agricultural Instruction Service.*

THE ORCHARD.

HARVESTING, GRADING, AND STORING.

THE orchard harvest is at its height during the month of March, leading varieties of apples—Dunn's, Jonathans, London Pippin, and Delicious—and most varieties of pears being then gathered. The flavour of pears is often depreciated through the fruit being left too long on the tree; the juice and aroma are usually best developed by picking as soon as maturity is reached and affording proper storage. Fruit receiving such treatment travels well and with little loss.

Second-grade fruit requires the careful attention of the orchardist; there is a common tendency for cull fruit to be allowed to get into this class. A fruit-grader must not merely grade out the "fancy" fruit, but he must also see that the second grade is kept clear of culls. The market in the past has suffered badly from mixed and low-grade fruit. Packing fruit true to grade is sound business, and the main factor in successful marketing.

The fruit-store will again be in demand, and, before recharging, a good clean-up will be required. A knowledge of fungus, bacterial, and insect life, even if only an elementary one, makes one realize the need for cleanliness in a fruit-store. Fumigation, spraying, or washing are different ways of dealing with the problem. Apples and pears can be stored in boxes stacked in tiers of six or seven, and raised high enough off the ground to permit a good draught beneath. To build the stacks true one must start with a level foundation. Each variety, separated into its respective sizes, should be kept together, and a passage left sufficiently wide and straight to operate the store. For the first few weeks considerable moisture is given off, and ample ventilation—indeed, a draught—is required to carry it away.

GENERAL.

A common oversight at this period is the neglect to spray the late pip-fruit crop until an inspection reveals the fact that late infections of black-spot and leaf-roller have caused rather serious damage. The former is apt to recur during the cooler moist days of autumn, while every owner of fruit for storage has a wholesome dread of the attacks of the leaf-roller caterpillar. Spraying with lime-sulphur and arsenate of lead should therefore be carried out to prevent such trouble.

Where cover-crops are needed, peas, oats and vetches, or oats and horse-beans may still be sown. The application of 2 cwt. or 3 cwt. of manure per acre at the same time is usually an advantage.

Autumn winds are apt to damage grafts made in early spring. These should be looked over, and those likely to be blown out made secure.

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

CITRUS FRUITS.

Contrary to expectations at this season of the year the weather conditions have remained wet, and although this has been beneficial to citrus-growers as regards inducing growth, it has also been conducive to the rapid spread of brown-rot. This particular disease thrives under humid conditions, and, as there is every appearance of the continuation of moist weather, orchardists are advised to pay particular attention to the immediate removal of any affected fruits, destroying them by burning. Afterwards the trees upon which the disease has been noticed should

receive a dressing of from 2 lb. to 3 lb. of pulverized sulphate of iron per full-bearing tree, applied to the ground directly beneath the spread of the branches and lightly forked in. This will assist in the control of the disease, but the application of bordeaux, 4–4–40, as advised in last month's notes, should be continued monthly under such conditions, for the control not only of this disease, but of other fungoid diseases attacking the trees.

Cultivation should receive as much attention as is possible at this busy season of the year. It has been noticed that in many cases citrus orchards have suffered from the exceptional frosts experienced during last winter, and that insufficient care has been paid to the removal of frosted parts. These should be removed immediately without fail.

FIREBLIGHT.

Further tip-infection on apples may be looked for from time to time during this month. The treatment recommended for this is the same as previously—immediate removal and destruction by burning, and painting over of the wounds as already advised.

Commercial growers generally are making a splendid fight in the control of this disease. Vigilance should be maintained if the disease is to be kept under reasonable control. Failure to effectively deal with fireblight immediately it has appeared in the orchard may mean the loss of entire trees, and, indeed, entire orchards.

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

DISPLAY OF NEW ZEALAND FRUIT MADE DURING LAST EXPORT SEASON IN STREET WINDOW AT THE HIGH COMMISSIONER'S OFFICE, STRAND, LONDON.

POULTRY-KEEPING.

FURTHER POINTS IN CULLING.

LAST month the matter of culling unprofitable hens was touched upon, March being mentioned as the best time of year for the purpose; some advice was also given in regard to the carrying-out of this important work. The necessity of acting upon the advice given and weeding out every bird that has passed its best period of production is again urged. Of late the average poultry-keeper, owing to the high price charged for foodstuffs and the low price received for eggs, is having a hard task to make both ends meet. The best way to meet this position is by retaining in the flock only birds that are paying their way, or that are likely to do so in the near future. The food bill will thus be reduced, and there will be a saving of labour, this result, generally speaking, being obtained without any appreciable reduction in the number of eggs produced.

The reason for stating that March is the best time to cull a flock of hens is that at this period of the year, or, in other words, towards the termination of the laying season, certain signs manifest themselves in individual birds as indicative of laying-capacity. These signs are not only a guide as to whether a bird is in a laying-condition or not, but they also indicate to a high degree whether it has produced heavily during the past laying season, and, further, whether or not it is likely to prove a good layer during the following season. Some persons are specially gifted in having a natural eye for form, and are thereby able to quickly observe the change that takes place in the appearance of individual birds. This faculty of discriminating between the good and the poor hen, however, is one which may easily be developed by observation and study, and, better still, by first being given a practical demonstration by a person of experience. Once this qualification is acquired, its value to the poultry-keeper cannot be overestimated. It enables him not only to eliminate poor producers from his flock, but also to select for future breeding purposes the birds best suited for the maintenance of a high-standard laying-flock.

In order to assist the novice in the work of culling, some of the chief points to be observed are here enumerated, but, naturally, to apply them in a proper manner requires practice. These guides can be made use of only previous to the time of moulting, as no one character of a bird can be judged with any degree of accuracy once the moulting process has begun. There should therefore be no delay in the carrying-out of a thorough culling campaign.

In the first place, the time of moulting gives a good guide to laying-capacity. It is the long-season layer, or, in other words, the bird that lays well in other than the natural laying season, that is desired and is the most profitable to keep. To do this a bird must necessarily be a late moulter, as the laying season usually ends when the moulting-period begins. Therefore the birds that show evidence of being early moulters should be culled out, and the late moulters retained for laying and breeding purposes. It must be remembered that this test only applies where the birds have been hatched at about the same time, and have been fed and managed under similar local conditions. As an instance, where first- and second-season birds are running together it will usually be found that the former will moult first, so that some allowance must be made for this. Especially is this the case where the older birds have been selected as late moulters the previous season. No rule is capable of universal application, however, and exceptions must be allowed for.

In addition to being a late moulter the good layer will usually bear a shabby appearance at this period of the year. For this reason alone such birds are often discarded by the novice. In the case of white varieties the plumage, although tight and dense, becomes more or less straw-coloured. This is especially so where the birds have free range or where good-sized runs are provided. The head also becomes more or less devoid of feathers. This, with a clean face and bold prominent eyes, is an undoubted sign of strong constitutional vigour. The legs will appear more or less white and decidedly flat, although they may have been very yellow and more or less round during the pullet stage. The fact of the legs becoming more flat and the colour leaving them is no doubt due to the yellow fat being drawn from them to supply the egg-yolk with its yellow pigment. Obviously, the greater the layer the greater will be the tax on the fat-content of the legs, and consequently the more flat and bleached the legs will become.

