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STRAIN DEVELOPMENT IN HERBAGE PLANTS.

Paper read by E. BRUCE LEVY, Agrostologist, Department of Agriculture, at the Annual Conference of the New Zealand Grassland Association, Christchurch, August, 1933.

BREEDING, feeding, and management are prime factors in animal husbandry, and the same basic principles are rapidly assuming like significance in grassland development.

In grassland ecology species and strains of these species have their specific habitats, and this is true also in animal ecology. The feeding of our grasslands—and by feeding I mean the provision of an environment suitable for optimum development by manuring, drainage, soil moisture conservation, soil aeration, &c.—is akin to the feeding of stock, and finally the management and utilization of the herbage produced has its parallel in the care and efficient exploitation of the animal. Choosing species, breeding strains of these, feeding the sward, and utilizing to the best advantage the herbage produced are fundamental to sound grassland development.

Strain in herbage plants is now receiving world-wide recognition, and the strain-testing field laboratories are assuming a significance equal to that of seed-testing laboratories where seed germination and seed purity are determined.

Persistent strains of pasture plants that make a perennial sward hold the ground against weed invasion; high production strains give the greatest return for money spent in manuring and other cultural aids to growth; strains with a long seasonal growth or mixtures of strains that may be evolved extend the grazing period, and tend to level out better the seasonal production from grassland; improved strains give greater scope for specialist management and create an added incentive to better farming.

The object of this paper is to indicate the progress in strain testing and strain building as far as New Zealand is concerned. The species under critical study at one institution or another are perennial rye-grass, cocksfoot, crested dogstail, white clover, broad red clover, Montgomery Red clover, Italian rye-grass, brown-top, Lotus major, subterranean clover, and Danthonia pilosa.

There are two main practical phases in strain-building: (1) The location and isolation of useful ecotypes and the reproduction of

these under a system of certification—Hawke's Bay rye-grass, New Zealand No. 1 white clover, and Akaroa cocksfoot may be cited; (2) the selection from those ecotypes by single plant study, breeding to pedigree standard, and ultimate propagation of bred strains under a system of certification.

The immediate practical outcome of strain work to date in New Zealand is the production of some 236,000 bushels of certified perennial rye-grass, 600,000 lb. of certified cocksfoot, 30,000 lb. of certified white clover, 3,000 lb. of certified Montgomery Red clover, and approximately 200,000 lb. of certified brown-top. Lincoln College has produced a strain of cocksfoot (C. 23) that is up to pedigree standard, and some 36 acres of this strain is now sown out under the Department of Agriculture's certification system. The Plant Research Station is on the threshold of the production of pedigree strains of perennial rye-grass, white clover, and Montgomery Red clover. Five acres of a selected No. 1 White clover is to be sown this coming spring at the Department's Pure Seed Station, at Lincoln. A small crop, some 30 lb., of a selected Montgomery Red clover is available from the Plant Research Station for distribution as mother seed or for field trials on an extended basis. Up to the present year controlled pollination, excepting by isolation by distance, has not been possible for nucleus stocks of pedigree lots. Four glasshouses have now been erected at the Plant Research Station whereby control of pollination of nucleus lots is possible.

Pedigree seed production demands time. Beyond a certain point the process cannot be hastened. The Aberystwyth Plant Breeding Station after some twelve years is now commencing to place pedigree seeds on the market on a commercial scale. Unless commercialization of pedigree strains becomes an accomplished fact, the work goes for nought. Certain species, of course, may not lend themselves to rapid improvement, and the results of many years' work may lead to nothing but disappointment. A rapid survey of the position, however, should soon indicate to any one worker whether a particular species was amenable to a worth while improvement by selection.

I would like to indicate briefly the lines of strain building being adopted at the Plant Research Station at Palmerston North. The work is developing along the following set plan: (1) Collection of material; (2) testing of material by broadcast plot trial and single plants; (3) isolation from material of ecotypes that are of outstanding merit; (4) location and commercialization of these ecotypes under certification; (5) single plant study of approved ecotypes; (6) selection of the most promising single plant material; (7) study of these over a three to four year period (one to two years as single plants and one to two years further as tiller row and tiller single plants), including selfing (if possible) and crossing of parental material under isolation in cages; (8) increase of approved parental material under isolation within glasshouses; (9) increase of glasshouse progeny at Pure Seed Station under good isolation conditions; (10) increase of Pure Seed Station progeny on the farmers' fields under certification; (11) progeny testing of mother seed and its farm-grown progeny, to critically study trueness to or deviations from type by outgrowing.

The commercial seed sample has been used largely as a basis of our selection work. Certification affords a remarkable opportunity for the collection of these samples, and guarantees the authenticity of origin. A great number of lines are dealt with, and the more promising are chosen for critical study; as a basis for further selection we are endeavouring to put out each year some 4,000 to 6,000 single plants from (1) the best mother-seed lines offering out of those tested for certification purposes, and (2) from the seed-stock of the previous year's selections. Four thousand to six thousand single plants should give, say, 160 first-class plants after two years' study, and these may then be reduced to ten of the best that become the nucleus lot for the next season's elite strain. From this strain 4,000 to 6,000 single plants will be put out, and the process of culling a selection repeated. The work to date aims more at a good composite strain rather than a pure line strain, for the reason that a mixture of good strains is more likely to give a longer seasonal spread than is any one pure line strain.

In strain building there are two possibilities: (1) The production of strains for New Zealand's own requirement, and (2) production of strains for overseas requirement. The popular thesis held by workers in strain building is that no strain suits another country so well as the strains that are developed from stock within that country. We in New Zealand view as being the most desirable stock for our own conditions the Hawke's Bay type of rye-grass, the Akaroa type of cocksfoot, the New Zealand No. 1 white clover, and Marlborough lucerne. Whether this thesis is arising as a result of parochialism or as the outcome of definite trials I am unable to state. Evidence for and against the thesis is being gradually accumulated, and there is certainly much that conflicts with a general acceptance of it as a sound working hypothesis.

In the case of perennial rye-grass, the best British commercial rye-grass appears almost identical to what we would term good false perennial. It carries on the average approximately a 6 to 12 per cent. glow under screened violet light. The British indigenous rye-grass is very like the Hawke's Bay in growth form, but its production is lower and its period of growth shorter than those of the Hawke's Bay when both are grown in New Zealand. In Australia, in the Western District in Victoria, there is a type of rye-grass indistinguishable from the best Hawke's Bay, and the dominant note in the Australian experience is that the Western District seed is on a par in Australia with Hawke's Bay seed sown also in Australia. The Australian evidence places the British commercial as inferior to their own Western District seed and inferior to the New Zealand certified perennial rye-grass. One individual report from the United States indicates greater persistency from the New Zealand certified strain than from American commercial types alongside, and one individual report from Natal asserts that the New Zealand certified strain is the best rye-grass in the world. Other reports from Africa, however, indicate that rye-grass is suitable only in the heavier rainfall belt. Stapledon in his trials at Aberystwyth has stated generally that the lots that do best in New Zealand also do correspondingly well in Great

Britain, but that none of the New Zealand rye-grass is as good as the British indigenous. The British indigenous in New Zealand is inferior to the Hawke's Bay strain from two points of view—(1) Low productivity and (2) comparatively short seasonal growth.

In the case of cocksfoot, Britain condemns Danish cocksfoot for the same reason that we do in New Zealand—*i.e.*, its low leaf-yield in relation to seed stalk, its greater tendency to winter dormancy, and its relatively low persistency. The type of cocksfoot being developed in Great Britain is almost identical to the Akaroa strain, and this is particularly true of certain Irish selections and those of the Welsh Plant Breeding Station specifically referred to as "hay" types. The pasture type being developed at Aberystwyth is a low-yielding type, leafy, dense, and persistent, but too low-yielding for New Zealand conditions.

In the case of white clover, Britain again denounces the Dutch type of white clover as being virtually an annual. It is virtually an annual in New Zealand. The N.Z. No. 1 type—the best in New Zealand—is also the best New Zealand type at Aberystwyth. In New Zealand it outyields by two to one the Kentish wild white type, and up to the present has been more persistent, the Kentish suffering badly during the longer dormant winter period by ingress of volunteer winter-growing grasses and weeds. The N.Z. No. 1 carries to Great Britain the tendency to extend the seasonal growth of white clover in Great Britain, but yet the white clover laurel in Great Britain is given to Kentish wild white, which in New Zealand yields no more than half the production of N.Z. No. 1 type, and has a considerably shorter period of growth.

Montgomery Red clover is a moderately perennial clover in Great Britain, and it has also proved more persistent in New Zealand than any other red clover type. We in New Zealand welcome the Montgomery Red type for permanent pastures in New Zealand because we have in New Zealand no red clover sufficiently persistent to incorporate in our permanent pastures. The point, however, that I wish to make is that Montgomery Red growing in New Zealand is identical with Montgomery Red growing in Great Britain—the type does not alter as a result of change in habitat.

In the case of Italian rye-grass, New Zealand would appear to be weak in relation to trueness to type. Aberystwyth has produced an Italian rye-grass that is superior to New Zealand lots of Italian sown at Aberystwyth; they also are superior to New Zealand lots when sown in New Zealand.

In the case of lawn grasses, also, the New Zealand brown-top and New Zealand Chewings fescue are the best in New Zealand. The work of the British Board of Greenkeeping Research, at St. Ives, Bingley, Yorkshire, also acclaims these two species as the best all-round species for lawns and greens in Great Britain—*i.e.*, of the commercial stocks of lawn seeds available.

In the case of annual crops such as turnip varieties, swede varieties, flower seeds of leading seed firms in Great Britain, &c.,

these surely behave in New Zealand almost identically to what they do in Great Britain, otherwise there is a big case for New-Zealand-grown seeds in this class of crop.

From this it will be seen that the evidence for and against the thesis of "home-grown seeds are best" is very conflicting. I have, however, particularly emphasized this point because on the correctness or otherwise of it depends our future policy as far as an export trade in seeds from New Zealand is concerned. Pedigree internationally means nothing unless the type holds under a moderate range of conditions.

Ecologically we may class world types in three groups: (1) The cold habitats of the world, (2) the temperate habitats of the world, and (3) the arid habitats of the world. I feel that free interchange of pedigree seeds could be possible between one cold country and another, one temperate climate and another, and one arid country and another, but in all probability the exchange of seeds between any one of the main ecological groups would not be a success. New Zealand should be in a position to grow strains for all temperate countries of the world, and in this there is an enormous field. The North Island east coast strains may be more eminently suited for Australian and like conditions, whereas Southland may ultimately develop good types more perfectly attuned to conditions in Great Britain. I put this forward merely as a suggestion without any concrete data to support it.

Within New Zealand itself there is no doubt of the superiority of certified strains, and if we but grow on and improve these strains much greater material wealth will be latent in our sown grasslands. I say "latent" specifically, because it is only good farming that will bring out the latent possibilities in a good strain. Good strains will not thrive in spite of poor farming any more than a good cow will yield to its maximum under ill treatment; but good strains do make good farming pay better. They make a specialist in grassland management possible. Poor strains limit one as a specialist in management, using the word "management" in the wide sense of cultivation, manuring, drainage, harrowing, and utilization.

Use of Limonite for Iron Deficiency.—In his annual report for 1932–33 the Director-General of Agriculture remarks on this subject: "Perhaps the most remarkable and far-reaching aspect of animal nutrition ever experienced in the Dominion's history has been brought about by the widespread adoption of the advice given by the Chief Chemist in the use of limonite for the rectification of those stock conditions associated with iron deficiency and generally known as 'bush sickness.' The use of finely ground high-grade limonite can now be looked upon as a standard farm practice on all known bush-sick country, and is rapidly extending to the marginal areas where the condition is present in a modified form. The treatment is so well recognized that the distribution of the material has been taken up by commercial agencies, some operating on an extensive scale. Successful treatment of iron deficiency by such simple means is proving a godsend to farmers in affected country. Although the North Island is mainly affected, limonite has been used experimentally in the South, particularly on one localized deficiency area. The results to date are not conclusive, but nevertheless can be regarded as most encouraging."

OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SUMMARY OF THE 1932–33 SEASON'S WORK.

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

THE present summary, which is for the year ending 30th September, 1933, covers the sixth year of operation of the Government Official Herd Test. The total number of cows tested under this system since its inception has now passed the ten thousand mark, being 10,548. Many of these cows have been tested more than once. The number tested last year was 1,692, a falling off of 106 cows from the 1931–32 total of 1,798. There was, however, a slight increase in number of herds, the 1932–33 figure being 163, as compared with 160 for the preceding twelve months.

Average production rose by 19·84 lb. of butterfat, and reached the high level of 309·78 lb. This was in an average milking period of 283 days, and is based on all cows in milk 180 days or more. It must be taken into consideration that the great majority of O.H.T. cows would be run under ordinary dairy-herd conditions, which makes the average yield attained all the more creditable, and at the same time enables a satisfactory comparison with testing results for average dairy factory supply herds.

As already stated, there were fewer cows tested in 1932–33 than the year before, but it will be noticed from Table 1 that there was a slight increase in the number of cows qualifying for inclusion in the table. This merely means that fewer cows were withdrawn before they had been six months on test.

Table 1.—Official Herd-testing in Two Past Seasons on Basis of all Cows on Test for 180 Days or more.

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days.	Milk.	Butterfat.
Season 1931–32.					
Jersey	121	998	284	5,704·2	307·73
Friesian	20*	279	274	7,518·2	262·92
Ayrshire	4	37	260	6,462·3	273·96
Milking Shorthorn ..	11	174	274	6,039·7	243·41
Red Poll	2	18	268	4,926·3	204·57
Totals ..	158	1,506	280	6,088·4	289·94
Season 1932–33.					
Jersey	132	1,087	284	5,988·6	320·44
Friesian	20	253	280	8,506·0	301·91
Ayrshire	2	31	284	5,957·4	233·28
Milking Shorthorn ..	7	125	275	6,623·8	265·39
Red Poll	2	29	297	6,209·8	251·81
Totals ..	163	1,525	283	6,461·9	309·78

* One Friesian breeder also testing Jerseys.

Table 2.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.	Season 1931–32.				Season 1932–33.			
	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
					Jersey.			
			lb.	lb.			lb.	lb.
Two-year-old and under	403	286	5,126·8	277·24	462	283	5,365·9	290·57
Three-year-old	191	283	5,774·6	315·63	179	282	5,925·7	318·47
Four-year-old	130	286	6,226·7	337·93	161	286	6,479·8	345·72
Mature	274	282	6,256·6	332·76	285	285	6,760·1	355·81
					Friesian.			
Two-year-old and under	85	280	6,116·9	217·61	56	281	7,139·7	252·96
Three-year-old	60	273	7,763·3	270·02	49	281	8,400·1	297·54
Four-year-old	40	275	8,035·6	281·13	47	281	9,293·2	330·18
Mature	94	268	8,408·8	291·60	101	278	8,948·6	318·03
					Ayrshire.			
Two-year-old and under	9	234	5,649·5	220·96	18	285	5,439·7	214·54
Three-year-old	2	233	5,522·2	241·66	6	288	6,434·0	257·00
Four-year-old	11	256	6,754·0	275·49	2	305	6,504·3	239·15
Mature	15	280	6,861·5	308·93	5	268	7,030·6	269·93
					Milking Shorthorn.			
Two-year-old and under	53	275	4,850·2	198·83	34	270	5,005·5	205·72
Three-year-old	34	268	5,753·4	231·67	21	275	6,431·8	262·16
Four-year-old	19	273	6,600·1	267·96	21	281	7,194·5	291·27
Mature	68	277	6,953·4	277·16	49	276	7,584·3	297·09
					Red Poll.			
Two-year-old and under	8	283	4,937·4	199·05	9	305	5,151·9	210·28
Three-year-old	6	239	4,538·0	196·09	5	305	5,589·3	223·40
Four-year-old	3	274	5,321·7	225·66	7	299	7,063·8	293·76
Mature	1	299	5,980·3	236·34	8	284	7,040·6	279·59

During the year testing was carried out for forty-nine cows other than registered purebreds. The records of these cows are not taken into consideration in the accompanying tables, while 118 registered purebred cows failed to remain on test 180 days, as compared with 186 for 1931–32.

The following particulars will be found useful for purposes of comparison: New Zealand's average herd-tested cow for last season, including all cows in milk 100 days or more, yielded 255·57 lb. butterfat in 257 days. The Official Herd Test average on the same basis was 302·92 lb. in 276 days. The Certificate-of-Record 305-day test average was 427·23 lb., and the C.O.R. 365-day test 500·35 lb.