What applies in the case of the legs does so in like degree to the body-skin, particularly about the vent, and also to the beak. It may be mentioned that hens running on a grass range do not usually bleach out in the legs to the same degree as those kept in confinement. Here again local conditions must be taken into account in applying the test.

The body of the good layer is usually deep. A well-developed crop and abdomen are imperative, as the bird must have large capacity for food and the digestive power to convert this to the manufacture of eggs, and for the maintenance of the strong bodily vigour which is demanded in the high-type laying-bird. The skin of the abdomen should be soft and flexible to the touch, so as to allow for contraction and expansion in accordance with the bird's laying-condition. Beware of the bird that is hard and coarse to the touch around the abdominal region; this indicates that it is converting its food to fat and flesh instead of, as in the case of the good layer, into eggs.

This point also applies in the case of birds above the normal weight of their breed. Such birds may exhibit a well-groomed, healthy appearance, but nevertheless in the majority of cases they do not pay to keep. On the other hand, the good layer at this period of the year will be found in a lean condition, and, as already indicated, generally presents a worn-out, unkempt, rough-and-ready appearance. The reason for this is obvious: it could not be expected to lay on fat while producing a maximum egg-yield.

Summarizing the foregoing points, the birds that should be culled are those that show signs of early moulting; those with a well-kept plumage, and which are above the normal weight of their breed; those with hard development in the abdominal region; and those with points indicating a weak constitution, such as dull sunken eyes, heavy well-feathered eyebrows, bright-yellow legs, loose feathering, and sluggish appearance.

Some poultry-keepers practically refrain from culling their hens until they have passed their second season of production, but this is a mistake. Drastic culling should take place after the pullet's first laying season. Indeed, poultry-keepers would be well advised to cull out all undersized, weak-constitutioned pullets even before they commence to lay. Usually such stock not only produce small eggs, but are also susceptible to every passing ailment. In any flock few birds which have passed their second season of production will really pay to keep for another year, and it is only the person with the trained eye who is able to distinguish these. Culling unprofitable stock is one of the essentials in successful poultry-keeping, and yet there are probably thousands of people who keep their birds almost until they die of old age. In these circumstances it is of little wonder that the question as to whether or not poultry-keeping pays is so often debated.

SELECTION OF BREEDING-HENS.

Because the drone types have been eliminated from the flock and only useful birds remain on the plant it is not to be taken for granted that all of the latter are suitable for the breeding-pen. A bird may show abundant evidence of possessing productive power, but something more is required. If everything is sacrificed to egg-yield, the other important points in the make-up of a good breeding-specimen will suffer as a consequence. Combined with the desired constitutional points and features suggestive of laying-capacity, due consideration must be given to breed-characteristics. Intending breeders should not be misled by the foolish advice, so often given by inexperienced persons, that the best layer is necessarily the best breeder. If a uniform, heavy-producing flock is to be bred and maintained, an ideal type, in addition to productive capacity, must be aimed for. In this connection the novice who is really anxious to build up a high-standard flock of layers is well advised to secure a copy of the "New Zealand Utility-poultry Standards," obtainable from the Department at a cost of 3s., postage free. This contains plates of the types aimed at in the popular breeds of poultry, together with weight clauses and general standard requirements.

Another important point is to avoid for the breeding-pen undersized specimens of their breed, even though such birds have proved themselves good layers. They may succeed in an egg-laying test, or even break records, but it is seldom or never that they produce desirable progeny. It is always a good plan to choose for the breeding-pen a hen slightly larger than that desired in a laying-flock. Always remember that, as in the case of other classes of live-stock, the small birds will come readily enough without specially breeding for them. On the other hand, oversized specimens should certainly be guarded against.

After selecting the best specimens for future breeding purposes, these should be carefully marked and placed by themselves, preferably on a free range. This will enable them to recoup after their exhausting laying season, and they will thus be in a healthy vigorous condition when the breeding season comes round.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FINAL EXTRACTING OPERATIONS.

THE honey season up to the time of writing has been very disappointing. The bees throughout have been in excellent condition and the pastures all that could be desired, but the weather conditions have not been in favour of the apiarist. Most of the time it has been too cold and showery either for clover to secrete nectar or for bees to fly freely. There is just a possibility that weather conditions may yet improve in time for the bees to add considerably to their present stores, but this is most unlikely. The honey-flow, as a rule, closes about the middle of February, and very rarely continues into March. Beekeepers generally will no doubt have done most of their extracting before the end of February, as it is generally recognized that this work should be attended to as far as possible before robbing starts.

The bees are very difficult to handle to any extent immediately after the close of the honey-flow, and, in consequence of this, outdoor feeding is sometimes resorted to to bring about conditions approaching as nearly as possible those of a natural flow. Some American beekeepers recommend feeding a syrup consisting of 1 part sugar to 9 parts of water for this purpose. As a temporary expedient to tide the beekeeper over a very trying period this may occasionally be practised, but it cannot be recommended as a general practice. A simpler and better plan for dealing with robbers while taking off honey for extracting is to put out a few supers of wet combs—combs from which the honey has been extracted. These supers should be placed on a bottom-board and covered with a roof, giving the bees just the ordinary hive-entrance as a means of access to the combs.

But although this answers admirably as a means of attracting robbers while more honey is being taken off for extracting, it cannot be recommended as a means of getting the extracted combs cleaned up. The bees do not mend any broken combs under such circumstances. There is no better plan for the latter purpose than to put the supers of empty comb back on the hives. The bees may store the honey in a few of the centre combs, but they can be induced to remove this by taking out the combs that have been cleaned up and spacing the remainder some distance apart, and, for preference, so placing a mat under the combs that a small space is left at the end for the bees to come up. The Deadman super-cleaner is an excellent contrivance for getting the bees to clean up the combs after extraction. It is simply a large bottom-board capable of holding one or more stacks of supers in addition to a colony of bees. Means of access for the colony of bees are provided by cutting the slats on which the supers rest.

It is to be deplored that some beekeepers put the cappings outside for the bees to clean up. While there may be no objection to such a practice in districts quite free from foul-brood, it should on no account be resorted to when there is any possibility of this disease existing.

TREATMENT OF FOUL-BROOD.

It is now too late to adopt the treatment known as the McEvoy system, and yet it is advisable to do as much as possible to reduce the risk of infection spreading during the winter or spring months through the robbing of infected colonies. With this object in view there should be set aside as many combs of fully-capped honey as may be necessary, these being taken from colonies known to be free from disease. When brood-rearing has practically ceased all the bees of the infected colony should be shaken into a clean, empty hive, and left until on the point of starvation. A few of the reserve combs of sealed honey may then be given, and the hive filled up with empty combs.

A safer plan, still, would be to remove the queen (if valued) from the infected colony immediately, and form a three- or four-frame nucleus colony with her,

taking the bees and brood required from one or more clean colonies. The infected colony must then be destroyed. Apiarists should make a point of adopting one of these two courses if foul-brood is present, and should not take the risk of infection spreading during the winter or spring.

PACKING HONEY FOR EXPORT.

Beekeepers are reminded that it is now necessary to pack honey intended for export in new tins that have not been used for any other purpose. The use of benzine-tins was allowed for a short time during the war period, but this concession has been withdrawn. The tins should contain exactly 56 lb. or 60 lb. net, and should be packed in cases 19½ in. by 9¾ in. by 14 in. The ends of the cases should be of ⅞ in., and the sides, tops, and bottoms of not less than ½ in. dressed timber. As most beekeepers packing honey for export ship through the New Zealand Co-operative Honey Producers' Association, they will obtain further information from that company. Independent shippers may obtain copies of the export regulations and any other particulars in this regard on application to the Department.

—H. W. Gilling, Apiary Instructor.

THE GARDEN.

VEGETABLE-CULTURE.

Tomatoes: Irish blight is causing losses in a number of places. This disease, however, can be almost entirely avoided by planting in an open situation on well-drained soil, by avoiding the use of manures or fertilizers that cause over-luxuriant growth, and by consistent spraying before the disease appears. A bad attack of leaf-spot in a number of glasshouses has come under my notice. The houses are 40 ft. wide and 150 ft. long, the plants being arranged in rows 2 ft. apart and 1 ft. apart in the rows. At the time of writing the plants are over 6 ft. high. In this crowded state it is quite impossible for air to pass freely through the foliage, and as a consequence the atmosphere is kept in a humid and unwholesome state. Further, none of the old or diseased leaves have been removed, so that the disease has spread till scarcely a sound leaf remains. The plants should have been a third less in number, which would have secured a better circulation of air. The old leaves should have been cut off as soon as the fruit below them was gathered, thus securing drier conditions on the soil-surface, which would beneficially affect the whole of the house. These measures, together with spraying—impossible in such a crowded house—would have prevented the disease assuming the proportions of an epidemic. The smaller number of plants could have been properly attended with the same amount of labour as expended on the larger number, and with far better results.

An early kind of cabbage, such as Flower of the Spring, should be sown at once to provide heads from towards the end of September. Lettuce-seed for the earliest crop should also be sown.

Cabbages, brussels sprouts, broccoli, and cauliflowers for cutting about Eastertime should have been planted in December and January, and should by now be growing freely. If they have not made a satisfactory start give a dressing of nitrate of soda—about ½ oz. per square yard—repeating the application about four or five weeks later. If immediate results are desired apply the nitrate in a liquid form, 1 oz. in 3 gallons of water being sufficient for about twenty plants. The surface soil should be kept loose and free from weeds by shallow hoeing, or with a Planet Jr. cultivator. If the soil has not been supplied with fertilizer this can be applied before cultivating. Blood-and-bone is suitable, applied at the rate of 2 oz. to 4 oz. per square yard according to the quality of the soil.

Spinach is one of the most valuable winter vegetables, and is not subject to any special pest; it can therefore be regarded as a sure crop. Sow at once in drills 12 in. to 15 in. apart, and thin the plants to 8 in. or 10 in. apart in the drills. For commercial crops thinning is not done, as the plants are pulled out by the root and tied in bundles. In private gardens only the leaves are gathered, and the larger these are the better they are in quality.

Turnips for winter use should be sown about the middle of March. Sow two kinds—Snowball for first use, and a yellow-fleshed variety to stand longer. These latter are not well flavoured during warm weather, but when the weather becomes cold they are decidedly superior to the white-fleshed sorts.

Onions will be near ripening. Keep the soil clean by shallow cultivation. Do nothing in the way of feeding or watering at this stage; a clean, open soil-surface will give them all the assistance that it is safe to give. Breaking down the tops may be advisable at times, especially if wet weather occurs, but it is seldom necessary, and is best avoided. Care must be taken not to rupture the stem in doing it, or a new top will grow up through the break and ruin the bulb.

Pumpkins and marrows that are to be kept for winter use should be cut as soon as the rind becomes so hard as to be difficult to pierce with a thumb-nail. At this stage the flesh has not become thinned to a great extent, nor has the rind fully hardened. Provided they are not knocked about, these gourds will keep through winter. A good storage place is under trees that will throw off most of the rain and protect them from frost, but they are safer under cover in a building.

—*W. H. Taylor, Horticulturist.*

ANSWERS TO INQUIRIES.

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

LAMBS ON RAPE.

A. DAVESON, Albury:—

I would be obliged if you could inform me regarding the dying of lambs on rape. It is customary in these parts to lose quite a number of lambs when on this crop. Experience has shown that when rape is sown with grass the death-rate is very low, but when grown alone the deaths are very frequent. Probably you could recommend something to replace the grassing-down. How would oats do?

The Live-stock Division:—

The greatest care should be exercised when first feeding lambs on rape, as it readily causes bloating. Lambs, therefore, should only be allowed on rape for short periods until they become accustomed to it, and they should never be put on it when they are very hungry or when the weather is wet. When sowing rape it is advisable to occasionally miss the width of a drill, and about three weeks later to sow that portion with mustard, which tends to counteract the action of the rape when feeding. Oats sown with rape would have no counteracting effect.

CALIFORNIAN THISTLE IN HAY.

J. C. C., Taupiri:—

In my hay paddock I have a clump of Californian thistle about 2 acres in extent bounding the creek, there being not a sign of thistle on any other part of my farm. Each year the thistles are mown and burned. This year they form a portion of my hay crop, and among them is an abundance of clover. I made a separate stack on this 2-acre patch. The thistles were cut and put in the stack while they were flowering, none having seeded. Is it advisable to feed this stack to stock if it is fed out in the vicinity of the stack? Will thistles seed in the stack? Will stock carry the seed to other parts; and, if so, will the seed germinate? Is there any method of complete eradication?

The Agricultural Instruction Service:—

The question of whether the thistle is likely to spread from feeding out the hay depends on the condition of the seed-heads. It sometimes happens that all the flowers on a patch may be either male or female, in which case naturally no seed forms, and the patch only extends by means of its underground stems. To eradicate the thistle is difficult, but the following method is successful if thoroughly carried out. This autumn you should mark out the limits of the patch. Next spring, before the thistle starts to grow, plough the patch and work it down to

a fine tilth. Then plough the land every ten to fourteen days during the summer. This prevents the stems ever reaching the light, and exhausts the food-reserves in the underground stems. Ploughing the area during the summer is the only method to adopt, as it cuts off the stems before reaching the light; surface cultivation will not do this.

CALVES WITH HUSK OR HOOSE.

"CALVES," Turakina :—

I have half a dozen Jersey-cross calves, one to three months old, affected as follows: They cough when moved, and also at rest, and especially after feeding. Some have quickened breathing and panting with the mouth open. One died frothing at the mouth and gasping for breath, the ribs moving as well as the flanks. The calves sleep at night in an open shed with an earth floor, which they mess up very much in wet weather. They are grazing on high, dry land with good clover and grass. Could you inform me as to treatment?