For the highest month of the past season there were 158 herds on Official Herd Test out of a total of 221 herds on Certificate-of-Record Test. The number of cows on O.H.T. per herd during that month was 10·2.

The rapidly increasing number of C.O.R. and O.H.T. cows, and consequently bulls, with butterfat record backing is placing the prospective buyer and herd-builder in a more favourable position each year from the point of view of selection of foundation stock. We should, however, like to see each breeder who enters cows for C.O.R. test place the whole of his sound and untested cows under O.H.T., and we consider that the full benefit of this convenient, reliable, and comparatively cheap system of testing cannot be obtained until this practice becomes more general.

The fact that the individual O.H.T. records are now published along with C.O.R. records by the breeders associations of those breeds participating in the test makes full information concerning tested cows conveniently available to those interested.

HUMIDITY CONTROL IN CHEESE-CURING ROOMS.

G. M. Moir, Dairy Chemist, Wallaceville Dairy Laboratory.

Most cheesemakers realize the importance of maintaining a uniform moderate temperature in the curing room and accordingly do their best to achieve this, although adequate facilities are frequently lacking. Until recently, less notice has been taken of an important related factor, the humidity of the curing room. What is more correctly called the "relative humidity" of the air is the ratio of the weight of water vapour actually present in the air to the weight required to saturate the air at that same temperature. On bringing a glass of cold water into a warm damp room moisture at once condenses on the outside. This demonstrates that at lower temperatures less moisture is required to saturate the air; conversely at higher temperatures more moisture is required. To produce the best cheese a certain amount of drying out should take place while the cheeses are on the factory shelves. If this is not properly regulated, good cheese may suffer damage. An unduly dry curing room accentuates the bad effects of high temperatures—excessive drying out, shrinkage, and cracked rinds—while if the air be

too moist moulds are likely to grow, and as satisfactory rind may not form, a careful cheesemaker must therefore watch not merely the temperature of his curing room, but also the humidity.

The exact determination of the relative humidity of the air is a rather difficult matter, but for practical purposes a fairly simple approximate method is available. This depends on the fact that the lower the proportion of moisture in the air the more rapidly does evaporation take place from a damp surface. Evaporation produces cooling, so that by keeping the bulb of a thermometer constantly moist the temperature registered will be lower to an extent depending upon the relative humidity as well as upon other factors. The use of a pair of wet and dry bulb thermometers for determining relative humidity has been rendered possible by the making of many careful experiments, in which the readings of the thermometers were correlated with humidity determinations by accurate methods. In this way large tables have been drawn up to enable the humidity to be read off from the wet and dry bulb readings. The portion of these tables which is of use in a cheese factory is included here, the figures being extracted from "Cheese Making" by Sammis.

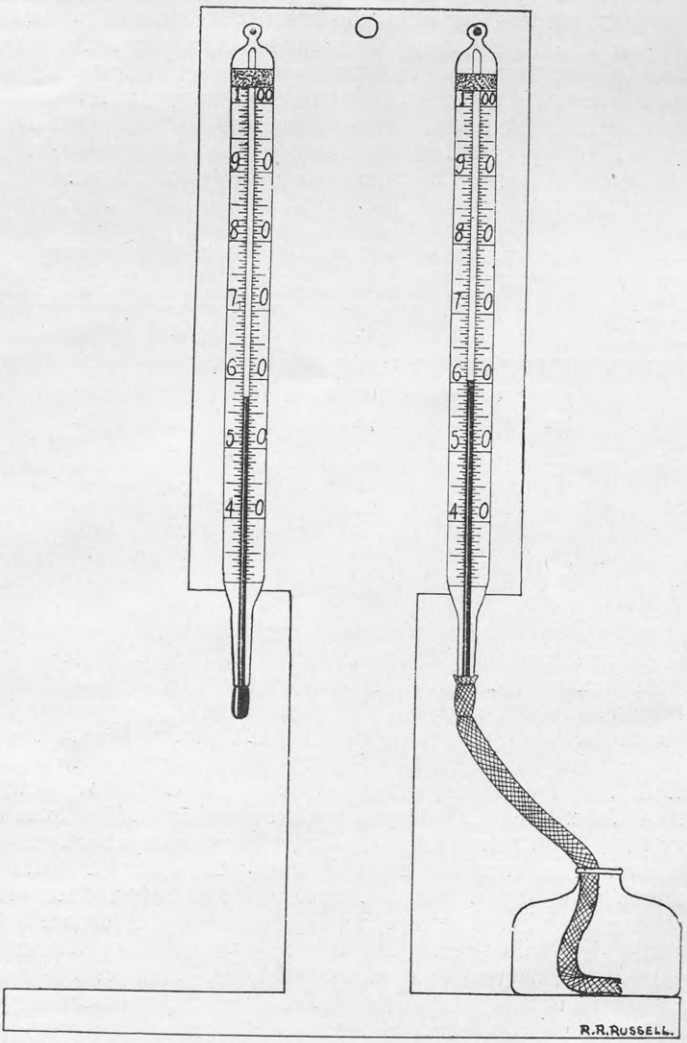
RELATIVE HUMIDITY FROM WET AND DRY BULB THERMOMETERS.

Dry Bulb Temperature. °F.	Difference between the Wet and Dry Bulb Thermometers, in Degrees Fahrenheit.						
	1°.	2°.	3°.	4°.	5°.	6°.	7°.
	Approximate Percentage of Humidity.						
40	92	84	76	68	59	52	44
45	92	85	78	71	64	57	50
50	93	87	80	74	67	61	55
55	94	88	82	76	70	65	59
60	94	89	84	78	73	68	63
65	95	90	85	80	75	70	65
70	95	90	86	81	77	72	68
75	95	91	87	82	78	74	70
80	96	92	87	83	79	75	72

In these readings the important figure is the difference between the two temperatures, and as this is small, care must be taken to use a pair of thermometers which agree. Instead of the more expensive instruments usually sold for this purpose, a suitable pair of ordinary dairy thermometers can be selected. The two thermometers are held together and used to stir a bucket of water. Readings are taken at intervals of about five or six degrees over a range extending from about 45° to 80° F. A pair can easily be selected which give exactly the same readings over this range. Even if the pair differ a little from temperatures given by a tested accurate thermometer, that will not matter, because the humidity reading depends on the difference between the wet and dry bulb readings. A good type of dairy thermometer graduated in half-degrees has recently been placed on the market. These are particularly suitable for making up into wet and dry bulb pairs, as the important small differences of two or three degrees can be very easily seen.

As shown in the accompanying drawing, the wet bulb must be covered with a small wick of thin muslin or cheesecloth (one thickness)

dipping into a small bottle of water, which should be about 3 in. below the bulb and set a little to one side. Sufficient water must be kept in the bottle to maintain the wick damp without being sodden. The thermometers should be hung up at a convenient place in the curing room, not necessarily in the middle, but away from walls or corners so that there is free access of air all round both bulbs. By holding the wet and dry bulb pair in a current of air the wet bulb temperature will be seen to fall, due to the occurrence of more rapid evaporation. Consequently a draughty spot should be avoided.



PAIR OF WET AND DRY BULB THERMOMETERS AS DESCRIBED IN TEXT.

If a second wet and dry bulb pair is available it may be used to detect draughty spots in the factory, where the difference in the two readings will be greater than elsewhere. Similarly small differences will be found in badly ventilated corners where the dampness encourages mould growth. Cracked rinds occur more frequently in draughty corners, which are sometimes due to faulty ventilating arrangements.

General experience has shown that the best results are obtained when the curing room humidity is about 80 to 85 per cent. The dry bulb indicates the actual curing-room temperature—and when this is normal the humidity will be fairly right if the wet bulb reading is about 3° lower than the dry. A difference of less than 2° indicates too damp a room, while 4° or more shows the room to be too dry.

In considering how to adjust the humidity it must be remembered that, provided the amount of moisture in the air is unaltered, raising the temperature lowers the humidity. This frequently occurs in hot summer weather. Apart from the lower humidity the higher temperature facilitates more rapid evaporation from the cheese, so it becomes urgently necessary to keep the humidity up by sprinkling a little water on the floor. If this is systematically done with measured quantities of water, experience soon teaches whether half a bucket or two buckets, &c., are necessary, according to the size of the room. Sprinkling of water is best done, when necessary, in the morning. If the humidity is a little low in the late afternoon a fall in temperature will usually occur at night and the humidity will rise, provided the total amount of moisture in the room remains the same. High humidity in cold weather can be reduced by raising the temperature a few degrees.

In many factories it is the practice to ventilate the curing room at night to introduce the cool night air. For this purpose ventilators in the ceiling should be opened to allow the warm air to escape. To replace it, cool air should enter at ports placed low down at floor level and fitted with baffle plates to prevent draughts. The same principle should be applied to the design of simple air circulating devices which are valuable for establishing uniform humidity throughout the room, and thereby minimizing mould development in corners. It is important to remember that if the thermometers are placed in the current of air due to a fan, much larger wet bulb differences will be recorded, and to obtain the humidity one must use a different table from that given above.

Cheese factories in New Zealand are now required by regulation to record twice daily—first thing in the morning and late in the afternoon—the temperature and humidity of curing rooms. This may be delegated to one member of the staff, whose duty also it should be to attend to the necessary ventilation, &c., of the room. When reading the thermometers care should be taken not to breathe on them. Records are best kept in the following way:—

Date.	Time.	Dry Bulb.	Wet Bulb.	Difference	Relative Humidity.	Initials.	Weather Condition.
Nov. 12 ..	7 a.m.	60·5°	57·5°	3°	84%	J.W.	Mild night.

Past tendencies to make cheese with the maximum of moisture have now fortunately abated, but in some factories little thought is given to the losses of moisture due to high summer temperatures and low humidities in badly constructed curing rooms. Regular records of temperature and humidity should provide evidence of the need for effecting necessary improvements.

FARMERS' FIELD COMPETITIONS.

SUMMARY OF DOMINION RESULTS, SEASON 1932–33.

R. P. CONNELL, Fields Division, Department of Agriculture, Palmerston North.

THE number of entries judged in the Farmers' Field Competitions for the season 1932–33 exceeded by 175 the number for the previous season, which itself was a record one. The entries judged in the various districts for the past three seasons were :—

	1930–31.	1931–32.	1932–33.
Auckland	*	134	165
Wellington	560	807	875
Canterbury	*	*	46
Otago	*	*	30
	560	941	1,116

* Figures not available.

Pleasing current aspects of the competitions are (1) the continued strong support for the competitions in Taranaki, where they have been widely conducted for a relatively long time, (2) increased support in districts in which competitions recently have been inaugurated ; (3) the introduction of the competitions into additional districts.

Notable features of the 1932–33 competitions were (1) the 421 ensilage entries judged constituted a record—ensilage competitions were inaugurated in Taranaki in 1926–27 with 37 entries ; (2) the root crop entries were 325—or 109 more than the number for the previous season—and were characterized by material increases in the entries in both mangels and swedes.

The trend in entries may be taken as being to some extent indicative of the trend of development of interest in farm practice, and so, while it would seem that improved utilization of grass growth by means of ensilage continues rightly to receive study, at the same time the importance of good methods of crop production is being given increased consideration, which it well warrants.

MANGELS.

The number of mangel entries judged increased from 58 in 1931–32 to 94 in 1932–33. In view of the fact that the entries in mangel competitions in Taranaki had declined in recent previous years, an increased entry in 1932–33 seems of some significance, especially when considered in conjunction with the strong support of ensilage competitions ; it suggests that the tendency is to reinforce still further the winter and early spring feed position—in general a most advisable course.

The heaviest crop in the competitions was one of 150 tons 7 cwt. per acre grown by Evan Jones, Toko, Taranaki. The crop was grown on a former pig paddock, the fertility of which was augmented by drainage from a milking shed. The paddock was ploughed in August, thoroughly worked and sown on 2nd November with Prizewinner Yellow Globe at the rate of 6 lb. an acre in drills 16 in. apart. Manure consisting of a mixture of superphosphate, basic slag, bone, and potash was applied at the rate of 7 cwt. an acre.

In South Taranaki the heaviest crop, of 124 tons 1 cwt., was grown by A. T. Sulzberger, who ploughed the land out of grass in October, and on 15th November sowed Prizewinner Yellow Globe in drills 14 in. apart at the rate of 7 lb. an acre, together with a mixture consisting of 2 cwt. superphosphate, 2 cwt. bone, and ¾ cwt. potash an acre.

The heaviest crop in the Wanganui district, 102 tons 13 cwt. an acre, was grown by H. Birch, Maxwell, on land ploughed out of pasture in August. It was sown on 10th October with Prizewinner Yellow Globe at the rate of 6 lb. an acre, and received 10 cwt. an acre of a mixture of superphosphate and bonedust. The growing crop was hand-hoed.

In Manawatu, the heaviest crop, 103 tons 2 cwt., was grown by A. J. Baxter, Aorangi, on land ploughed out of grass on 16th September. After thorough cultivation, the land was sown with Prizewinner Yellow Globe at the rate of 8 lb. an acre on 11th October, in rows 27 in. apart, and 7 cwt. an acre of a special mangel manure was applied.

In Hawke's Bay the heaviest crop, of 79 tons, was grown by G. Kells, Norsewood. The crop followed potatoes on land which was ploughed in late July and sown on 7th November with Prizewinner Yellow Globe at the rate of 6 lb. an acre in rows 20 in. apart, together with 10 cwt. an acre of a special mangel manure.

In the Pahiatua district, the winning crop, of 63 tons 13 cwt. an acre, was grown by N. E. Parry, Ballance, who skim-ploughed grass in July, ploughed in late August, cultivated thoroughly, and broadcast ten days before sowing agricultural salt at the rate of 3 cwt. an acre. In early November Prizewinner Yellow Globe at the rate of 5 lb. an acre was sown in rows 27 in. apart, with 5 cwt. an acre of a mangel manure.

The heaviest crop in Auckland—one of 49 tons 10 cwt. an acre, of Jersey Queen—was grown by H. Swinbourn, Mauku.

In Canterbury the heaviest crop, of 88 tons 12 cwt. an acre of Prizewinner Yellow Globe, was grown by F. Brundell, Kaiapoi.

The prominence of the Prizewinner Yellow Globe variety in the prize list is noteworthy. Common features of the crop management of the majority of the prizewinners and of other competitors who secured heavy yields were (1) thorough cultivation; (2) provision of high fertility, as a rule obtained by resorting to a combination of the use of land of good quality and liberal manuring.

In one instance a crop received manure at the rate of 18 cwt. an acre, but as this included 10 cwt. of kainit the manurial treatment could not be considered a well balanced one. Apart from this instance, crops in Taranaki received up to 10 cwt. an acre, and as an indication that liberal manuring is not confined to any one district the use of dressings of 8 cwt. an acre in Manawatu

may be quoted. Further, both in North Taranaki and in Manawatu, more than half of the crops judged received 6 cwt. or more of manure per acre, in which superphosphate and blood and bone were very common constituents, and in which phosphates were predominant.

SWEDES.

In the swede-growing competitions for all districts 157 entries were judged in comparison with 76 entries in the previous year.

The heaviest crop in the competitions, one of 78 tons 10 cwt. an acre, was grown by R. S. Gilbert, Hurworth, Taranaki. The land was ploughed early in September, on 25th November Grandmaster at the rate of 1 lb. an acre was sown in rows 14 in. apart, and 5 cwt. an acre of root manure was applied at time of sowing.

The heaviest crop in Southland weighed 73 tons 6 cwt. and was grown by James A. Edwards, Otikerama. It consisted of Elephant and Superlative varieties sown at the rate of 16 oz. an acre after pasture, and received a dressing of 1 cwt. superphosphate, 1 cwt. carbonate of lime, and ½ cwt. potash per acre. It was sown on ridges, well cultivated, and hand-tilled.

In Manawatu the heaviest crop, 68 tons 10 cwt. an acre, of Superlative, was grown by Minson and Marshall, Waituna West. The land was ploughed in October, again in December, and seed at the rate of 16 oz. an acre was sown in drills 7 in. apart on 24th December, together with 3 cwt. an acre of turnip manure.

In South Taranaki the heaviest crop, 67 tons 16 cwt. an acre, was grown by K. Herman, Okaiawa, on land ploughed in August and sown on 30th November with Grandmaster at the rate of 14 oz. an acre, in 7-in. drills, with 3 cwt. an acre of a root manure.