The Live-stock Division :—

Your calves are evidently suffering from an attack of husk or hoose, caused by the presence of the *Strongylus filaria* worm. The floor of the open shed in which the calves lie at night must be dug up and thoroughly dressed with quicklime, and the walls limewashed. Each calf should receive the following drench, carefully administered: One teaspoonful turpentine and four tablespoonfuls milk, this being well shaken before it is given. If the calf attempts to cough, its head should be released or it may choke. Repeat the drench in two or three days. An immediate change of pasture should be made.

INTERPOLLINATION OF APPLE-TREES.

W. W., Redvale :—

Will you kindly inform me which variety of apple is necessary to cross-fertilize the Delicious? We have forty Delicious apple-trees planted in a gully with one hundred Gravensteins, and, though the former (nine-year-old trees) are covered with blossom in the spring, we get only about a dozen apples from the lot, so it appears that the blossoms do not get fertilized.

The Horticulture Division :—

The opinion of investigators is that one variety is as good as another for interpollination purposes, provided the blossoms are open at the same time. Gravenstein flowers with Delicious, so should answer as a pollinator for Delicious. Other popular varieties that flower with Delicious are Jonathan, Golden Pippin, Dunn's, and Commerce. It may be stated that the Delicious is rather erratic in bearing, failing at times to produce a full crop when circumstances appear favourable.

WARTS ON DAIRY CATTLE.

G. H. NEILL, Tutekehua :—

I have a cow with warts all over her udder and teats. Can this condition be cured? I have also a Jersey bull, two years old, and warts are appearing round his eyes and nose and on the back of his legs where the calves suck. What treatment should be given in this case?

The Live-stock Division :—

We should advise, with reference to the cow with warts on her teats, that these be removed in the off season, when the animal is dry. They should then be clipped off with a pair of surgical scissors. After removal, any blood that remains on the parts should be washed off, and a little tincture of iodine applied. In the case of the bull, the warts should be cleansed, and a little powdered bluestone applied daily. If this has not the desired effect they will have to be surgically removed. When applying the bluestone care should be taken to see that it does not get into the animal's eyes. He should also be separated from the calves.

SHEEP WITH SORES ON NOSE AND MOUTH.

"X. Y. Z.," Taumarunui :—

Last summer quite a number of my lambs and some sheep suffered with sores or scabs on the nose and mouth, which had a serious effect on their condition. Some of my neighbours say it is a form of eczema. Could you tell me the cause and a cure, if any ?

The Live-stock Division :—

Lambs and sheep are seen to be affected as you describe when running in rough pastures or among thistles, &c., which set up irritation and sores around the nose and lips. All that is required in such cases is a change on to shorter feed, and a little zinc ointment smeared on the sores.

BROKEN GLASS FOR POULTRY GRIT.

"INQUIRER," Kurow :—

Is broken glass suitable as grit for poultry ?

The Chief Poultry Instructor :—

We do not favour broken glass as grit for poultry, chiefly for the reason that it is soon passed from a bird and eaten by others, which in itself would act as a ready means of spreading such a disease as tuberculosis should a bird happen to be affected. Furthermore, the sharp pieces of glass voided are apt to stick in the birds' feet and cause abscesses, corns, &c. As grit we recommend sharp crushed gravel, and as an egg-shell-forming material crushed oyster or other sea shell.

HORSES AND TUTU.

M. ADAMS, Silverstream :—

Would you be kind enough to tell me if there is any danger in allowing horses to graze in a field where tutu is growing ?

The Live-stock Division :—

There are no cases on record of horses being poisoned by tutu. Under present conditions, with plenty of grass available, a horse is not likely to attempt to eat it.

FEEDING OF MOTHERLESS FOAL.

J. A. SCARFF, Geraldine :—

I would be pleased if you would let me know the best food to give a foal which is now a little over a month old, the mare having died a few days ago. I am now feeding the foal on new cow's milk.

The Live-stock Division :—

If the foal is being fed from a pail it will be a simple matter to get the foal to take a little crushed oats and bran. All that is necessary is to put into the bottom of the pail a handful of crushed oats and bran after the foal has finished drinking the milk. In a day or two the foal will commence to nibble the oats and bran. If, however, it has been fed from a bottle there will be some difficulty in getting the foal to eat. You should get a small box containing a handful of bran and crushed oats, over which a wisp of sweet hay is suspended by cord or twine. The foal will nibble the hay, and after a few days or so will find the oats and bran. Under no consideration mix the oats and bran with the milk. If this is done the oats and bran are bolted with the milk, digestion is impaired, and diarrhoea and irritation of the stomach and bowels ensue. Once the foal commences to clean up the oats and bran he should be fed with this three times daily, the quantity given at each feed being gradually increased as the foal grows older.

OCCUPATION AND USE OF LAND IN NEW ZEALAND: 1920-21 AND 1921-22.

—	1920–21.	1921–22.	Increase	Decrease.
	Acres.	Acres.	Acres.	Acres.
Grain and pulse crops	883,129	954,094	70,965	..
Grasses and clovers (cut for seed or hay), green and root crops	1,027,338	1,020,647	..	6,691
Sown grasses not cut for seed or hay	15,912,803	16,112,598	199,795	..
Fallow lands	137,898	147,678	9,780	..
Gardens, orchards, tree-plantations, &c.	198,661	146,346	..	52,315
Unimproved land	25,386,928	25,146,974	..	239,954
Total area of occupied land	43,546,757	43,528,337	..	18,420

DETAILS OF UNIMPROVED OCCUPIED LAND: 1921–22.

Land District.	Phormium Tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush	Barren and Unproductive Land.	Total Unimproved Occupied Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland ..	2,211	215,641	789,051	372,711	81,058	1,460,672
Auckland	6,739	293,498	1,104,250	784,694	57,911	2,247,092
Hawke's Bay ..	621	569,492	460,473	310,130	37,838	1,378,554
Taranaki	67	5,718	74,545	295,439	5,558	381,327
Wellington.. ..	15,403	538,777	319,326	414,758	98,795	1,387,059
Nelson	1,916	352,465	138,865	441,849	42,492	977,587
Marlborough ..	754	1,305,245	235,333	215,169	325,438	2,081,939
Westland	6,980	134,028	93,804	1,036,182	327,210	1,598,204
Canterbury.. ..	2,542	4,203,684	98,560	239,354	668,467	5,212,607
Otago	958	5,578,143	403,626	292,572	286,317	6,561,616
Southland	5,705	1,412,912	180,276	176,427	84,997	1,860,317
Totals	43,896	14,609,603	3,898,109	4,579,285	2,016,081	25,146,974

NOTES.—Land in boroughs is excluded from the above statistics. The total area of New Zealand is 66,292,232 acres.

REVIEW.

THE GEOMORPHOLOGY OF NEW ZEALAND.

A NOTABLE book* has recently appeared from the pen of Professor C. A. Cotton, D.Sc., F.N.Z.Inst., which must forthwith not only take a high place in that captivating branch of science to which it belongs, but is assuredly destined to stand out—a conspicuous landmark—in New Zealand's scientific history.

The term "geomorphology" can hardly suggest to the uninitiated any reason for the work being the subject of a review in a journal devoted to agriculture, even in its widest sense. But geomorphology is that science, related to geology on the one hand and geography on the other, which is concerned with those numerous features of the landscape—mountains, valleys, plains, rivers, lakes, &c. —which together make up the surface of any country; and it seeks to classify them, explain their origins, and determine their destinies. This explanation should make clearer the relationship of agriculture to geomorphology, for is not the former governed, in no small degree, by the forms of the earth's surface where its operations are carried on? An alluvial plain, a hollow between coastal dunes, a gentle or a steep slope, the irregular surface of an ancient moraine—to mention a few common land-forms—each of these usually demands its special agricultural treatment. Long before there was any agriculture each distinct land-form had its particular type of vegetation, modified, of course, by climate and soil, and it has been shown clearly enough from New Zealand farming that the plant covering, where still virgin, gives a definite clue to the agricultural usage to which the land may be put. The practical farmer may not be particularly concerned with the geomorphology of his farm—his main business being to use his land to the best advantage—nevertheless, some of the teaching in the book under review concerns him closely.

Thus the author calls attention to the effect of erosion on the natural vegetation, and shows that there is a "critical slope," varying with the nature of the rocks and the climate, but, so far, only to be learnt by experience, from which it is just possible to remove the forest and replace it by artificial pasture. But deforest steeper ground, and "not only the hill-slopes are rendered barren, but neighbouring valleys are also injured." It is a well-known fact that much land, thought suitable to carry grass, has been ruined for agricultural purposes in New Zealand through injudicious removal of forest, which should have been left intact.

Generally, the changes in a land-form are of unthinkable slowness, but in some instances they are so rapid as to directly concern the farmer. Thus the author points out how the changes brought about by a meandering river make "rivers unsuitable for geographical or farm boundaries. Old and new maps of the same river-valley will show the meanders in quite different positions and in quite different shapes," as exemplified by changes in the River Taieri (Otago), of which a map is given. Coastal sand areas, in particular, are subject to rapid change. The methods of farming, afforesting, and stabilization of such are based altogether upon a close study of their geomorphology in conjunction with their natural vegetation. A striking case of the effect of a heavy thunderstorm a few years ago in destroying buildings and an orchard situated upon an apparently stable alluvial fan in the Dunstan Gorge (Central Otago) is still to be seen. The aggrading of river-beds and the burial of good grassy flats is not uncommon in mountainous country, especially where forest has been destroyed by fire near the sources of the rivers.

*"Geomorphology of New Zealand—Part I, Systematic: An Introduction to the Study of Land-forms." Demy 8 vo. 462 pp., with 442 illustrations. New Zealand Board of Science and Art, Wellington, 1922. Bound in cloth, 22s. 6d.; in paper cover, 18s.

But if not of particular interest to the actual farmer, this text-book of geomorphology should be in the hands of every student of agriculture, agricultural instructor, and those—a far too small band at present—engaged in agricultural research. At the present time nearly all the University students of an agricultural bent rightly include geology in their curriculum, and in this the study of land-forms plays an important part. As agriculture is largely applied ecology, the importance of Professor Cotton's book for those engaged in agricultural research need hardly be stressed; while, so far as pure botanical ecology is concerned, now that the work is to hand, it is difficult to understand how one carried on without it.

Coming now to the actual contents, scope, and methods of the book, that which especially impressed the reviewer was the manner in which each chapter of the several major subjects under discussion leads up to the next, the series of chapters being bound together much as are the propositions of a book of Euclid. This interdependence and almost mathematical precision is the outcome of the special terminology of the work, term after term appearing and being carefully defined, while each leads up to some new conception. Doubtless a good deal of criticism will centre round this somewhat excessive employment of technical terms. But to reduce their number would be to do away not only with the author's well-conceived method, but also to destroy the interlocking sequence of chapter after chapter, and injuriously affect the clarity of the presentation and the precision aimed at in the description of the landscape. The sole criticism here offered on this head is that a glossary of terms would have been of great assistance, notwithstanding that each term is defined when it first appears.

Hand-in-hand with the text go no less than 442 explanatory figures—some photographs of actual land-forms in New Zealand, and others diagrammatic and explaining the evolution of most of the geomorphological units. To these diagrams, almost all of which are from the hand of the author himself, unstinted praise must be accorded; indeed, they are perhaps the outstanding feature of the work, if any part may be so designated. But many of the photographs are excellent, helpful, and of special value in illustrating the author's descriptions, and not for the student alone, but also for the general reader, either when leisurely reading the book or when travelling through the country. Many not interested in science should also find these photographs attractive, for they give a rapid glance of New Zealand's scenery with its mountains, glaciers, lakes, rivers, waterfalls, gorges, volcanoes, hot springs, fiords, and the varied landscape of the coast.

Although the presentation of the subject is based upon the work and ideals of that United States school of geomorphology of which W. M. Davis is now the leader and G. K. Gilbert the pioneer, Cotton's work is no mere copy. Page after page reflects the author's own researches, and is illuminated by his well-considered conclusions. But in considering these researches those of other New Zealand workers in the geomorphological domain must not be forgotten, and to them, indeed, full recognition is accorded.

The conception of "cycles of erosion" forms one of the most alluring features of the book. First of all, there is the uplifted surface—itself of many forms—into which, as times goes on, gullies are cut by the action of water, which widen into valleys; debris is being constantly removed; change after change takes place—land-forms appear only to disappear; youth fades away; so, too, with maturity; and finally comes old age, when, at its close, the original high land will be worn down, in an ideal case, to about the level of the sea.

Deeply interesting is the account, based on the author's special researches, of ancient land-surfaces, long buried by deposits of various kinds, but again brought to the light of day, the covering material having been stripped off by erosion. Such the author calls "fossil plains." Land-forms of this kind can be seen in various localities when travelling by the Otago Central Railway.

There are many more topics dealt with in the book, but a consideration even of a few would lead too far. Suffice it to say, each page contains information, frequently of surpassing interest, not for the scientific student alone, but for that gradually increasing band of readers who love Nature and are eager to know something of her methods of working; these, as they fascinated read, will learn with wonderment how, with the simplest tools, she raises to the heavens the most sublime monuments, ever building, ever destroying!

L. COCKAYNE.

WEATHER RECORDS.

JANUARY, 1923.

THE following general summary and rainfall statistics are supplied to the *Journal* by the Director of the Dominion Meteorological Office (Mr. D. C. Bates) :—

The weather for the month of January was remarkable for the number of wet days as well as a heavy rainfall, especially in the north-eastern districts of both Islands. The total falls so far reported by post and telegraph show that over the greater part of the Dominion the quantities recorded were from two to three times greater than usual in the same period in former years; but in the west coast and southern districts of the South Island the rainfall was below the average. There were some very heavy downpours scattered throughout the Dominion, mostly occurring at the time of electric disturbances, which were quite common. The winds were variable, but easterlies had a predominance. The most striking feature of the meteorological conditions was the small range of barometric pressure in all parts of the country, this being less than half an inch, and the readings below the normal nearly the whole time.