In Wairarapa the heaviest crop, 50 tons 19 cwt., was grown by J. Campbell, jun., Mount Bruce, with the only crop of Magnum Bonum in the Wairarapa competition.

The heaviest crop in the Auckland District was one of 47 tons 10 cwt., of Superlative, grown by A. W. Tyler, Patumahoe, in drills 7 in. apart, and manured with a mixture of superphosphate and blood and bone.

In Canterbury the best swede crop was that of J. Campbell, Methven.

It is to be noted that the popularity of varieties of swedes varies considerably from district to district. In North Taranaki the most popular variety, with the splendid average yield of 52 tons 8 cwt., was Superlative, which was also the most popular in Wairarapa, while in North Taranaki, Grandmaster, and in Wairarapa, Majestic, stood second in popularity; in Southland the order of popularity was Elephant and Masterpiece. In North Taranaki there was only one crop—a good one—of Hernings, which was not listed in Wairarapa or Southland. In South Taranaki and in Manawatu no variety received special preference.

The feature of the manuring was that the great majority of the competitors favoured a dressing of about 3 cwt. an acre in which phosphate was dominant; the maximum dressing recorded, one of 6 cwt. an acre in North Taranaki, gave a crop of 66 tons 4 cwt., which may usefully be compared with the fine average of 46 tons 6 cwt. for the 78 crops judged in North Taranaki.

Soft Turnips.

The heaviest crop of soft turnips was one of 56 tons 7 cwt. an acre grown by W. Sadlier, Woodlands, Southland, who sowed 8 oz. an acre of Waite's Eclipse in ridges, together with 2¼ cwt. of root manure.

In North Taranaki the heaviest crop, 51 tons 15 cwt. an acre of Purple Top Mammoth, was grown by R. G. Gilbert, Hurworth, who used 5 cwt. an acre of root manure and sowed 1 lb. of seed on 26th November in 14-in. drills.

In South Taranaki the winning crop of 49 tons of Hardy Green Globe was grown by R. Jones, Lowgarth, who used 3½ cwt. an acre of root manure, and sowed 1 lb. of seed an acre on 17th November in 7-in. rows.

In Canterbury the best crop was that of H. E. Lock, Methven.

Carrots.

The carrot competitions were confined to the west coast of the North Island (Wellington and Taranaki), where many splendid crops were obtained, as is indicated by the fact that the average yield of 32 crops in North Taranaki was 51 tons an acre. The heaviest crop in the competitions was one of 68 tons 5 cwt. an acre, grown by R. Rolfe, Tikorangi. The land was ploughed out of grass early in October, well cultivated, and sown on 26th November with 1½ lb. an acre of Matchless White Belgian seed, in drills 16 in. apart. The crop, which received 6 cwt. an acre of root manure before sowing and 4 cwt. an acre of similar manure at the time of sowing, was hoed only once, but then thoroughly.

In South Taranaki the best crop, of 65 tons 12 cwt. an acre, was grown by K. Herman, Okaiawa, who sowed a mixture of Matchless White and Barriball in 14-in. rows on 30th October in land which was ploughed in August, and who used 4 cwt. an acre of a mixture of superphosphate, blood and bone, and potash.

In Wanganui, the best crop, one of 64 tons 17 cwt., was grown by N. Hughes, Maxwell, who sowed 12 oz. an acre of Matchless White in 21-in. rows on 8th November and used 5 cwt. an acre of superphosphate. The crop was weeded and hoed four times.

Throughout the competitions Matchless White was the most popular variety. In North Taranaki the variety of highest average yield was Holmes Improved, which was not grown elsewhere. Other varieties which gave good yields were Sinclair's Champion and Guerande.

Miscellaneous Crops.

Chou moellier competitions were held in South Taranaki and Southern Hawke's Bay. The heaviest crop was one of 34 tons 13 cwt. an acre grown by G. Kells, Norsewood, who sowed 1 lb. an acre of seed in 28-in. rows on 20th October on land ploughed in July, following a crop of mangels. He hand-thinned and horse-hoed the crop, which received 6 cwt. an acre of superphosphate. In South Taranaki the heaviest crop yielded 28 tons 18 cwt. an acre. It was grown by J. Phillips, Lowgarth, who sowed 2 lb. of seed an acre in 14-in. drills on land ploughed on 7th November, following swedes, and used 3½ cwt. of manure an acre.

In Canterbury a potato competition was won by J. Carr, Methven. A green feed competition was won by Frizzell Bros., West Eyreton. Their crop was Algerian oats sown on 1st March, at the rate of 2 bushels an acre, on land ploughed out of old pasture, thoroughly cultivated, and dressed with ¾ cwt. an acre of blood and bone.

A Canterbury lucerne competition was won by W. Stalker, Rangiora, with a young crop which received 25 cwt. of lime and 3 cwt. superphosphate an acre.

Ensilage.

The results of the ensilage competition in North Taranaki are given in a separate report in last month's issue of the *Journal*. The principal results in other districts were as follows:—

North Auckland.—(*a*) Stack ensilage: E. R. Walker, Pakaraka. Raw material good, leafy grasses and clovers; silage generally sweet, golden brown, with 4 per cent. of wastage on sides. (*b*) Pit ensilage: R. Bindon, Ohaeawai. Round hillside pit not concreted; silage good quality, sweet brown to slightly sour green; very little wastage.

Central Auckland.—A Hill, Mauku. Short rye-grass trimmings cut in October and put in a pit; no waste.

South Auckland.—C. Musker, Tirau, pit silage; good quality throughout.

South Taranaki.—(*a*) Stack ensilage, H. A. Sutherland, Alton–Kakaramea. (*b*) Earth pit ensilage, S. E. McDonald, Alton–Kakaramea. In this district a general all round improvement in ensilage was noted, but an important weakness was lateness in cutting the crop.

Gisborne.—G. R. Moore and H. Davis were equal; both saved maize silage cut in the early cob stage, in pits.

Wairoa.—A. T. Rainbow, who ensiled lucerne with grass on top, cut early November. In this competition the pastures were generally cut too late for best results.

Southern Hawke's Bay.—(*a*) Pit ensilage: W. Jenkins, Norsewood; silage of very good quality from high class pasture cut at right stage; very small waste. (*b*) Stack ensilage: A. L. Anderson, Norsewood.

Pahiatua.—(*a*) Pit ensilage: J. H. Bremner, Ballance; practically no waste, and quality of silage very good. (*b*) Stack ensilage: J. E. Hewitt, Mangamaire; relatively little waste, and quality good.

Eketahuna.—(*a*) Pit ensilage: C. Evans, Rongomai, well cured silage made out of good material cut at the right stage. (*b*) Stack ensilage: J. P. Matheson, Rongomai. In this competition a common weakness was cutting of the material when it was too mature.

Haymaking and Pasture Competitions.

The results in North Taranaki have already appeared in the *Journal*. The principal results in other districts were:—

Haymaking.—Central Auckland: J. B. McKinney, Bombay. South Auckland: R. C. Smith, Rotorua (baled hay), H. M. Martin, Rotorua (stack hay). South Taranaki: H. V. Ward, Tokaora (meadow). A. T. Sulzberger (lucerne).

Pasture.—Central Auckland: A. T. Woolsey, Mauku. Westland: Price Hamer, Totara Flat.

HALO-HAIRS IN THE ROMNEY LAMB.

BREEDING EXPERIMENTS UP TO 1933 SEASON.

F. W. DRY, Massey Agricultural College, Palmerston North.

THE results of earlier breeding experiments at Massey Agricultural College on the inheritance of the abundance of halo-hairs, or large birthcoat kemps, have been recorded already in this *Journal* (January, 1933). Further experiments have been performed in the 1933 breeding season, and the present article supplements the previous record. In some of the 1933 experiments, as before, like was mated with like; in others the parents differed in classification for abundance of halo-hairs.

From the point of view of hereditary factors the situation revealed is complicated, as was, indeed, anticipated. For breeding practice, as was likewise not unexpected, the conclusion that can be drawn is simple, selection in any direction having largely been effective. As reported previously, there is great variation from lamb to lamb in the collection of successional fibres that take the place of the shed halo-hairs, but follicles that begin by putting forth halo-hairs are apt to continue to produce extremely objectionable fibres, either kemps, shed in their turn, or coarse persistent hairy fibres.

The facts about succession in these follicles have not yet been presented in more than a preliminary way, but what is known supports the common-sense conclusion that halo-hairs should be tolerated no more than is unavoidable in the management of a flock. Halo-hairs are, of course, perfectly easy to see in the early days of life, and it is clear that keen selection against them will quickly bring its reward. The problem of the coarsest of the kemp group of hairy fibres is therefore not a difficult one. It should, however, be emphasized anew that kemp hairiness is one thing and non-kemp hairiness another (*Journal*, March and May, 1933), and that the latter is of the greater economic importance. It is only appropriate that selection against kemp hairiness should be the easier.

It was explained before that the sheep taking part in these experiments had to be graded for abundance of halo-hairs very early in life, and, as with their progeny, this was almost always done within three days of birth. These breeding experiments can largely be described, as in the earlier account, in terms of four groupings for abundance of halo-hairs on the back—namely, Many, Medium (numbers), Few, and None. Actually, six grades were recognized, the highest being Grade 6, the lowest, with no halos, Grade 1. Many-halo lambs are of Grades 6 and 5, Medium-halo lambs Grades 4 and 3, and Few-halo lambs Grade 2. This grading is illustrated by Fig. 1 of the present article, high Grade 6, and by the figures of the January article, Fig. 5 showing Grade 6, Fig. 6 low Grade 5, Fig. 8*b* a tuft of Grade 4, and Fig. 7 Grade 3.

In the Welsh Mountain breed Roberts makes an important feature in classification of birthcoats of the sustaining or otherwise of the abundance of halo-hairs on the withers. In my lambs this abundance has been kept up in only a very few animals, less than half a dozen of all those making an appearance, as parents or offspring, in this

breeding work. These few are all of Grade 6, but by no means all animals of that grade are so kempy on the withers, the classification being made on the abundance on the back behind the level of the shoulder. Almost always the numbers rapidly diminish down the side, but some Grade 6 lambs have halo-hairs all over the body. A 1933 lamb without the decrease on the withers is shown in Fig. 1. (With this may be compared Figs. 5, 6, and 7 of the January article.) Lambs as immensely kempy as this over most of the body are plentiful in the 1933 mating of Many × Many, several having just a slight drop in abundance on the withers.

The breeding results are given in the following table:—

Table 1.

Parents' Classification for Halo-hairs.		Year.	Tag Number of Ram.	Offspring: Number of Lambs having			
Ram.	Ewes.			Many Halo-hairs.	Medium Numbers of Halo-hairs.	Few Halo-hairs.	No Halo-hairs.
Many	Many ..	1931	M.A.C. 784 ..	2	1	..	..
		1932	E. 59 ..	4	5	2	..
		1933	X. 303 ..	10	1	1	..
Totals ..	..	..	..	16	7	3	..
Medium ..	Medium ..	1931	M.A.C. 731 ..	..	2	..	..
		1932	M.A.C. 745 ..	2	12	5	..
Totals ..	..	..	..	2	14	5	..
None	None ..	1932	E. 131 ..	..	..	4	9
		1933	E. 89 ..	..	..	..	3
Totals ..	..	..	.. ..	..	..	4	12
Many	Medium ..	1933	E. 59 ..	4	5	3	.
Many	None ..	1933	E. 59 ..	1	4	8	2
None	Many ..	1933	E. 131 ..	..	1	9	2
Totals ..	..	..	..	1	5	17	4
None	Medium ..	1933	E. 131 ..	..	..	8	4
None	Few ..	1933	E. 131 ..	..	..	2	1

Additional Notes on the Breeding Results.

In the simple form in which the breeding results are presented differences within the groupings—Many, Medium, and Few—are not revealed. When such differences are considered the part played by heredity in determining the abundance of halo-hairs is emphasized the more in some experiments.

In the Many × Many matings, the ram E. 59 was a low Grade 5, the average grade for the ewes (calculated here by counting a ewe with two lambs twice) was 5·2, and only one lamb was Grade 6. On the other hand, the Ram X. 303 was a high Grade 6, and the average grade for the Many-halo ewes with which he was mated was 5·4; eight of the lambs so produced were Grade 6, most of these being high for their grade.

In the None × None mating, as indicated in the earlier article, all four few-halo lambs sired by the ram E. 131 were very low Grade 2, two of them possessing only a single halo-hair on the back.

Certain additional details may be given about the 1933 experiments in which the sheep mated together differed in their grouping for halo abundance. The two rams E. 59 and E. 131 figuring in these 1933 experiments had been used in those of 1932, each with ewes of his

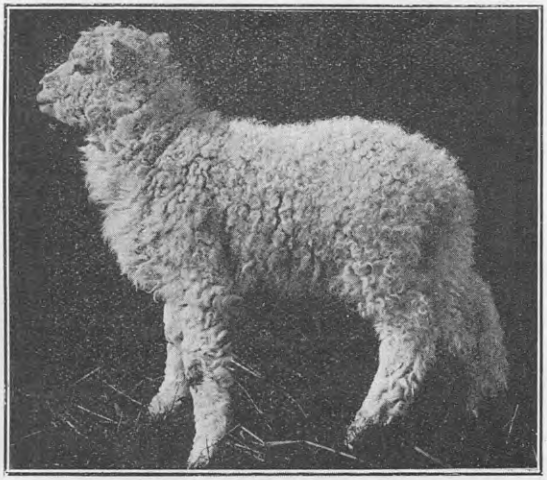


FIG. 1. LAMB OF HIGH GRADE 6 ON THE BACK; HALO-HAIRS VERY ABUNDANT THROUGHOUT THE COAT.

own grouping. The same applies to many of the ewes. A comparison is made in Table 2 of the performance of groups of ewes mated in 1932 to one ram and in 1933 to a ram of a different halo grouping. These figures show that where only one parent was free from halo-hairs on the back a good deal was done towards keeping down the abundance of halo-hairs in the lambs.

Table 2.

Ewes.		1932 Ram.			1932 Lambs.		1933 Ram.			1933 Lambs.	
Halo Grouping.	Average Halo Grade.	Halo Grouping.	Tag No.	Halo Grade.	Number born.	Average Halo Grade.	Halo Grouping.	Tag. No.	Halo Grade.	Number born	Average Halo Grade.
Medium ..	3·4	Medium	M.A.C. 745	4	8	3·2	Many ..	E. 59	5	8	4·1
Medium ..	3·2	Medium	M.A.C. 745	4	7	3·3	None ..	E. 131	1	5	1·4
Many ..	5·3	Many ..	E. 59 ..	5	7	3·9	None ..	E. 131	1	10	1·9
None ..	1·0	None ..	E. 131 ..	1	12	1·2	Many ..	E. 59	5	13	2·3

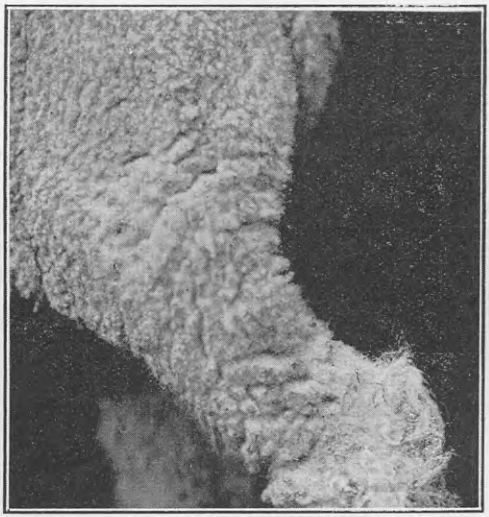


FIG. 2. BRITCH OF VERY LOW GRADE I, ALL BUT FREE FROM HALO-HAIRS.

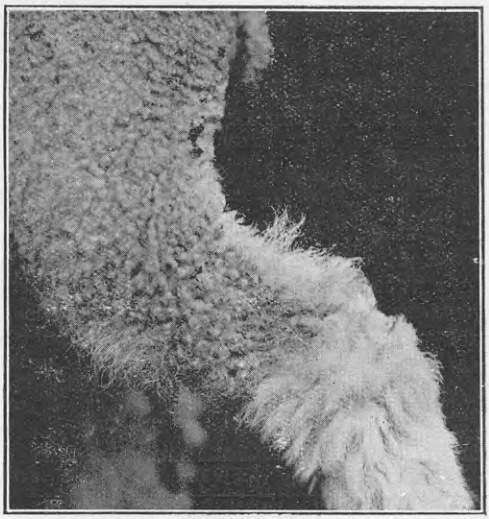


FIG. 3. BRITCH OF HIGH GRADE I, HAVING HALO-HAIRS PLENTIFUL ON THE MARGINS OF THE BRITCH, BUT FREE WITHIN.