Dull and misty weather with warm and humid conditions were prevalent, and made hay-harvesting a very trying business for the farmers.

RAINFALL FOR JANUARY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	..	..	..	3·36
Russell	3·18	9	0·94	4·54
Auckland	6·44	15	2·14	2·57
Hamilton	5·34	19	0·90	3·70
Kawhia	5·00	14	0·98	3·37
New Plymouth	12·29	18	4·86	4·32
Inglewood	17·48	21	7·17	7·31
Whangamomona	13·04	20	3·40	5·82
Tairua, Thames	4·48	13	0·72	4·12
Tauranga	6·12	16	2·12	4·35
Maraehako Station, Opotiki ..	7·82	17	1·98	2·87
Gisborne	5·90	14	1·44	2·77
Taupo	6·95	15	2·76	3·46
Napier	..	..	..	3·03
Taihape	8·40	19	2·12	3·03
Masterton	6·52	18	1·39	2·62
Patea	10·20	17	3·94	3·38
Wanganui	4·78	9	2·14	2·84
Foxton	5·23	13	0·78	2·11
Wellington	5·77	18	1·69	3·32
South Island.				
Westport	6·78	20	2·60	0·86
Greymouth	5·91	18	2·38	9·04
Hokitika	8·39	22	2·92	9·84
Arthur's Pass	7·42	13	1·78	6·75
Okuru, Westland	8·46	11	2·16	12·86
Collingwood	13·18	19	4·62	6·95
Nelson	8·26	23	1·70	2·76
Spring Creek, Blenheim ..	6·89	17	1·30	2·22
Tophouse	8·98	22	2·00	5·16
Hanmer Springs	8·72	19	1·90	3·30
Waiau	5·45	15	1·31	2·47

RAINFALL FOR JANUARY, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Gore Bay (North Canterbury) ..	4·73	17	1·21	2·47
Christchurch	5·48	16	3·23	2·15
Timaru	4·65	21	1·04	2·28
Lambrook Station, Fairlie ..	4·49	17	1·22	2·34
Benmore Station, Omarama ..	4·19	22	0·67	2·66
Oamaru	1·70	10	0·68	2·15
Queenstown	1·78	12	0·45	2·71
Clyde	3·23	15	0·69	1·72
Dunedin	2·95	17	0·55	3·39
Gore	..	..	..	3·34
Invercargill	3·14	17	0·68	4·17

ESTIMATED YIELDS OF WHEAT AND OAT CROPS.

THE following estimated average yields per acre of wheat and oats for the season 1922–23 have been compiled by the Government Statistician from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 7th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	30·35	35·45
Nelson	26·96	30·00
Marlborough	33·47	44·11
Canterbury	29·97	36·54
Otago	32·18	41·90
Southland	36·66	46·73
Average (estimated) for the Dominion, season 1922–23	30·48	39·50
Average (actual) for the Dominion, season 1921–22 ..	29·94	39·56

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 8,500,000 bushels, as against an actual yield of 10,565,275 bushels for the season 1921–22 (when a greater acreage was sown).

The percentage of oat crop threshed for the five seasons ending with 1921–22 was 31·49 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be 5,000,000 bushels, as against an actual yield of 6,752,663 bushels for the season 1921–22.

IMPORTATION OF FERTILIZERS, DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st December, 1922 : *Sulphate of Ammonia :* United Kingdom, 91 tons; Australia, 90 tons : total, 181 tons. *Gypsum :* Australia, 20 tons. *Nitrate of Soda :* United Kingdom, 110 tons; Belgium, 10 tons; Chile, 40 tons : total, 160 tons. *Basic Slag :* United Kingdom, 502 tons; Belgium, 1,256 tons; Luxemburg, 50 tons; United States of America, 1,500 tons : total, 3,308 tons. *Bonedust :* India, 550 tons; Australia, 455 tons : total, 1,005 tons. *Char-dust and Bone Char :* Australia, 215 tons. *Guano :* United Kingdom, 10 tons; Malden Island, 1,415 tons; New Caledonia, 1,565 tons : total, 2,990 tons. *Rock Phosphate :* Ocean Island, 6,300 tons. *Kainit :* United Kingdom, 125 tons; France, 100 tons; Germany, 315 tons : total, 540 tons. *Muriate of Potash :* Germany, 5 tons. *Sulphate of Potash :* United Kingdom, 10 tons; Germany, 135 tons : total, 145 tons. *Potash, other :* France, 85 tons; Germany, 125 tons : total, 210 tons. *Sulphate of Iron :* Australia, 46 tons. *Other Fertilizers :* United Kingdom, 1 ton.

BOARD OF AGRICULTURE ACT REGULATIONS.

PROCEDURE AS TO NOMINATIONS, ETC.

NEW regulations under the Board of Agriculture Act, 1913 (revoking those of 20th January, 1914), were gazetted last month, and are reprinted in full below. Preliminary action in regard to nominations, as prescribed, has been duly taken by the Director-General of Agriculture.

REGULATIONS.

1. In these regulations "Board" means the Board of Agriculture. "Society" means a society incorporated under the Agricultural and Pastoral Societies Act, 1908.

2. The manner in which societies may recommend persons for appointment as members of the Board shall be as follows:—

(1.) The North Island shall for the purposes of these regulations be divided into four districts, having the names and boundaries set forth under the heading of North Island in the First Schedule hereto; and the South Island shall similarly be divided into four districts as set forth in the said Schedule under the heading of South Island. One member of the Board may be appointed on the recommendation of such of the societies as have their headquarters in each of the said districts.

(2.) The societies specified as Metropolitan Societies in the said Schedule shall for the purposes of these regulations be deemed to be the Metropolitan Societies for their respective districts.

(3.) The Director-General of Agriculture (hereinafter called the "Director-General") shall, not later than the 21st day of January in the year 1923, and not later than the same date in every third year thereafter, send by registered post to the President (hereinafter called "the Metropolitan President") of the Metropolitan Society in each of the said districts a list giving the names of all the societies having their headquarters within the district of such Metropolitan Society and which were incorporated on or before the 31st day of December next preceding the issue of the said list. In the event of a casual vacancy occurring in the membership of the Board the Director-General shall as soon as possible issue in like manner a similar list in respect of the district whose representation has ceased by reason of the said vacancy.

(4.) The Metropolitan President in each district shall, not later than the last day of January aforesaid, send by registered post to the President of each of the societies named in the said list a notice (in the form set out in the Second Schedule hereto) advising each society that it may send a delegate or delegates to a meeting to be held for the purpose of recommending persons for appointment by the Governor-General to the Board, and calling for nominations for such appointment to be sent in to the Metropolitan President not later than the last day of February. Every such delegate shall be a member of the society appointing him.