On the point now to be mentioned—one connected with hairy sickle-fibres—it is not possible to draw a definite conclusion from the results now available. One naturally wonders whether No-halo animals free from hairy sickle-fibres (on the standard back position) are likely to keep down the numbers of halo-hairs in their offspring better than

No-halo animals that do possess hairy sickle-fibres. That this might be so is suggested by the low gradings of the lambs from Many-halo and Medium-halo ewes mated with the No-halo ram, E. 131, who was free from hairy sickle-fibres. An examination was therefore made of the results of the matings between the Many-halo ram, E. 59, of Grade 5, and No-halo ewes. Mated with No-halo ewes possessing hairy sickle-fibres on the back and with No-halo ewes free from such fibres, he sired lambs of the same average grade, 2·4, but the numbers of lambs were only small. The evidence is therefore inconclusive.

Here attention is directed to one of the finer points that are being raised in our study of hairiness. In all this work we are ever on the look-out for glimpses, for avenues of attack, that may lead to an understanding of the forces underlying the production of hairiness or determining the degree of hairiness of a fibre.

Comments upon the Breeding Results.

Lambs may have more halo-hairs than either parent or less than either parent. As usually happens with quantitative characters, it is not possible to relate any very simple story about the hereditary factors determining the abundance of halo-hairs. This is true for height in man, for body weight in fowls, and also for average fineness in wool—as can, indeed, be most readily believed in the light of what has already been placed on record about the fibre types of the Romney lamb.

On the whole the offspring are similar, in their grading for halos, to the average of their parents, but in this limited series of experiments the lambs have less than their parents rather than more. Here it may be added that, while lambs with None born in these experiments always had at least one parent with None, one lamb lacking halos on the back was born of a Grade 6 ewe to a ram (not seen as a lamb) with kemp quite plentiful on the back. It is to be noted that one lamb by ram X. 303 from a many-halo ram had few.

All but two of the many-halo lambs produced in these experiments have had at least one parent with Many, and those two, from Medium × Medium, were both of only Grade 5. It would be interesting to know how wide the departure can be in the lambs from the grading of the two parents; especially should we like to know how much more abundant halos can be on the back of a lamb than on that of either parent.

At the two extremes the results of selection have been most marked. The ram X. 303, with halo-hairs extremely abundant, has been a great success, if one may so term it, in breeding lambs like himself (Fig. 1). When both parents have had None, only few of the lambs have had any halos at all on the back, and then their numbers have been very small. Although the results of mating the Many-halo ram with No-halo ewes indicate that we could not expect all No-halo rams to be so successful, the one No-halo ram tried, E. 131, has done very well in keeping down the number of halos when mated with Many-halo and Medium-halo ewes.

HALO-HAIRS ON THE EXTREMITIES.

Further data have been accumulated upon the abundance of halo-hairs in the poll, brisket, britch, and tail, an arbitrary grading system being used. The grading for the britch is illustrated (Figs. 2 to 6). As on the back, it is clear enough that the abundance of halo-hairs on the extremities is inherited.

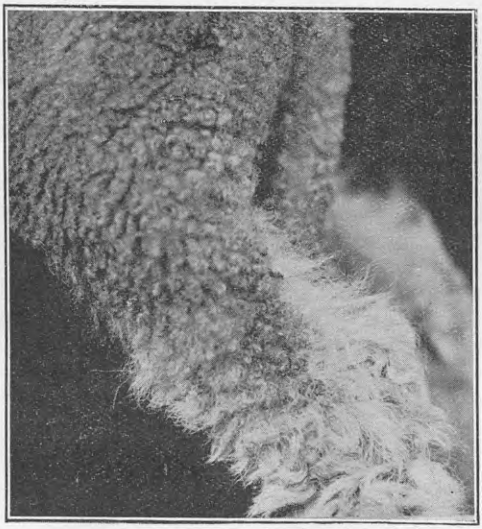


FIG. 4. BRITCH OF GRADE 2, HAVING A GOOD MANY HALO-HAIRS ON THE MARGINS AND A FEW WITHIN.

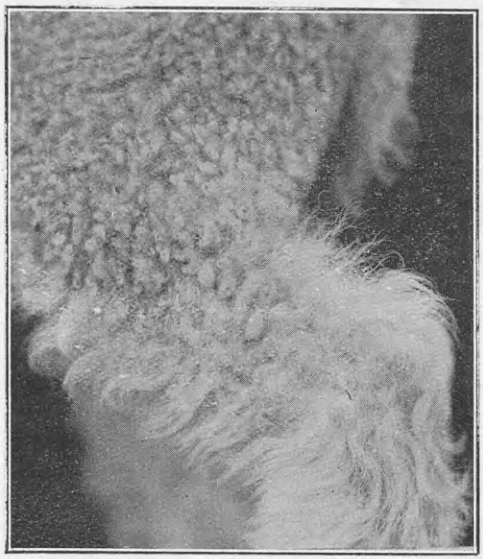


FIG. 5. BRITCH OF GRADE 3, WITH MANY HALO-HAIRS ON THE MARGINS AND CONSIDERABLE NUMBERS WITHIN.

Rather more lambs than previously (January article, p. 15) have been found with a low brisket grade accompanying a relatively high back grade, so that if lambs were selected for marked freedom on the brisket they would grade much the same on the back as if they were selected for marked freedom on the britch. At the same time, as stated before, in selecting against larger tufts of halo-hairs on the brisket many lambs free from halos on the back would be thrown out. It thus comes about that while there is on the whole a correspondence between the brisket grade and the back grade, this is much less pronounced than between the poll and the back, the britch and the back, and the tail and the back.*

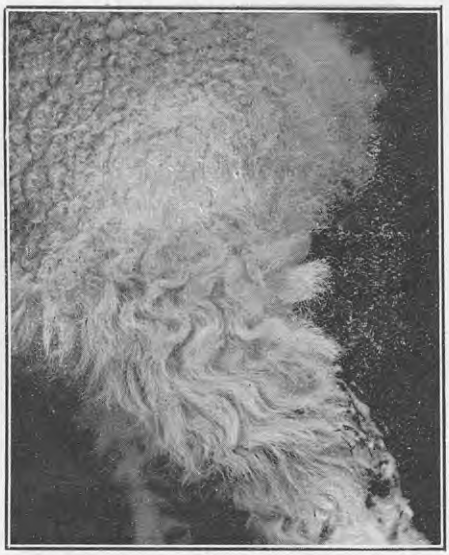


FIG. 6. BRITCH OF HIGH GRADE 4, WITH VERY MANY HALO-HAIRS ALL OVER THE BRITCH.

In her work on the development and distribution over the body of fibre types Miss N. Galpin is finding additional reasons for regarding halo-hairs and sickle-fibres as closely allied. It therefore seemed worth while analysing the records for No-halo lambs to see whether No-halo lambs possessing hairy sickle-fibres graded higher on the average on any of the extremities than No-halo lambs free from hairy sickle-fibres on the standard back position. No significant difference was found for any of the four regions under consideration—the poll, brisket, britch, and tail.

On present knowledge, therefore, we may be inclined to be lenient to a lamb with a substantial tuft of halo-hairs, like that shown in Fig. 8,

* The correlation coefficients between grades, which, it will be remembered, are fixed arbitrarily, are: Between brisket and back, + ·29 ± ·02; between poll and back, + ·64; between britch and back, + ·68; between tail and back, + ·61: the probable error for the last three figures is less than ·01.

FIG. 7 (LEFT). BRISKET FREE FROM HALO-HAIRS, HAVING A FEW RATHER PROMINENT FIBRES INTERMEDIATE BETWEEN HALO-HAIRS AND SICKLE-FIBRES.

FIG. 8 (RIGHT). BRISKET WITH FAIR-SIZED TUFT OF HALO-HAIRS.

or even larger, on the brisket (contrast Fig. 7) so long as the rest of the animal is satisfactory. The britch, on the other hand, makes a larger contribution to the weight of the fleece than the brisket, so that the britch is more important for its own sake, while the correlation between britch grade and back grade is high. Here must be quoted the opinion of two breeders who select against halo-hairs very carefully at docking-time. They have obtained marked success in keeping down the numbers of halo-hairs. Their view is that extreme freedom from halo-hairs on the britch (Fig. 2) is accompanied by poor density of the coat there, but this view has not yet been tested by the necessary counts and measurements. With this reservation in mind the suggestion previously given may be repeated, that most attention should should be paid to the back and the britch.

CONCLUSION.

The argument for selection against halo-hairs is strengthened. While it is repeated that kemp hairiness is not so important as non-kemp hairiness, at the same time it is emphasized that selection against halo-hairs is an easy matter.

Especially is it desirable to know how abundant were the halo-hairs upon rams used in stud breeding.

My thanks are due to Mr. W. J. Allen, Mr. R. Dossor, and Mr. R. Briggs for looking after the sheep, and to Mr. M. T. Gabriel for the photographic work. The starting of this research was facilitated by a grant from the Department of Scientific and Industrial Research.

THE BRUCE CLUB-ROOT RESISTANT TURNIP.

EXPERIMENTS AND FARMERS' TRIALS IN OTAGO-SOUTHLAND.

R. B. TENNENT, Fields Superintendent, Department of Agriculture, Dunedin.

IN continuance of the policy of conducting trials with varieties of swedes or turnips reputed to be resistant to club-root (*Plasmidophora brassicae*), and as a result of the publicity given to the Bruce turnip in this respect, it will be of interest to briefly record the experiences which have resulted from extensive trials in Otago and Southland with this variety.

The writer's attention was first drawn to the Bruce turnip by an article written by Mr. W. M. Findlay, N.D.A. of the North of Scotland College of Agriculture, in the *Scottish Journal of Agriculture*, April, 1931. The history and origin of the variety was outlined, and the results of Findlay's experiments indicated conclusively that the Bruce had considerable merit in so far as club-root resistance was concerned. Samples of seed were obtained, and from 1931 onwards extensive trials were conducted in Otago-Southland, the results of which amply support the claim that this turnip has exceptional merit, not only as a producer but also as a club-root resister.

The Bruce turnip originated in Scotland, and evidently has been grown there for close on a century. The variety was perpetuated by various small farmers, who invariably made it a practice to produce their own seed. In different districts it was vicariously named, the terms "Geordie Hendry," "Skene," "Tammy Mackie," &c., being applied to it. These names have now been discarded in favour of the term "Bruce." The turnip itself, under New Zealand conditions, is a purple-top yellow-fleshed variety; the purple colour, however, is often streaked with green—in fact, it is obvious that the colour is not yet a fixed characteristic. A fair proportion of green-top turnips with a rich orange coloration under the ground are to be noted in the lines of Bruce seed imported. This green-top variety, which must be regarded as distinct from Bruce, is a splendid type of turnip, and has now been segregated under the name of "Wallace"; it is interesting to note that it also is highly resistant to club-root.

When grown under good conditions, the Bruce turnip is capable of yielding highly, and on account of the close texture of its flesh it has proved to be an excellent keeper, a matter of vital importance to Southern farmers.

EXPERIMENTAL RESULTS, SEASON 1931–32.

Gore Experimental Area.—Samples of Bruce Purple Top turnip were received from Mr. Findlay and from Messrs. Sutton and Sons, Reading, these being sown out in twenty-two replicated raised drills in early December, 1931, superphosphate at the rate of 3 cwt. per acre being applied. The land was known to be heavily infected with club-root, having grown a crop of swedes during the previous season.

A commercial line of Purple Top Aberdeen was used as a control. The crop was finally weighed and examined on 30th July, 1932, with the following results :—

Table 1.

Variety.	Yield in Tons per Acre.	Average Number of Roots per 33 ft. by 26 in.	Percentage of Club-root Infection.
Bruce Purple Top (ex Suttons) ..	16·4	33·3	8·3
Purple Top Aberdeen (control) ..	13·4	28·5	25·8
Wallace Green Top (ex Suttons) ..	17·5	33·9	10·1
Bruce Purple Top (ex Findlay) ..	14·7	31·5	5·2

On statistical examination the yields of Bruce Purple Top (ex Suttons) and Wallace Green Top (ex Suttons) are significantly higher than the two remaining varieties. The percentage of club-root present in the Bruce and Wallace varieties was considerably lower than in the case of the control variety, and the roots in themselves were much more edible. This trial showed conclusively that the varieties tested against the control were superior in all respects.

Experimental Results, Season 1932–33.

Following on the initial results recorded for 1931, it was decided to conduct a more extensive series of trials embracing a wider range of districts and soils.

Gore Experimental Area.—On 16th December, 1932, three varieties of turnips were ridged in five replications on land which had been premanured with superphosphate at the rate of 3 cwt. per acre. The crop was lifted, weighed, and examined on 20th July, 1933, with the following results :—

Table 2.

Variety.	Yield in Tons per Acre.	Percentage Incidence of Club-root Infection.		
		Bad.	Slight.	Free.
Bruce Purple Top	13·9	0·1	2·2	97·7
Bortfield	7·7	20·5	23·5	56·0
Green Top Scotch Aberdeen ..	13·3	0·8	5·2	94·0

In this experiment Bortfield was much inferior to either of the other two varieties. Green Top Scotch Aberdeen was practically as good as Bruce, evidently being a good strain of seed. The low yields recorded at the Gore Area in this and the previous experiment have to be accounted for by the fact that the land there is of low fertility.

J. Crighton, Waimahaka.—In mid-December, 1932, this farmer sowed an area of 3 acres of turnips ; the previous crop was a heavy yield of swedes from the lea. Prior to sowing the turnips the field was limed with carbonate of lime at the rate of 1 ton per acre, and a mixture of basic slag, Seychelles phosphate, carbonate of lime, and superphosphate was sown at seeding time at the rate of 4 cwt. per acre. Equal parts of Sutton's Purple Top, Green Top, and Waite's Eclipse were mixed and sown through one box of the ridger, Bruce Purple Top being sown through the other box. The germination

in all cases was very good. An inspection was made in February, and the appearance of the crop at that time indicated that the mixed seed was not going to withstand club-root to the same extent as the Bruce. Towards the end of April, prior to feeding-off, a further inspection was made and club-root counts taken at various parts of the field, with the following results :—

Table 3.

No.	Bruce Purple Top.				Mixture of Purple Top, Green Top, Waite's Eclipse.			
	Clean Bulbs.	Club-root on Bulbs.	Club-root on Roots.	Total.	Clean Bulbs.	Club-root on Bulbs.	Club-root on Roots.	Total.
1 ..	21	2	2	25	0	25	0	25
2 ..	25	0	0	25	1	23	1	25
3 ..	23	1	1	25	3	21	1	25
4 ..	22	1	2	25	3	18	4	25
5 ..	24	1	0	25	3	19	3	25
6 ..	25	0	0	25	4	18	3	25
7 ..	18	3	4	25	0	25	0	25
8 ..	23	2	0	25	5	19	1	25
9 ..	24	1	0	25	3	17	5	25
10 ..	21	4	0	25	0	25	0	25

Winton Demonstration Farm.—A small area of a field that was known to have produced club-root infection on swedes the previous year was selected for trial. Bruce Purple Top was sown through one box of the ridger and Leviathan swede through the other box. The swede, recognized as being more susceptible to club-root than the Aberdeen, was used in this instance to show that the ground was capable of producing club-root. Throughout the growing period, this trial was inspected by numerous farmers, and it was noted that the control drills of swedes practically disappeared through a severe attack of club-root, leaving the drills of the Bruce turnip more or less intact. Disease counts ultimately were made with the following results :—

Table 4.

Variety.	Slight Infection.	Bad Infection.	Free of Club-root.
Leviathan swede	2	38	Nil
	3	37	Nil
	1	39	Nil
Bruce Purple Top	1	2	37
	Nil	1	39
	1	3	36

Farmers' Observational Trials.

In addition to the foregoing experiments numerous farmers were persuaded to lay down observational trials with the Bruce turnip, with instructions to sow Bruce through one box of the ridger and their own standard variety through the other box. This resulted in the field being sown in alternate double ridges, thus affording an excellent comparison as to the value of Bruce. While space will not

permit publication of the full results of each farmer's trial, a few of the more outstanding ones are given in the form of condensed reports received from the various field officers.

A. Allison, Drummond.—Bruce turnip grown against Waite's Eclipse. Counts of 75 Bruce roots showed 72 to be free from disease. The Waite's Eclipse turnips were completely destroyed. Bruce gave an excellent crop.

T. Norman, Otautau.—Bruce turnip grown against a mixture of Lincoln Red and Green Top Aberdeen. Counts of 75 Bruce bulbs showed 71 free from disease, whereas the Lincolns and Green Tops had been completely destroyed. Bruce in this case yielded 35 tons per acre.

A. Findlay, Pukemaori.—Sowed Bruce alternatively with Webb's Invincible. Where Invincible showed 80 per cent. of club-root, Bruce showed 10 to 15 per cent.

C. Clarke, Fairfax.—Bruce and Green Top Aberdeen sown adjacent to one another. Of 100 bulbs of Bruce examined 64 were free from disease, 31 slightly infected, and 5 badly infected. The Green Tops showed bad infection in 77 per cent. of the bulbs examined; the remainder were slightly infected, no clean ones being observed.

T. McNab, Tahatika.—Sowed Bruce turnip on ground which had previously grown crop of swedes, this latter completely failing on account of club-root. Sowed block of rape alongside Bruce turnips. Crop of Bruce very good. Rape crop completely destroyed by club-root.

C. E. Norrish.—Owaka Valley.—This farmer reports as follows: "I sowed Bruce turnip seed mixed with swede seed on land with no club-root, and some where a fair amount of club-root existed. On either side of these I sowed Purple Top and Green Top Aberdeens. There is no sign of club-root in the Bruce turnips, but a sprinkling through the others. The Bruce turnip is a good cropper, and I should say a valuable turnip from a feeding point of view."

H. Gamble, Otara.—Mr. Gamble reports as follows: "I am very pleased with the Bruce turnip's resistance to club-root. I have about 35 acres in the paddock, most of it in third crop, and had 8 acres of the same paddock in oats last year. I sowed a width of the drill round them with soft turnips and they all disappeared with club-root, so I thought it would be a fair trial this year and I have a good crop. In some places where the third crop is I sowed swedes out of one box of the ridger and Bruce out of the other. The swedes are clubbed, but the Bruce are not. I am certain it is the only seed to sow for a seconder.

Mr. J. Milne, Otara.—A field that was down in grass for eight years was broken up and sown with a mixture of Webb's Masterpiece swede and Bruce Purple Top turnip seed. Club-root counts showed 90 to 95 per cent. of club-root attack on the bulbs of the swedes; on the Bruce turnip 3 to 5 per cent. of club-root attack on the bulbs. The majority of the swedes were a little larger than table potatoes, whereas the Bruce bulbs measured 20 to 30 in. in circumference.

General.

Sufficient has been recorded to indicate that the trials with Bruce turnip have been most gratifying, but in addition to the foregoing

trials outlined it is to be recorded that the following farmers also grew this variety and expressed themselves as being satisfied that it has a high degree of resistance to club-root disease: A. L. Stokes, Lawrence; A. Rae, Tarara; F. Coney, Brydone; J. W. Kennedy, Brydone; Coker Bros., Brydone; F. McDowell and Sons, Brydone; A. H. Kingdom, Mandeville; F. B. Johnston, Otara; R. T. Byars, Otama; S. Graham, Knapdale; C. Bowman, Waimumu; D. Gilchrist, Waikaka; G. McBride, Charlton; A. N. McBride, Waimumu; T. G. Bunting, Wendonside; A. W. Robb, Lochiel; J. Hubbard, Spar Bush; Guy Chewings, Mossburn.

It has, however, to be pointed out that all farmers who grew the Bruce turnip during last season did not meet with satisfactory results, and it is quite obvious that some of the seed sold as Bruce was not of a disease-resistant strain. Where resistance to club-root was most marked, it was noted that the seed in all such cases originated from one source, consequently the importance of retaining a genuine strain of seed on the market cannot be overstressed. Mr. Guy Chewings, who is an enthusiastic grower of the Bruce turnip stated: "I am satisfied that its adoption as a universal crop would save the farmers in Southland thousands of pounds a year, even if they had to pay 10s. per pound for the seed."

In view of the experimental work and farmers' trials carried out over the past three years the growing of Bruce turnip can confidently be recommended, even on land infected with club-root.

Acknowledgment is due to the field staff in Otago and Southland for collecting information, and to those farmers who so willingly co-operated with them by undertaking trials.

SEED CERTIFICATION.

SUMMARY OF OPERATIONS FOR SEASON 1932–33.

J. H. CLARIDGE, Assistant in Agronomy, Plant Research Station, Palmerston North.

SEED certification has again been a prominent activity of the Fields Division, Department of Agriculture, during the season 1932–33. A further large increase in the number of areas under certification is recorded, a total of 2,617 having been inspected, as against a total of 1,614 areas during the 1931–32 season. The following notes summarize the position in regard to the various crops in certification:—

PERENNIAL RYE-GRASS.

The increase in the volume of rye-grass seed certified has been very great, as is shown by the quantity of seed finally sealed and tagged in each of the four seasons during which the scheme has been in operation as follows: 1929–30, 17,052 bushels; 1930–31, 45,983 bushels; 1931–32, 81,186 bushels; 1932–33, 245,667 bushels.

When it is realized that the average annual production of perennial rye-grass seed for New Zealand over the past six seasons is estimated at 350,000 bushels of machine-dressed seed, the widespread effect of

certification is very apparent. As might be expected, the large increase in production has been associated with a considerable fall in price. This should result in a more general use of certified seed.

The total area of rye-grass under certification—21,000 acres—was rather more than double that for the 1931–32 season; the proportionately greater total production was brought about by a considerable increase in the yield per acre.

Of the "Old Pasture" areas, seed from which is certified as "Permanent Pasture, eligible for reclassification as Mother Seed" (*i.e.*, "Y" areas), practically all have now been reported upon. Of these lines of seed approximately 91 per cent. have been reclassified as "Mother," the remaining 9 per cent. have been relegated to the "Permanent Pasture" class.

Cocksfoot.

Although the number of cocksfoot areas entered has not materially increased, the total yield of seed during the 1932–33 season has been almost four times that of the preceding season. A total of 116 areas, aggregating 5,097 acres, was accepted for the production of certified seed, and 622,000 lb. of machine-dressed seed was finally sealed and tagged. Except for approximately 3,000 lb., all the seed has been harvested from "Mother Seed" areas.

Certification operations on Banks Peninsula have again been undertaken by the Akaroa Cocksfoot Seed Growers' Association, the field-dressed seed being forwarded mainly to Christchurch for machine-dressing.

White Clover.

In the season under review the certification of white clover on a basis of type has been firmly established. The 12 areas entered from the South Island were all closed up definitely with a white clover seed crop in view; whereas in the North Island the rye-grass seed crop was the main consideration, the white clover seed from 42 areas being separated during machine-dressing.

Nine of the areas were eligible to produce "Mother Seed," these yielding 2,800 lb. of machine-dressed seed. The forty-five "Permanent Pasture" areas produced 30,900 lb. of machine-dressed seed. The total production for the season shows an increase over that of the 1931–32 season (when certification on type was first introduced) of over 27,000 lb.

Brown-top.

In contrast with other seeds, the quantity of brown-top certified has shown quite a decided reduction during the past season. Three new areas in the South Canterbury district were found, on inspection, to consist of a large proportion of red-top. These were the only rejections recorded for the season.

There has been a considerable drop in the 1932–33 season, both in the number of areas entered and in the quantity of seed finally certified. In the former case the number fell from 130 in 1931–32 to 82 in 1932–33, while the amount of seed machine-dressed decreased from 198,000 lb. to 135,000 lb. The Otago District again produced the largest quantity of seed, the Mid-Canterbury district being next in order.

RED CLOVER.

Four areas of Montgomery Late Red clover were entered for certification. Three of these, all qualifying as "First Harvest" areas and totalling 64 acres, have been harvested. From these areas 8,481 lb. of field-dressed seed was obtained, which when machine-dressed gave 2,492 lb. of certified seed. The high dressing loss is accounted for by the fact that one line consisted in the main of white clover, which is included as a dressing loss. The yield per acre also is low, although one area—the only one where heavy loss was not experienced either during harvesting or at machine-dressing—averaged 163 lb. of seed per acre. It would appear, therefore, that, given a fair chance, the Montgomery type of red clover will produce quite a payable seed crop.

SEED WHEAT.

The high standard shown at field inspection of the 1931–32 season's entries has been maintained during 1932–33. Thirteen crops were rejected owing to the presence of weeds of an undesirable nature. Three crops were rejected on account of too high a percentage of foreign varieties, while in one crop the loose-smut infection was higher than the amount permissible. Seventy-four crops were passed at field inspection, Hunter's II and Solid Straw Tuscan varieties between them accounting for sixty-two of these areas.

Of the crops passed at field inspection, grain samples were submitted from twenty-nine. Two of these failed to reach a satisfactory standard of grain quality. This compares very favourably with the results of the previous season, when eight crops of a total of twenty-eight examined were lacking in grain quality.

Six thousand four hundred and twenty-four sacks of seed wheat were branded in the paddock, compared with 1,784 sacks for the previous season. Seven thousand bushels of seed were sealed and tagged after having been machine-dressed.

POTATOES.

An increase of fifty-eight in the number of potato crops inspected is recorded for the 1932–33 season. Despite a higher standard having been adopted than in the previous season 196 crops were provisionally certified, as compared with 175 crops during 1931–32.

In some of the varieties—notably Aucklander Short Top and Arran Chief—the standard is such that crops showing a virus infection of higher than 7 per cent. are rejected from certification. There is year by year a steady improvement in the virus position as a direct result of certification, and it is possible each season to raise the standard accordingly.

The position regarding varietal purity is highly satisfactory. In only three crops were foreign varieties present beyond the maximum of 2 per cent. allowed. In the 1929–30 season, when entries were not restricted to those crops planted with certified seed, 23·5 per cent. were rejected on account of varietal impurities. It therefore appears quite definite that with reasonable care a high standard of varietal purity can be maintained.

The two main varieties under certification are Aucklander Short Top and Dakota. The Arran Chief variety has again improved its

position in the lists, while Arran Banner is growing in favour rapidly and bids fair to become an important factor in commercial potato-growing.

Up to the end of October 940 tons of seed potatoes have passed the tuber inspection and certification tags have been issued accordingly. This is an increase on the 811 tons similarly treated during 1931–32.

An increase is recorded in the number of samples tested in the potato qualification trials. These samples may be taken as representative of the general run of commercial crops. Only 25 per cent. of the lines entered in these trials came up to the standard of the lines passing in certification. By way of comparison, 56 per cent. of the crops in certification, representing the produce of the crops certified in 1931–32, attained the standard required in the season 1932–33.

Further, those crops under certification which did not reach the required standard were all of a standard higher than the average of the lines entered in qualification. In other words, while some of the crops originating from certified seed were in 1932–33 season below certification standard, they were nevertheless above the general average of potato crops not under certification.

All Crops in Certification.

The following table summarizes the acreages of each crop inspected since the inauguration of certification :—

Seed.	Chief Consideration upon which Certification is based.	Acres inspected each Season.					
		1927–28	1928–29	1929–30	1930–31	1931-32	1932–33
Potatoes ..	Varietal purity, cropping power, and freedom from virus diseases	821	909	1,200	1,334	1,146(1)	1,154
Wheat ..	Varietal purity and freedom from loose and stinking smuts	473	1,184	2,277	3,289	1,063(2)	1,873
White clover ..	Age of pasture, 1928–31. Type of clover, 1931–33	..	325	664	311	31(3)	100(3)
Perennial rye-grass	Genuine perennial type conforming to certain standards of purity	..	..	3,028	6,539	9,709	22,917
Brown-top ..	Freedom from red-top (*Agrostis palustris*)	..	..	22,000	24,901	18,297(4)	14,860(5)
Cocksfoot ..	Type as exemplified in the produce of Banks Peninsula	..	..	..	..	4,226	5,097
Montgomery Red clover	Type conforming to that of English - grown Montgomery Red clover	..	..	..	..	9	71
Totals ..	.. ..	1,294	2,418	29,169	36,374	34,481	46,072

(1) The preceding season had been one of unprecedented low prices.

(2) An alteration in the regulations was the cause of this reduction.

(3) Reduced area due to alteration of standard from one of age to one of type. Acreage given does not include white clover, which was separated from rye-grass during machine-dressing.

(4) Reduction due to growers entering only the best areas. Actually a greater amount of seed was harvested from this area than from the larger area the previous season.

(5) Reduction probably due to a combination of adverse season and poor demand.

LENGTH OF OESTROUS CYCLE AND DURATION OF PREGNANCY IN EWES.

SOME OBSERVATIONS UNDER NEW ZEALAND CONDITIONS.

D. A. GILL, M.R.C.V.S., D.V.S.M., Assistant Officer in Charge, Wallaceville Veterinary Laboratory.

THE writer is not aware of any observations on the length of oestrous cycle and duration of pregnancy in ewes having been recorded in New Zealand, and, while work was undertaken among the ewes at the Wallaceville Laboratory farm for another purpose, it seems worth while to put on record the information that was gathered there.

The flock comprises some fifty ewes of varying ages. They were in excellent fettle when the ram was put out to them, having been "flushed" for two or three weeks on a specially rich young rye-grass and clover pasture. The ewes are Romneys, and a ram of that breed was mated with them.

The procedure was as follows: The ram was smeared over the brisket daily with a preparation of vaseline containing a red dye, and it was found quite easy in consequence to pick out the ewes he had served. The flock was inspected daily, and the ewes that had been served since the previous day were drafted out. These ewes were later run with another ram that was similarly smeared with a green raddle and the daily inspection of these ewes soon made it clear that any which returned to service could easily be detected by the plentiful smearing of green colour on the rump.

It was found necessary to keep ewes that had been served by the flock ram away from the mob containing the second ram for about a week. This was not done at first, and the consequence was that one ewe was still in oestrum and took the second ram two days after being served by the first one (from her lambing date it seems probable that she had not actually been served by the first ram and was probably just coming into oestrum when removed from him), and another took the second ram after an interval of five days (subsequently lambing to the first service).

LENGTH OF OESTROUS CYCLE.

Quite a number of the ewes came back to a second, and four to a third service, and thus the number of days from the commencement of one period of oestrum to the commencement of another could be determined. This is shown in the following summary:—

Number of Returns.	Interval in Days.	Remarks.
1	14	Ewe proved empty.
3	15	One of these second services very doubtful, and the ewe lambed to the first.
6	16	..
6	17	..
2	18	..
1	22	Second service very doubtful; lambed to first.
1	35	First service doubtful; lambed to second.
1	39	Both services quite definite; lambed to second.
1	5	Unusually prolonged oestrum; lambed to first service.

It is quite apparent from this that the normal interval between periods of oestrum was from 15 to 18 days in the small number observed. Four of the ewes each returned to service twice, and the intervals they gave were 17 and 18 days, 16 and 18 days, 16 and 16 days, 17 and 16 days.

Duration of Pregnancy.

The ewes being ear-tagged and the dates of service known, it was a simple matter to calculate the duration of pregnancy by noting the date of lambing. That the gestation period was remarkably constant will be gathered from the following summary :—

Number of Ewes.	Duration of Pregnancy in Days.	Remarks.
4 ..	..	Ewes proved empty.
1 ..	153	Twin.
2 ..	152	Twin and single.
3 ..	151	2 twins and 1 single.
7 ..	150	3 twins, 4 singles.
12 ..	149	4 twins, 8 singles.
21 ..	148	10 twins, 11 singles.
2 ..	147	1 twin (dystobia ; died), 1 single.
3 ..	146	3 twins (1 lamb died at birth).
1 ..	145	Single.

Total ewes in flock	56 (excluding 3 deaths).
Total lambs	77
Lambing percentage	137·5
Ewes pregnant	52
Average duration of pregnancy ..	148·75 days.

Discussion and Conclusions.

It was found in Missouri[1] that among Hampshire, Shropshire, and Southdown ewes the interval between successive manifestations of oestrum varied from 14 to 16 days in 92 out of 116 ewes that were observed. The duration of pregnancy varied from 143·7 days in Southdowns to 144·6 days in Hampshires and Shropshires. These latter are average figures, however.