(5.) The Metropolitan President shall send to the President of each of the aforesaid societies, not later than the 9th day of March, a list of the nominees referred to in the preceding subclause, and shall also at the same time advise the societies of the date on which the meeting shall be held to elect a representative on the Board, such advice to be sent out at least twenty-one clear days before the meeting.

(6.) The meeting shall be held at such convenient centre in the district as may be decided upon by the Metropolitan President, and the notice shall give full particulars of the place and time at which the meeting will be held.

(7.) In the event of no nomination being forwarded to the Metropolitan President as provided in subclause (4) hereof a representative shall be nominated by the meeting of delegates.

(8.) The Metropolitan President shall be the delegate or one of the delegates of the Metropolitan Society at the said meeting, of which he shall be Chairman, and he may exercise thereat a casting-vote in addition to a deliberative vote.

(9.) The voting at the said meeting shall be by ballot, and, except as provided in subclause (12) hereof, every delegate of a society may exercise one vote and no more.

(10.) No person except the delegates of societies named in the list supplied as aforesaid by the Director-General shall speak or vote at the said meeting; and every delegate shall, before speaking or voting, produce to the satisfaction of the Metropolitan President a document signed by the President or Secretary of his society certifying that the delegate has been duly appointed by the said society to attend the said meeting, and setting out the number of financial members comprised in the said society on the 31st day of December next preceding the date of the meeting.

(11.) Every society advised as hereinbefore provided to be represented at any such meeting may send thereto one or more delegates according to the number of its financial members as stated in the certificate referred to in the last preceding subclause. The number of such delegates shall not exceed the following scale: 400 members or under, 1 delegate; over 400 and not over 800, 2 delegates; over 800 and not over 1,200, 3 delegates; over 1,200 members, 4 delegates.

(12.) If any society fails to send to any such meeting the full number of delegates corresponding to the membership of the society, the delegate or delegates sent by the society may exercise the full number of votes which the whole of the delegates of the society would have been entitled to exercise if present at the meeting.

(13.) At the time and place appointed for any such meeting the Metropolitan President shall, if more than one person is nominated to be recommended to the Governor-General for appointment to the said Board, take a vote as between the said persons. In the event of there being more than one candidate a ballot or ballots shall be taken, and the candidate at each ballot polling the lowest number of votes shall retire until (*a*) one candidate receives an absolute majority, when he shall be declared elected; or (*b*) only two candidates remain, in which case a further ballot shall be taken, and the one who receives a majority of votes shall be declared elected.

(14.) The Metropolitan President shall within three days after the said meeting notify to the Minister of Agriculture by registered letter the names of all persons so nominated, and, if a vote has been taken, the number of votes cast for each. The persons so nominated shall thereupon be deemed to have been recommended to the Governor-General in the order indicated by the number of votes cast for each.

3. Subject to the provisions of clause 5 hereof, each member of the said Board shall, when absent from home on the business of the Board, be entitled to a refund of his expenses of locomotion, and to a travelling-allowance of thirty shillings for each day or part of a day during which he is so absent.

4. The Board may, subject to the written concurrence of the Minister of Agriculture, set up one or more temporary special committees, consisting wholly or partly of persons not members of the Board, to inquire into and report to the Board upon any specified matter or matters.

5. Excepting in the case of his locomotion expenses and travelling-allowances in connection with attendance at meetings of the Board, no member of the said Board shall incur any charge against the public funds without first obtaining the written authority of the Minister of Agriculture.

6. The undermentioned officers may, unless otherwise requested by the President, attend any meeting of the said Board: The Director-General of Agriculture, the Director of Education, the Under-Secretary of Lands, and the Director of Forestry.

FIRST SCHEDULE.

North Island.

1. *The Auckland District.*—Comprising the Provincial District of Auckland, except the counties of Waiapu, Waikohu, and Cook. Metropolitan Society: The Auckland Agricultural and Pastoral Association.

2. *The Hawke's Bay District.*—Comprising the Provincial District of Hawke's Bay, together with the counties of Waiapu, Waikohu, and Cook. Metropolitan Society: The Hawke's Bay Agricultural and Pastoral Society.

3. *The Taranaki District.*—Comprising the Provincial District of Taranaki. Metropolitan Society: The Taranaki Metropolitan Agricultural Society.

4. *The Wellington District.*—Comprising the Provincial District of Wellington. Metropolitan Society: The Manawatu and West Coast Agricultural and Pastoral Association.

South Island.

5. *The Marlborough-Nelson-Westland District.*—Comprising the provincial districts of Marlborough, Nelson, and Westland. Metropolitan Society: The Nelson Agricultural and Pastoral Association.

6. *The Canterbury District.*—Comprising the Provincial District of Canterbury. Metropolitan Society: The Canterbury Agricultural and Pastoral Association.

7. *The Otago District.*—Comprising the Provincial District of Otago, except the counties of Southland, Wallace, Lake, Fiord, and Stewart Island. Metropolitan Society: The Otago Agricultural and Pastoral Society.

8. *The Southland District.*—Comprising the counties of Southland, Wallace, Lake, Fiord, and Stewart Island. Metropolitan Society: The Southland Agricultural and Pastoral Association.

SECOND SCHEDULE.

The President of the Society, .

In accordance with the regulations under the Board of Agriculture Act, 1918, I hereby give notice that the Society is requested to send a delegate or delegates (according to the number of its members*) to a meeting to be held at the [*Name of building*] at [*Name of town*], at [*Hour*] .m., on day, the day of , 19 , for the purpose of recommending persons for appointment by His Excellency the Governor-General to the Board of Agriculture.

Nominations for such appointment may be made by your society, and must be forwarded to the undersigned on or before the last day of February, 19 .

Dated at , the day of , 19 .

[*Signature.*]

*See subclause (11) of clause 2 of the regulations mentioned.

EXPORT BUTTER-BOXES.

The Department is advised that several shipments of butter from New Zealand this season have been landed with an undue number of boxes broken in transit or discharge. In the case of one vessel repairs to broken boxes cost the shipping company over £57. Such charges, of course, tend to come back ultimately on the producer. In many cases lately the boxes used by our butter-factories have been made rather too light. The ends should be not less than ½ in. thick after double-dressing. Care should also be taken that the nails driven into the ends are well centred.

WORLD'S POULTRY CONGRESS, 1924.

Advices have been received by the Department from the High Commissioner, and from the President of the International Association of Poultry Instructors and Investigators (Mr. Edward Brown), London, that the Second World's Poultry Congress and Exhibition will be held at Barcelona, Spain, in 1924. The Congress will be under the auspices of the Barcelona Municipality, and have the support of the Spanish Government, while the Royal School of Agriculture and the Live-stock Breeders' Association of Spain will co-operate in the arrangements. The University of Barcelona has offered to accommodate the Congress in its fine buildings, and one of the buildings erected for the forthcoming Barcelona Universal Exhibition has been made available for an educational exhibition in connection with the Poultry Congress. An executive committee is in progress of formation which will in due course announce further plans and details for the Congress.