Quinlan and Mare[2], studying Merino ewes under South African conditions, found that the oestrous cycle was remarkably constant at 16 to 19 days. Out of 234 ewes observed 200 showed cycles within those limits. They found that the duration of pregnancy among 338 Merino ewes varied from 142 to 156 days, but that the average duration might be considered as from 146 to 152 days, with the majority at 149 days.

Marshall[3] states that Scotch Blackface sheep in the Highlands have two periods of oestrum separated from each other by 21 days, whereas similar sheep in the Lowland country have at least three and often more periods with intervals of 13 to 18 days.

Lydekker[4] states that the duration of pregnancy is 144 days in Southdowns and 150 days in Merinos, while the hybrid is intermediate.

Summarizing the observations mentioned above and the conclusions that can be drawn from the Wallaceville flock records we have the following :—

Breed of Sheep.	Locality.	Duration in Days of Oestrous Cycle.
Hampshire, Shropshire, and Southdown	Missouri, U.S.A. ..	14–16
Merino	South Africa ..	16–19
Scotch Blackface	Highlands	21
Scotch Blackface	Lowlands	13–18
Romney	New Zealand ..	15–18
		Duration of Pregnancy.
Southdown	Missouri	143·7 (average).
Southdown	Not stated	144
Hampshire and Shropshire ..	Missouri	144·6 (average).
Merino	Not stated	150
Merino	South Africa ..	149 (146–152).
Romney	New Zealand ..	148 (145–153).

Both as regards the oestrous cycle and duration of pregnancy, it will be noticed how closely the Romney in New Zealand compares with the Merino in South Africa.

REFERENCES.

(1) Annual Report, Missouri Agric. Expt. Station, 1931.
(2) Quinlan and Mare, 17th Report, Director of Veterinary Services, South Africa, 1931.
(3) Quoted by Marshall, Physiology of Reproduction, Longman, Green, and Co., 1922, page 40.
(4) Quoted by Marshall, Physiology of Reproduction, Longman, Green, and Co., 1922, page 68.

WHEAT VARIETY TRIALS IN THE SOUTH ISLAND, SEASON 1932-33.

Fields Division, Department of Agriculture.

NINE trials were carried out in collaboration with the Wheat Research Institute in the 1932–33 season to determine the relative yielding capacities of certain wheat varieties or lines of Cross 7 (Solid Straw Tuscan × White Fife). These were all sown on farms in Canterbury and Otago.

The lay-out of the trials was similar to that described in this *Journal* for June, 1931, pages 398 and 399, and reference should also be made to the latter for particulars of rate of seeding, manuring, and statistical examination of the results.

No attempt was made to harvest each variety at its optimum stage of ripeness. Harvesting was carried out usually when the later-ripening varieties in the trial were in fit condition. Under these circumstances shaking of grain occurred with one or two of the varieties in a few trials, although in most cases this was only slight.

These trials can be divided into two groups—(1) those in which lines of Cross 7 were compared with Solid Straw Tuscan, and (2) trials of standard varieties in which, with one exception, Solid Straw Tuscan was the control variety.

TYPE A EXPERIMENTS.—TRIALS OF CROSS 7 LINES.

This series of trials, in which were included Solid Straw Tuscan and Crosses 7·03, 7·04, 7·06, and 7·09, was carried out on the following farms: (1) C. R. Page, Glasnevin; (2) High School, Rangiora; (3) D. Mulholland, Darfield; (4) A. Amos, Wakanui; (5) Boys' High School, Timaru.

Particulars of dates of sowing and harvesting and results of these trials, together with one carried out by the Wheat Research Institute at Lincoln College, are given in Table 1.

Table 1.—Trials of Cross 7—Dates of Sowing and Harvesting, Yields and Differences from Solid Straw Tuscan, in Bushels per Acre.

Variety.	Number and Location of Trial.						
	1 Glasnevin.	2 Rangiora.	3 Darfield.	4 Wakanui.	5 Timaru.	Lincoln.	Average Difference
Dates sown*	20/5/32	14/6/32	19/5/32	31/5/32	7/7/32	..	..
Dates harvested ..	26/1/33	30/1/33	26/1/33	2/2/33	10/2/33	..	..
Cross 7·02	22·4	38·9	33·7	56·4	27·3	85·1	..
Difference from S.S.T. ..	+ **2·1**	— *2·5*	— *1·8*	— **5·3**	— *1·1*	— **4·0**	— *2·1*
Cross 7·03	22·5	37·7	32·9	57·5	28·4	88·5	
Difference from S.S.T. ..	+ *1·8*	— *2·6*	— **2·7**	— **4·0**	— *0·6*	— *0·5*	— *1·4*
Cross 7·04	22·3	38·8	34·1	55·9	27·8	88·1	
Difference from S.S.T. ..	+ **2·4**	— *3·1*	— *0·6*	— **5·1**	— *1·0*	— *2·2*	— *1·6*
Cross 7·06	19·9	35·4	23·5	47·2	24·1	62·4	
Difference from S.S.T. ..	+ *0·2*	— *3·6*	— **11·8**	— **13·9**	— **7·3**	—**28·5**	—*10·8*
Cross 7·09	19·4	29·8	24·9	46·2	23·3	66·6	
Difference from S.S.T. ..	— *1·2*	— **8·0**	— **11·0**	— **15·2**	— **7·0**	—**24·5**	—*11·1*

* "Date harvested" does not necessarily mean date of ripening, since generally the Crosses 7·02, 7·03, and 7·04 ripened a day or two before Solid Straw Tuscan, whereas the Crosses 7·06 and 7·09 were slightly later in ripening than Solid Straw Tuscan. No losses of grain at harvesting were reported from any of the trials.

NOTE.—In this table and Table 2 differences printed in heavy type are statistically significant. Differences in favour of the variety are denoted by a plus sign; a minus sign denotes a difference in favour of Solid Straw Tuscan.

Comments on Table 1.—In view of promising milking and baking tests,* the yields of Crosses 7·02, 7·03, and 7·04 in this series of trials have been sufficiently encouraging for further trials to be carried out, and during the present season some twenty-five trials in which one of these crosses is compared with Solid Straw Tuscan have been laid down at the request of the Wheat Research Institute. These are distributed over Marlborough, Canterbury, and Otago.

TYPE B EXPERIMENTS.—TRIALS OF STANDARD VARIETIES.

Four co-operative trials were carried out in districts where varieties other than Solid Straw Tuscan are commonly grown or have given promise in previous trials. With one exception—*i.e.*, Experiment No. 8—Solid Straw Tuscan was the control. In Experiment No. 6, Webb's Harvester was included at the request of local farmers who

* Third annual report of the Wheat Research Institute, Bull. No. 42, Department of Scientific and Industrial Research.

desired information on this variety. Results are given in Table 2 in which results obtained at Lincoln College are again incorporated.

Following are details and observations on the trials:—

No. 6: J. C. Hay, Waimate.—Date sown, 14/6/32. Date harvested, 3/2/33. Varieties under trial: Solid Straw Tuscan, College Hunter's II, Dreadnought, Major, and Webb's Harvester.

On 24/1/32 Solid Straw Tuscan appeared to be the best variety although most affected with stem and leaf rust, while it was the only variety of which all heads were filled. Dreadnought was the least affected by rust and appeared the most healthy. Major was the earliest ripening, but looked thin. Webb's Harvester was very backward and was affected with rust and mildew.

At time of cutting all varieties had ripened except Webb's Harvester, which would have been a week later in ripening and which was so obviously inferior to the other varieties as not to warrant delaying the harvesting until this variety ripened.

No. 7: D. M. Borrie, Papakaio.—Date sown, 7/6/32. Date harvested, 6/2/33. Varieties under trial: Solid Straw Tuscan, College Hunter's II, Yeoman, and Velvet.

On cutting, all varieties appeared practically at the same stage of maturity and quite ready for cutting. Velvet was more affected by mildew than any of the other varieties. There was no loss of grain by shaking.

Table 2.—Trials of Standard Varieties.—Yields and Differences from Solid Straw Tuscan, in Bushels per Acre.

Variety.	Number and Location of Trial.				
	6 Waimate.	7 Papakaio.	8 Weston.	9 Maungatua.	Lincoln.
College Hunter's II	35·9	38·6	55·5	..	66·3
Difference from S.S. Tuscan	— 18·3	— 9·8	— 15·0*	..	— 16·2
Dreadnought	43·9	..	66·2	..	..
Difference from S.S. Tuscan	— 10·3	..	— 4·3*	..	..
Major	39·6	..	..	40·7	..
Difference from S.S. Tuscan	— 13·6	..	..	— 29·0†	..
Yeoman	..	33·9	53·0	..	61·8
Difference from S.S. Tuscan	..	— 13·1	— 17·5*	..	— 23·9
Solid Straw Velvet	..	..	..	65·6	73·8
Difference from S.S. Tuscan	..	..	..	— 4·1†	— 9·0
Velvet	..	32·6	40·3	..	..
Difference from S.S. Tuscan	..	— 14·4	— 30·2*	..	..
Webb's Harvester	20·0	..	..	..	..
Difference from S.S. Tuscan	— 33·2	..	..	..	..
Marquis	..	..	..	46·4	..
Difference from S.S. Tuscan	..	..	..	— 23·3†	..

* Differences are those from Dreadnought 5/27 which was used as a control in this experiment

† Differences in yields were not examined statistically as plots of each variety were bulked for threshing.

No. 8: G. Stevenson, Weston. — Date sown, 21/5/32. Date harvested, 13/2/33. Varieties: Dreadnought 5/27, Dreadnought, College Hunter's II, Yeoman, and Velvet.

The crop had an exceptionally long growth of straw. When harvested one section of the experiment was dead ripe, while the other half was barely ripe. However, it was necessary to cut all varieties, otherwise there would have been a marked loss of grain. A slight loss of grain from shaking did occur in all varieties when cutting. Dreadnought suffered more loss from shaking than Dreadnought 5/27. Velvet was very badly lodged throughout the experiment, and this to a great extent accounted for the low yield of this variety.

No. 9: J. Miller, Maungatua.—Date sown 30/8/32. Date harvested, 17/2/32. Varieties: Solid Straw Tuscan, Solid Straw Velvet, Major, and Marquis.

When cut Solid Straw Tuscan was in good condition, while Velvet was on the green side. Major was overripe, and heavy winds during the previous week had resulted in approximately 10 per cent. of the grain being shaken. Marquis was ripe and had also suffered from the winds, although to a lesser extent than Major.

Comments on Table 2.—A feature of the 1932–33 season's trials was the outstanding superiority of Solid Straw Tuscan. In previous seasons the varieties under trial at Waimate and Papakaio have given good results when tried against Solid Straw Tuscan in these particular districts.

The Department is indebted to those farmers on whose farms the trials were carried out for their co-operation and willing assistance. The field work in connection with the trials was carried out under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, by Instructors G. G. Calder, Christchurch, E. M. Bates, Ashburton, W. Stafford, Timaru; and under the direction of Mr. R. B. Tennent, Fields Superintendent, Dunedin, by Instructors T. A. Sellwood, Oamaru, and A. Stuart, Dunedin.

—*Crop Experimentalist's Section.*

Review of Empire Pasture Investigations.—The Animal Husbandry section of the Annual Report of the Empire Marketing Board for 1932–33 states as follows: "Dr. Orr, Director of the Rowett Research Institute, Aberdeen, recently suggested to the Empire Marketing Board that the results of pasture investigations, which have been carried out in different part of the Empire with the aid of grants from the Board, should be brought together and reviewed in a form convenient for the use of bodies and persons who are responsible for applying the information to local conditions and bringing it into general practice. This proposal was discussed between Dr. Orr, Professor Stapledon, of the Welsh Plant Breeding Station, and Professor Richardson, of the Waite Institute, University of Adelaide. As a result Dr. Orr and Professor Stapledon have agreed to co-operate in preparing this report with the help of collaborators in oversea Empire countries and the Imperial Bureaux of Animal Nutrition and Plant Genetics."

Noxious Weeds Orders.—The Hawke's Bay County Council has declared star thistle to be a noxious weed within its jurisdiction. The Manawatu County Council has similarly declared prickly pear and fennel within the County of Manawatu.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. ALLAN, Botanist, Plant Research Station, Palmerston North.

(5) Water Purslane and Primrose Willow.

THE two plants here discussed have recently been collected in swampy ground near Rangiriri and near Ruakura. Both belong to the Evening Primrose family (*Onagraceae*), made familiar to most of us by the favourite garden plants belonging to the genera *Clarkia*, *Fuchsia*, *Godetia*, and *Oenothera*. Several of the evening primroses have escaped from gardens, and one, *Oenothera odorata*, is a familiar sight in many localities in its flowering season, especially on sandy coastal areas. In the very light pastures it affects this species does more good than harm, as it is well liked by stock and is fairly nutritious. In the indigenous flora the family is represented by three species of fuchsia and about forty species of willow-weed (*Epilobium*), a number of which are swamp species of somewhat similar habit to the water purslane and the primrose willow.

Water purslane (*Ludvigia palustris*) (Fig. 1) is a small herb, much branched from the base. In plants growing actually in the water the stems are erect; in those growing in the mud or in damp ground they are prostrate, and root freely at each leaf-node. The stems are smooth, rather fleshy, usually reddish, and up to 18 in. long. The leaves are about oval, one-half to an inch long, with slender stalks and blunt to rather sharp-pointed tips. They are placed along the stems in opposite pairs. The flowers are very small, a single one in each leaf-axil. They are unstalked, the calyx with four small triangular sharply pointed lobes. The petals are minute, reddish, and on floating plants may be absent. There are four stamens and a four-parted stigma. The ripe capsule is four-sided, flat at the top, with fine wrinkled brown seeds.

This species is found native in all the continents except South America and Australia. In North America it sometimes gives trouble to the "muckland" farmers and gardeners, who have to resort to hand-pulling to keep it in check. Under New Zealand conditions it is unlikely to give trouble, though it is to be expected that it will gradually establish itself in swamps in other parts of North Island.

Primrose willow (*Jussiaea diffusa*, synonym *J. repens*) (Fig. 2) is a rather more robust plant than the water purslane. The stems creep along the mud or float on the water surface, and root very freely at the leaf-nodes. The upper parts of the stems generally bear soft spreading hairs. The leaves are from 1 in. to 2 in. long, oval to oblong, tapering into a slender stalk, veiny and smooth, with blunt or acutish tips. They are alternately arranged, and in specially luxuriant plants at Rangiriri may be more than 3 in. long. The flowers are large, up to 1 in. across, yellow, and borne on long stalks. At the summit of the stalk, or appearing actually on the capsule, are two small scale leaves. There are five narrow, sharply pointed calyx lobes, and five petals, which are shallowly notched at the tips. There are ten stamens and a two-lobed stigma. The ripe capsule is about $\frac{3}{4}$ in. long, rather woody, cylindric, with five rather prominent ribs and a tapering base.

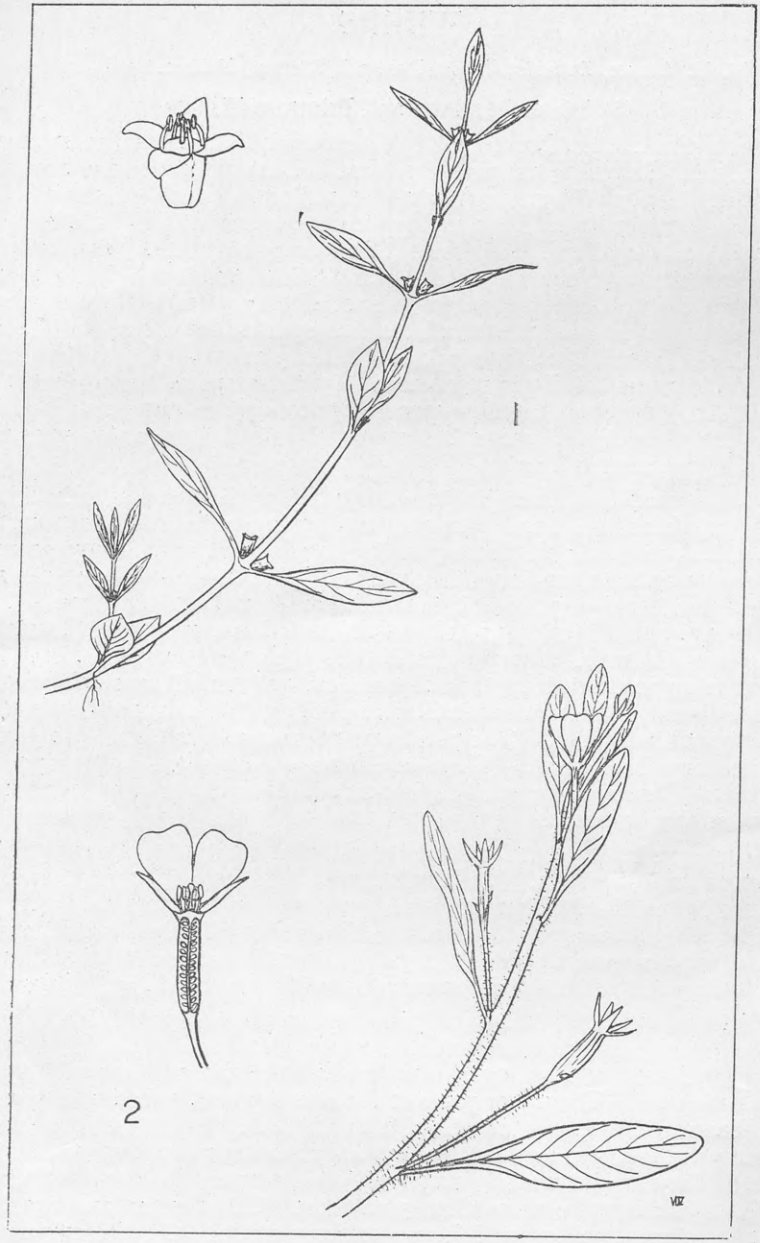


FIG. 1. WATER PURSLANE (HALF) AND SEPARATE FLOWER (TWICE NATURAL SIZE).

FIG. 2. PRIMROSE WILLOW (HALF) AND SEPARATE FLOWER (NATURAL SIZE).

This plant is a native of North America, and has become naturalized in Southern France. In Australia, especially in Southern Queensland, it has been present for a number of years past. The showy flowers and the ribbed capsule make it easily recognizable. A rather similar species from Brazil, also with yellow flowers (*J. longifolia*) is occasionally grown in water gardens. The primrose willow also, like so many swampy species, may be expected to extend its range in New Zealand. I understand that in Australia it has recently been suspected of being the cause of a curious contraction of the tendons found in newly born calves. With this in mind it would appear well to keep a watch on the plant. Once it became established in swamps its eradication would present great difficulties.

A TOP-DRESSING TRIAL ON POOR PASTURE ON LIGHT LAND IN CANTERBURY.

[Appendix to article, "Establishment and Management of Permanent Pastures on the Light Lands of the Canterbury Plains," published in the three preceding issues of this *Journal*.]

A. H. FLAY, B.Sc., M.Agr.Sc., Canterbury Agricultural College, Lincoln.

IN 1929 a manurial or top-dressing trial was laid down on poor pasture on light land near Chertsey. In two adjacent fields areas of 2 acres each were fenced off and subdivided into half-acre sections. Thus there were (side by side along a water-race) eight half-acre sections, four on one type of pasture and four on another. Different fertilizers were used on each plot. The grass growth was measured by controlled rotational grazing with sheep. The total number of sheep on the eight plots varied from two in the low-producing period, up to twenty in the "flush" of the growing season. Sheep were added to or taken out of the flock according to the estimated requirements. Ewes and lambs were used some of the time in the spring, but were equated to dry sheep. The greater portion of the grazing was carried out with dry halfbred ewes.

Like all top-dressing trials carried out on the half-field method this one has definite limitations. Carry-over from manured to control plots, and holding stock on unpalatable danthonia, brown-top, and Chewings fescue pastures, give the no-manure plots, without doubt, a higher figure for carrying capacity than they rightly deserve. These errors, unfortunately, could not be eliminated here.

Pastures manured.—Four plots treated on one field consisted of danthonia and trefoil, while those on the other field were originally a three-year run-out perennial rye-grass and red clover pasture, with Chewing's fescue, brown-top, danthonia, hair-grass, and other inferior grasses invading. Some red clover and perennial rye still remained.

Manures used.—Similar treatment was given to the plots in each field, (*a*) Danthonia pasture, (*b*) run-out pasture, as follows:—

Plot No.	Manure, Quantity per Acre.	Date applied.
1.	Nil	Nil.
2.	5 cwt. carbonate of lime	July, 1929.
3.	1 cwt. superphosphate	July, 1929.

Plot No.	Manure, Quantity per Acre.	Date applied.
3.	1 cwt. superphosphate	April, 1930.
	1 cwt. superphosphate 5 cwt. carbonate of lime	August, 1930.
	1 cwt. superphosphate	April, 1931.
	1 cwt. superphosphate	August, 1931.
	1 cwt. superphosphate	April, 1932.
	1 cwt. superphosphate	August, 1932.
4.	1 cwt. superphosphate 1 cwt. sulphate of ammonia	July, 1929.
	1 cwt. Nitrochalk, 1 cwt. superphosphate	April, 1930.
	5 cwt. carbonate of lime, 1 cwt. superphosphate, and 1 cwt. Nitrochalk	August, 1930.
	1 cwt. superphosphate, 1 cwt. Nitrochalk	April, 1931.
	1 cwt. superphosphate, 1 cwt. Nitrochalk	August, 1931.
	1 cwt. superphosphate	April, 1932.
	1 cwt. superphosphate, 1 cwt. Calnitro.	August, 1932.

NOTE.—In the (*a*) series the superphosphate and lime plot—*i.e.*, No. 3—is on better soil against the fence dividing the two main fields, and therefore not strictly comparable with the other plots. The lime plot of the (*b*) series is in a similar position on the other side of the original fence.

GRAZING RECORDS.

These are tabulated as follows :—

Table 1.—(1) Danthonia Pasture.

Plot.	Manure.	Dry Sheep per Acre grazed for Period.											
		1st Sept.–31st Jan.,				1st Feb.–31st May,				1st June–31st Aug.,			
		1929–30.	1930–31.	1931–32.	1932–33.	1930.	1931.	1932.	1933.	1930.	1931.	1932.	1933.
1	No manure ..	..	1·69	1·61	1·65	0·74	1·08	0·76	..	0·08	0·27	0·68	..
2	Lime ..	..	1·41	2·01	1·76	0·59	1·78	1·51	..	0·18	0·27	0·97	..
3	Lime + super	0·79	2·62	3·14	5·57	0·74	2·17	2·26	..	0·26	0·62	1·27	..
4	Lime + super + nitrogen	0·80	3·30	3·38	5·34	0·89	2·23	1·51	..	0·35	0·67	1·17	..

Table 2.—(b) Run-out Pasture (Chewings Fescue, Brown-top, &c.).

Plot.	Manure.	Dry Sheep per Acre grazed for the Period											
		1st Sept.–31st Jan.,				1st. Feb.–31st May,				1st June–31st Aug.			
		1929–30.	1930–31.	1931–32.	1932–33.	1930.	1931.	1932.	1933.	1930.	1931.	1932.	1933.
1	No manure ..	1·26	2·88	2·35	2·52	0·50	1·16	1·72	..	0·18	0·49	0·85	..
2	Lime ..	1·83	3·54	3·69	3·44	1·27	2·45	2·00	..	0·28	0·57	0·68	..
3	Lime + super	1·22	3·25	3·57	4·16	0·44	2·04	1·26	..	0·27	0·00	1·28	..
4	Lime + super + nitrogen	1·70	3·57	3·65	4·79	0·78	2·03	1·24	..	0·67	0·67	1·14	..

In order to show more clearly the cumulative effect of top-dressing and rotational controlled grazing the average of the no manure, lime + super, and lime + super + nitrogen plots of the (*a*) and (*b*) series has been taken out as follows :—

Table 3.

Plot.	Manure.	Dry Sheep per Acre grazed for the Period											
		1st Sept.–31st Jan.,				1st Feb.–31st May,				1st June–31st Aug.,			
		1929–30.	1930–31.	1931–32.	1932–33.	1930.	1931.	1932.	1933.	1930.	1931.	1932.	1933.
A1	No manure* ..	0·80	1·69	1·61	1·65	0·74	1·08	0·76	..	0·08	0·27	0·68	..
B1	No manure ..	1·26	2·88	2·35	2·52	0·50	1·16	1·72	..	0·18	0·49	0·85	..
	Totals ..	2·05	4·57	3·51	4·17	1·24	2·24	2·48	..	0·26	0·76	1·53	..
	Averages ..	1·03	2·28	1·75	2·08	0·62	1·12	1·24	..	0·13	0·38	0·76	..
A3	Lime + super	0·79	2·62	3·14	5·57	0·74	2·17	2·26	..	0·26	0·62	1·27	..
B3	Lime + super	1·22	3·24	3·57	4·16	0·44	2·04	1·26	..	0·27	0·00	1·23	..
	Totals ..	2·01	5·86	6·71	9·73	1·18	4·21	3·52	..	0·53	0·62	2·50	..
	Averages ..	1·00	2·93	3·35	4·86	0·59	2·11	1·76	..	0·27	0·31	1·25	..
A4	Lime + super + nitrogen	0·80	3·30	3·38	5·34	0·89	2·23	1·51	..	0·35	0·67	1·17	..
B4	Lime + super + nitrogen	1·70	3·57	3·65	4·79	c·78	2·03	1·24	..	0·67	0·67	1·14	..
	Totals ..	2·50	6·87	7·03	10·13	1·67	4·26	2·75	..	1·02	1·34	2·31	..
	Averages ..	1·25	3·44	3·52	5·06	0·84	2·13	1·38	..	0·51	0·67	1·16	..

* In order to get a reasonable average figure for no manure in the (*a*) series the average of lime + super and lime + super + nitrogen plots has been taken (compare average of Plots 3 and 4 for (*b*) series with no-manure plot of the same series).

By taking the percentage increase of the lime + super and lime + super + nitrogen plots over the carrying capacity of the no-manure plots the following table has been prepared :—

Table 4.—Lime + Super, and Lime + Super + Nitrogen, Carrying Capacities shown as Percentage of Increase over No Manure for Period 1st September to 31st January.

Manure.	1929–30.	1930–31.	1931–32.	1932–33.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Lime + super	0	28·5	91·40	133·65
Lime + super + nitrogen ..	20	50·9	101·14	143·23

If the total annual production be taken for the three years ending 31st August, 1932, and expressed as percentages of the no-manure plot the following is the table :—

Table 5.—Lime + Super, and Lime + Super + Nitrogen, Carrying Capacities shown as Percentage Increase over No Manure for Total Yearly Productions (Years ending 31st August).

Manure.	1929–30.	1930–31.	1931–32.
	Per Cent.	Per Cent.	Per Cent.
Lime + super	2·0	41·1	72·20
Lime + super + nitrogen	38·9	62·9	66·35

Notes and Comments.

From the foregoing tables it may be seen that (1) there is an increase in carrying capacity from all manures over that of no manure; (2) there is a cumulative effect from top-dressing for the first years of this experiment. The experiment is being continued. It will be interesting to follow this improvement to its conclusion.

For the three periods into which the grazing year has been divided there appears to be a steady improvement in production over all plots. Although there is a cumulative effect from annual top-dressing, this effect no doubt is assisted by good grazing management. The improvement in the no-manure plots, although partially due to "carry-over" and grazing factors previously explained as interfering with an experiment of this type, must be assisted by good grazing management also. The increase in carrying capacity from one to three sheep per acre during the spring is valuable on fat-lamb-raising farms. The increase in winter production is also important. It will not be out of place to state here that during the very dry weather of December, 1931, and January and February, 1932, the sheep grazed on these plots were in better condition than those grazed on the farm pastures. The carrying capacity on the farm pastures was much lower than that on the plots.

It is not possible from such an experiment as this to determine the value of improvement in quality of the herbage, out-of-season grass, or the cumulative effect of top-dressing and grazing management. It is important to note that in these experiments (and the same has been noted on some other poor pastures), except for clover development, little change in the sward has taken place. The pastures are of practically the same composition to-day as they were over three years ago, the only difference being a denser plant covering and a greater response to favourable growth conditions on the manured plots. The nitrogen plots show a more dense grass covering than do the others.

The total and final value of manures may be difficult to calculate, but when the annual cost of manuring these plots is considered, the top-dressing of such pastures in comparison with the returns obtained, must be classed as unprofitable.

In the course of the farm's cropping rotation such pastures should be ploughed up, cleaned, and properly sown down in permanent pasture of dominant cocksfoot or dominant true perennial rye-grass. Top-dressing with 1 cwt. superphosphate annually and 5 cwt. carbonate of lime every few years would then be worth while on such a pasture. Information is accumulating showing that from the net return point of view top-dressing good permanent pastures on well-managed light-land farms is profitable. This point is being investigated further.

The writer's thanks are due to Mr. W. Halliday and the N.Z. Farmers' Co-operative Association, Ltd., and latterly to Messrs. Campbell Bros., for allowing this experiment to be carried out on their property known as "Selma." Special thanks are due to Mr. T. Weir, manager of the estate, for the care, recording, and excellent grazing management carried out by him from the inception of the trial.

WAIMATE WEST DEMONSTRATION FARM.

NOTES ON THE 1932–33 SEASON'S OPERATIONS.

J. M. SMITH, Instructor in Agriculture, Fields Division, New Plymouth.

IN marked contrast to the previous season, when an abnormally dry autumn was experienced, the season of 1932–33 was a very good one as far as climatic conditions were concerned, and this was largely responsible for the wonderful increase in production that was registered fairly well throughout the length and breadth of Taranaki.

The main experiments at the Farm are in connection with pastures. The top-dressing trials on the young paddock have not yet gone far enough to be definite, but each succeeding year will make this trial more valuable if it can only be carried along. The trials with rye-grass strains were completed, it being shown conclusively that under no consideration should rye other than certified be sown in a permanent pasture mixture. With the price of certified rye-grass where it is to-day there is no reason why anything else should be used.

The nitrogen top-dressing and intensive rotational grazing trial on the eastern half of the farm was carried through its concluding season. This trial, which was conducted over four seasons, was planned to determine just whether the European system of grazing and heavy nitrogen top-dressing would prove economic under our conditions. From a financial point of view perhaps the time for such a trial was most inopportune, but, whatever the merits or demerits of nitrogenous manures, one thing was definitely proved to the Committee's satisfaction, and this was that with a herd of 60 cows 3-acre paddocks are too small. It was found that the herd settled down and did better on that half of the farm where the paddocks were 6 acres in area, and it was felt that for our Taranaki conditions this amount of subdivision—*i.e.*, ten cows per acre—should be the maximum subdivision aimed at.

So far as the nitrogenous manuring was concerned, after four seasons' experience under local conditions, it is felt that the general response hardly justifies the use of these fertilizers. There are times when and where they can be used to very definite advantage—for instance, where very early growth of grass is desired, although climatic conditions must be favourable for this to take place. Then again, pastures must be strong in rye-grass, and the phosphate and lime content of the soil must be well maintained for nitrogen to be beneficial.

With a view to determining whether or not something could be done to strengthen the hand of the purely grassland farmer against the usually dry autumn conditions experienced in these parts, an acre was sown down with paspalum in the mixture. It should be clearly understood that the sowing of paspalum is only an experiment, and not an indication that the sowing of this grass is desirable. A year or two of normal seasons will determine this point. In fairness to the Committee it should be pointed out that opinions as to the wisdom of sowing this grass are fairly evenly divided, but those who consider that the sowing of paspalum was futile were prepared to see it given a fair and proper trial. The area was sown in November, 1932, 12 lb. of paspalum being added to the standard mixture. Although it is early yet to judge, there are indications that paspalum will establish itself quite well on this area.

The growing of root crops, with the exception of about ¼ acre for the pigs, has been, for the time being at all events, eliminated, and with the exception of the 8 acres of lucerne, the farm is purely a grassland dairy-farm One of the main reasons for ceasing cropping was the state of the paddocks as regards weeds Any attempt to crop during recent years has been nullified by weed growth, and when one considers the previous history of the farm this is not surprising. Cropped extensively with wheat and oats in the early days, the area subsequently became a dealer's paddock, and the larger part of it was never properly grassed out. It is on this account—*i.e.*, the very great early drain on soil fertility—that production figures are but slowly increasing.