Cattle-tick Regulations.—Amending regulations under the Stock Act for the prevention of the spread of ticks (*Ixodidae*) among cattle were gazetted on 1st February. The amendments relate to the boundaries and crossing-places of declared areas in certain districts. The principal alteration is in the Bay of Plenty, where the Area A boundary has been moved back nearer Opotiki. Slight changes have also been made in the Rotorua and Coromandel districts.

THE FIREBLIGHT ACT, 1922.

THIS measure, the full title of which is "An Act to make special provision for the control of the disease of fruit and other trees known as fireblight," reads as follows:—

1. This Act may be cited as the Fireblight Act, 1922, and shall be read together with and deemed part of the Orchard and Garden Diseases Act, 1908 (hereinafter referred to as the principal Act).

2. In this Act "commercial fruitgrowing district" means a district declared as such by the Governor-General as hereinafter provided.

3. For the purpose of preventing the spread of and eradicating fireblight the Governor-General may from time to time, by Order in Council, declare any specified portion of New Zealand to be a commercial fruitgrowing district under a name set out in such Order, and may in like manner from time to time extend, vary, or abolish any such district.

4. The Governor-General may from time to time, by Order in Council, make regulations prescribing the trimming or cutting-down, in the manner and at the times specified, of all hawthorn growing within a commercial fruitgrowing district or any specified part thereof.

5. On being satisfied that fireblight exists in any commercial fruitgrowing district the Governor-General may, by Order in Council, prescribe the complete destruction within the time specified in the Order of all hawthorn growing therein or in any specified part thereof.

6. (1.) Every occupier of land within a commercial fruitgrowing district shall take such steps as may be prescribed pursuant to this Act to trim, cut down, or destroy hawthorn growing on such land.

(2.) If such occupier fails to take such steps he commits an offence against this Act; and any Inspector under the principal Act, or other authorized officer, may forthwith take such steps at the expense in all things of the occupier, who, nevertheless, shall not thereby be relieved from any other liability incurred by him under this Act.

7. Every person who commits an offence against this Act is liable to a fine not exceeding five pounds for a first offence, and not exceeding fifty pounds for a subsequent offence: Provided that no prosecution shall be instituted except by an Inspector under the principal Act.

8. Sections two and three of the Noxious Weeds Amendment Act, 1921, are hereby repealed; and all special orders made by local authorities pursuant to the Noxious Weeds Act, 1908, and that Act, declaring hawthorn to be a noxious weed within their districts or any part thereof shall, in so far as they relate to hawthorn, be deemed to be revoked as from the passing of this Act.

REGULATIONS.

Regulations under the Act were gazetted on 1st February, 1923. They define commercial fruitgrowing districts at Port Albert, Warkworth, Waitemata, Albany, Te Kauwhata, Thames, Hawke's Bay, Greytown, Waimea, Marlborough, Rangiora, Christchurch, and Otago. In the Thames and Greytown districts, and in parts of the Waitemata and Albany districts, all hawthorn must, in the months of June and July each year, be cut down so as to prevent any part from flowering. In other parts of the Waitemata and Albany districts, and in the Te Kauwhata district, the complete destruction of hawthorn before 30th June, 1923, is required.

Beech-forest Investigation.—Dr. L. Cockayne, F.R.S., F.N.Z.Inst., has been engaged by the State Forest Service as honorary botanist to make a report on the beech (*Nothofagus*) forests of New Zealand. The habit and behaviour of the various beeches in the forest are very imperfectly known, so that the sylvicultural treatment required to secure beech-regeneration and a maximum and sustained yield of timber cannot at present be laid down. Dr. Cockayne's investigations are planned to supply the required knowledge.

SEED DISPLAY FOR BRITISH EMPIRE EXHIBITION.

THE Dominion Advisory Council of the British Empire Exhibition desires it to be known that it is intended to make a thoroughly representative exhibit of New Zealand seeds at the British Empire Exhibition. This can only be done through the co-operation of the farmers of the Dominion, whose effective support in this respect is requested. To assist co-ordination a sub-committee has been set up to take the matter in hand, comprising the following experts: Mr. H. C. Wilton, care of Messrs. Wright, Stephenson, and Co., Ltd., Wellington (agricultural seeds); Mr. F. Cooper, care of Messrs. F. Cooper, Ltd., Wellington (vegetable-seeds); and Mr. A. H. Messenger, State Forest Service, Wellington (tree-seeds). Farmers who consider that they can assist in assembling a first-class exhibit are requested to communicate as early as possible with any of the above-mentioned gentlemen, who will supply them with full information. The co-operation of the New Zealand Grain-merchants' Federation has already been sought by the issue of circulars to the individual members. For decorative purposes a considerable quantity of sheaves will also be required.

NEW ZEALAND VETERINARY ASSOCIATION.

ADVANTAGE was taken of the presence of a large number of veterinary surgeons in Wellington in connection with the Science Congress last month to hold a meeting to discuss the formation of a veterinary association for New Zealand. The point was stressed that at the present time there is no law in New Zealand to prevent unqualified men setting up as veterinary surgeons, and that so long as such a state existed so long would stockowners suffer by having their animals subjected to unskilled treatment. This position, in the interests of both the stockowner and the qualified veterinarian, required remedying, and an association could do much in this direction in influencing the powers that be, and educating the farmer in the value of obtaining professional advice for his animals. It was unanimously decided to form a New Zealand Veterinary Association, and a committee was appointed to draft a constitution. Mr. W. T. Collins, M.R.C.V.S., Department of Agriculture, Wellington, is acting as Secretary.

FORTHCOMING AGRICULTURAL SHOWS.

Masterton A. and P. Association: Masterton, 20th and 21st February.
Te Awamutu A. and P. Association: Te Awamutu, 21st February.
Omaha and Pakiri A. and H. Association: Leigh, 21st February.
Whakatane A. and P. Association: Taneatua, 21st February.
Rangitikei A. and P. Association: Taihape, 22nd February.
Opotiki A. and P. Association: Opotiki, 23rd February.
Franklin A. and P. Society: Pukekohe, 23rd and 24th February.
Rotorua A. and P. Association: Rotorua, 28th February.
Katikati A. and P. Society: Katikati, 1st March.
North Kaipara Agricultural Association: Paparoa, 1st March.
Taumarunui A. and P. Association: Taumarunui, 7th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 7th and 8th March.
Waikato Central Agricultural Association: Cambridge, 7th and 8th March.
Morrinsville A., P., and H. Society: Morrinsville, 14th March.
Methven A. and P. Association: Methven, 15th March.
Hawke's Bay A. and P. Society: 20th and 21st March (Autumn Show).
Temuka and Geraldine A. and P. Association: Temuka, 22nd March.
Matamata A. and P. Association: Matamata, 22nd March.
Mayfield A. and P. Association: Mayfield, 24th March.

New Rabbit District.—The constituting of the Apiti-Pohangina Rabbit District (Wellington Land District) under Part III of the Rabbit Nuisance Act, 1908, is gazetted.