Hay and Silage.—A total of 44 acres out of the 90 acres comprising the farm was cut for hay and silage. It is considered good practice to have both hay and silage for winter and early spring feeding, although some farmers are carrying on apparently quite successfully with silage alone. The concrete tub silo was again filled, and while the waste showed a reduction on previous years it is still too great considering that the special object of the silo is towards eliminating waste. It is felt that the comparatively thin walls are largely responsible for the waste that has occurred, as the walls are quite air-tight and during the past three seasons the material has been built in in three different ways. During the present season it is hoped to partially fill this silo with grass in order to see if this has any advantage over lucerne as regards waste.

Lucerne.—There has been a decided tendency during the past few years for lucerne stands to deteriorate somewhat, chiefly owing to the encroachment of grass. In a district such as this, where frequently dry autumns are experienced, the lucerne paddock is the chief insurance policy against shortage of succulent fodder, and every endeavour should be made to keep the stands at a high state of production. Once a stand has started to deteriorate on account of age and grass invasion the best thing to do is to plough the area and resow it. Endeavouring to strengthen the stand by surface sowing is not satisfactory. During the past three years 4 acres of the older portion of the lucerne paddock were broken up and resown. This area is again in good lucerne, and now should with a little care and attention, carry along satisfactorily for eight or ten years.

Top-dressing.—Every endeavour has been made to maintain this important part of pasture management, as it is recognized that any falling away in top-dressing will be reflected in the production figures within a comparatively short time. Harrowing has been carried out when required to scatter the manurial droppings and to keep the pastures in an even condition. With limited finance for top-dressing, every endeavour should be made to utilize this valuable animal manure.

Herd Returns.—The herd milked during the season was fifty-seven in number. This number included some empty cows and some slips. The total butterfat for the season (factory return) was 16,639 lb., which works out at 290 lb. per cow and 185 lb. per acre, compared with 266 lb. per cow and 174 lb. per acre in 1931–32. The total butterfat for the past season creates a record for the farm, the best prior production being 16,270 lb. in 1926–27.

SEASONAL NOTES.

THE FARM.

A Fundamental Weakness in Early Summer Feeding.

THE most important and the most common weakness of the feeding during early summer of " wet " stock, including sows and ewes as well as dairy cows, arises not so much in the quantity as in the quality of the feed. It is not kept in mind enough that the bulk or weight of some of the most important summer crops is not at all a reliable criterion of their nutritive value. This applies especially to such crops as grass pastures, green lucerne, green maize, and green millet.

The general position may be indicated by considering the facts relative to pastures—the most important of all the crops. While a given quantity of green pasture growth consists principally of water, its feeding value is governed by the nature of the residue which is called the dry matter, this being what would remain if all the water were removed. The nature of the dry matter of the pasture of any one field is not necessarily constant or fixed, but may vary greatly within a short period of time, and depends upon whether the grass is maintained in a relatively short leafy condition or allowed to become stemmy and productive of flower heads. The dry matter of lucerne, green maize, and similar leafy crops varies likewise.

The suitability of stock feeds for any particular purpose depends mainly upon their content of mineral matter, which is required for bone and milk formation, their content of protein, which is required for flesh and milk production, and their digestibility.

The comparative feeding values of leafy crops and of stemmy crops at a stage of development corresponding to that at which pastures are commonly cut for hay is indicated by the following facts: (1) The dry matter of leafy pasture growth contains approximately twice as much phosphate and lime as the same amount of dry matter from corresponding herbage at the hay stage; (2) the dry matter of pasture in the leafy stage contains approximately two and a half times as much protein as it would at the hay stages; (3) about 80 per cent. of the dry matter of leafy pasture is digestible, whereas only from 40 to 50 per cent. of a similar pasture in the hay stage is digestible. The importance in feeding practice of these three facts lies in the further fact that the rations of wet stock frequently fall short of requirements in respect of their mineral content, their protein content, and their digestibility.

The feeding value of typical leafy pasture growth is indicated comparatively by the fact that its dry matter is practically identical with that of the valuable standard concentrate, linseed cake. It is to be noted that to say this is not the same as saying that 100 lb. of leafy pasture is practically equal in feeding value to 100 lb. of linseed cake. Although equal weights of the dry matter of these feeds are almost identical in feeding value, there is much more dry matter and much less water in 100 lb. of linseed cake than in the same weight of leafy grass, which is therefore of much smaller feeding value—about 5 lb. of leafy grass equals 1 lb. of linseed cake. The essential nature of the nutritive properties of leafy grass may be expressed substantially from the practical viewpoint by saying that it is a diluted high-class concentrate of the type particularly suited to the needs of wet stock, and fitted in a general way to function in our animal nutrition as linseed cake has done in other countries. At first sight the difference in bulkiness of these two feeds, in spite of the analogous nature of their dry matter, might seem sufficient to necessitate radically different

roles for them in stock feeding, but it has to be remembered that a dry food such as linseed has first of all to become thoroughly moistened in the stomach prior to digestion, and in this it will take up water and undergo swelling. Actual tests have shown that in doing this linseed cake swells to more than three times its bulk when dry, and thereupon approximates leafy pasture growth bulk for bulk.

These considerations assist in emphasizing the need for practising methods of crop utilization which will result in leafy herbage high in essential nutritive substances and high in digestibility being fed to wet stock. Especially in respect to pastures is this matter of current moment, and for information about the means of securing and maintaining pastures in the desirable leafy condition, as far as is practicable, reference may be made to these notes in last month's number of the *Journal*.

It is probable that more care would be taken in the summer feeding of wet stock were it fully realized how the feed requirements of stock producing large quantities of milk differ in points of practical importance from the feed requirements of store or of fattening stock. The store animal is less exacting in respect to protein and mineral content and to digestibility than the milking animal, and while the fattening animal calls for digestibility its daily utilization of nutriment is less extensive and its protein and mineral requirements are much smaller. In brief, successful handling of wet stock necessitates a higher class of feed than that of other types of stock—feed better than is often provided. And in summer the key to high quality in most of our feed is leafiness.

The Place of Hay and Silage.

Much unsound opinion is current about the place to be given hay and silage. For instance, hay is at times preferred to silage on the score of the relatively heavy waste that necessarily occurs in ensilage. This opinion arises primarily because much of the loss which occurs in ensilage remains prominently before the eye, whereas much of the waste that occurs in haymaking, such as that due to leaching by rain, is largely invisible. As accurate comparative measurements of the losses have not been made in New Zealand it is necessary to rely on overseas comparisons, which are instructive. For instance, in German investigations the following losses of yield were noted: Hay dried on ground, 23·6 per cent.; hay dried on frames, 11·6 per cent.; silage well made, 7·4 per cent. That the losses in hay in these investigations were not abnormal seems to be indicated by the fact that in other investigations losses of from 20 to 52 per cent. were noted. At times greater losses than specified above undoubtedly take place in ensilage, but even so it would seem that ensilage compares more favourably with haymaking in respect to wastage than the readily visible losses would suggest.

It is seldom advisable that ensilage should wholly replace haymaking. One reason for this is that on most farms special crops such as mangels, swedes, &c., should find a place, and hay of good quality is normally a better complementary feed to crops of this class than is silage. But ensilage warrants greater attention than many give it because (1) it enables pasture and other suitable growth to be saved in good condition with the minimum of waste, irrespective of weather conditions; (2) it enables cutting of these crops to take place at the stage which is best in respect to the quality of the silage and the future development of the crop—a fact which is of great practical importance because the best stage of cutting frequently is reached when weather conditions may be expected to be unfavourable for haymaking. Cutting as early as possible, consistent with proper curing, reacts favourably in two distinct ways upon the quality of the silage—Firstly, the green material right from the start is more digestible and

better balanced in its supply of nutritive material; and, secondly, the less mature material is less likely to develop in curing the high temperatures that are deleterious to quality.

In overseas investigations a very heavy loss of digestible protein occurred in silage in which a temperature of 158° F. occurred in the stack. While this temperature is unusually high, the consequence of it serves to indicate the downward trend in quality associated with high temperatures. There is some evidence that excellent results are obtained at temperatures in the vicinity of 100° F., at which a silage greenish and in texture little changed from the original green material is obtained.

The very high loss of digestible protein that was associated with the high temperature mentioned would be markedly serious in silage fed to wet stock of high production, which especially need heavy supplies of digestible protein. The leafy aftermath that develops relatively quickly on early-mown fields, and that becomes available at a season when leafy feed is likely to be needed acutely, is a weighty consideration in favour of silage from material mown early. Apart from excessively high temperatures, two of the most serious and common causes of loss of nutriment in silage are insufficient consolidation of green material in pits and trenches, and covering of the stored material with less weight then is needed to reduce the air in the material sufficiently.

Haymaking.

Primarily because of the occurrence of unfavourable weather at the time when herbage is at the best stage for mowing, much of the hay saved each year is of inferior quality, being too mature and woody. Late mowing is also disadvantageous, because it tends to lead to weakening and opening up of the sward, and militates against a satisfactory aftermath at the time when it is most greatly needed. Because so many advantages attach to cutting hay at the proper stage, it is advisable to consider fully all measures which will enable this to be done.

One of these measures is cocking. Over much of the Dominion it is doubtful if a heavy hay crop can be well saved at the right stage without cocking. Cocking, which proves particularly valuable in the saving of good-quality lucerne and clover hay, is to be looked upon as the ideal method when the weather is not altogether reliable.

In stacking much can be done towards securing good quality hay. The site should be well drained and not unduly shaded in a way which will remove the drying influence of winds. There should be an ample supply of suitable material—such as posts, rails, or branches of trees—to form a stack bottom. So that the roof will be small in proportion to the amount of hay a high stack is desirable, provided it is not made so high as to lead to unduly heavy work in its final stages. Relatively long narrow stacks are often to be preferred, because they facilitate drying and cooling of the material. Workers should not stand for long on one place on the stack, for this would cause uneven settling.

If broken weather occurs just after an area has been mown, it should, within reason, be left undisturbed until good weather has returned. Handling of mown material makes it more subject to the washing out of nutritive matter by subsequent rain. If bad weather seems likely cocking should be hastened—the amount of leaching is governed by the amount of rain which washes the herbage, and the amount of rain which falls on the area occupied by the cocks is necessarily much less than that which falls on the area occupied by the swathes.

General Cropping Work.

The growing of special crops for stock feeding could with advantage on many farms be made to occupy a more prominent position; the value

of these crops arises primarily from the fact that, being low in fibre and high in digestibility, they may be made to function as the expensive concentrates that are employed in many other countries. In fact, crops such as green lucerne, green cereals before they are in bloom, turnips, and rape, are essentially concentrates—diluted, it is true, but concentrates by virtue of the role they can fill in stock feeding.

Of the crops it is customary to sow at this season the swede is of much importance. Over wide areas successful results have been obtained consistently by sowing swedes in December at the rate of 10 oz. to 16 oz. an acre. Sowing through every second coulter of an ordinary grain drill is probably most popular, but sowing through every coulter has also given good results; and especially in the South Island sowing in ridges, followed by intertillage, also has given good results consistently. The question of varieties is discussed elsewhere in this issue. Modern practice is to use about 3 cwt. of manure per acre, of which phosphate is the chief constituent. When it is desired to mix the seed with the manure in sowing, care must be taken to avoid the serious injury to the seeds which results from bringing them in contact, even for a short period, with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. The injury caused by superphosphate can be avoided entirely by mixing the superphosphate with an equal weight of carbonate of lime (ground limestone) about a week before sowing. The mixture should not be bagged as soon as it is made, because it usually sets to some extent within two or three days, and if left in a heap it can more easily be pulverized, when it may be bagged. Steps should be taken to guard against similar seed injury in soft turnips and rape, the sowing of which is often carried out successfully at this season.

Maize and millet to provide green feed may be expected to give good results when sown in December. Almost invariably they respond well to a dressing of superphosphate at the rate of 1 to 2 cwt. an acre, and, unless the soil is highly fertile, it is likely to be profitable to supplement the superphosphate with nitrogenous manure such as blood and bone.

Chou moellier continues to be popular, partly because of its marked resistance to club-root, but also because of its good feeding value and ease of feeding to sheep, without undue waste, in wet soil conditions. Chou moellier calls for high fertility, which if not present naturally should be provided by liberal dressings of farmyard or artificial manure. Often a mixture of superphosphate and blood and bone in equal parts at the rate of 3 to 4 cwt. an acre may be applied with profit, and at times such a dressing may be supplemented advantageously by 1 cwt. of sulphate of ammonia an acre. Sowings in October and November are adapted to provide feed in late summer, and December sowings for winter feeding. A suitable sowing is 1½ lb. to 2 lb. an acre broadcast, or ½ lb. to ¾ lb. an acre in drills 2 ft. to 2½ ft. apart.

The best time to mow lucerne cannot always be determined by the flowering development. Safe guidance lies in the rule that the lucerne should be mown when the fresh shoots at the base or crowns of the plants are about an inch long.

Spraying for the control of potato blight and similar diseases is now very seasonable. As a rule, satisfactory results are obtained only when spraying is employed as a preventive instead of as a cure, and this means that spraying should be commenced early.

Information about the selection, preparation, and use of sprays may be obtained on application to local officers of the Department. Accurate information is desirable because unsuitable work in spraying may lead not only to waste of labour and good material, but also to crop injury.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Seasonal Spraying.

THE combination spray recommended for use in last month's notes for control of black-spot, powdery mildew, codling moth, &c., up to mid-December, should after that period be substituted by the following: Lime-sulphur 0·083 per cent., plus colloidal sulphur 2 lb.; lead arsenate 1½ lb. powder (or 3 lb. paste) per 100 gallons water. Continue applications according to climatic conditions. In normal circumstances from fourteen to twenty-one-day intervals should suffice. In those districts, however, subject to fogs or heavy dews, or should showery to wet days set in, the period between sprays should be reduced accordingly.

When applying any spray thoroughness should always be the main object, and from now onwards, owing to increased density through the trees being in full foliage and possibly carrying their full complement of fruit, the need for greater care and thoroughness arises. As mentioned in previous notes, spraying can only be 100 per cent. efficient when every part of the tree and its appendages are not only thoroughly covered but applied with sufficient force to drive the spray into every corner and cavity present on the tree. Lack of thoroughness and care in this direction may cause serious monetary loss by leaving some of the tree parts uncovered and thus provide an opening for disease to attack and spread at will.

A careful watch for black-spot should be kept from the time the leaves unfurl from the bud. Soon after this stage of growth the disease may be expected to appear in the form of small scattered spots on the under surface of the leaf, while a little later the embryo fruit may show the first sign of attack on the calyx and pedicels.

In making up 0·083 per cent. lime-sulphur mixture, if the polysulphide content of the brand is "12" the correct dilution is 1-144; if "15," 1-180; if "18," 1-216, &c.

Continue spraying pears with bordeaux 3–4–50 for control of pear scab, as recommended in September notes.

Thinning of Fruit.

Apart from the removal and destruction of spot-infected fruits, &c., from the trees, thinning of applies should not be carried out until after the natural dropping which occurs each season about the middle of December. It is inadvisable to apply summer oil just prior to this occurrence, owing to the fact that such oil apparently intensifies the dropping action. Thinning is an operation which consists of removing from the trees all fruit which is imperfect, insect infected, diseased, overcrowded in clusters, and all surplus fruit which can well be dispensed with, and which it is obvious the tree is incapable of nourishing and bringing to profitable size. On the other hand, overthinning (which may easily result if the work is carried out before the natural dropping takes place) must be avoided, otherwise oversized fruit will result, which puts it out of bounds as far as export is concerned. Another object to be aimed at when thinning is to space the fruits so as to prevent them coming into contact one with the other; in this way the risk of injury by codlin moth and leaf-roller caterpillar, &c., is very much lessened, if not eliminated.

Judicious thinning not only increases size but also improves appearance. It thus pleases and attracts the consumer, commands a fair price even on a glutted market, and is more profitable to the grower. Small, malformed, and poorly coloured fruit, on the other hand, gluts the market, brings down prices, and more often than not does not pay for the handling. The foregoing remarks refer to the thinning of all fruits.

Grafts.

Where top working of fruit trees has been carried out during the past grafting season it is a wise precaution to now look over the trees, and where good growth has been made to loose the binding without disturbing the scion or wax. The safest and simplest method is to sever the binding by drawing a sharp knife from top to bottom of it well away from the scion itself. No other action is necessary. Any surplus growths within reason which may have occurred can be allowed to remain, with a view to absorbing as much of the surplus sap as possible, thus eliminating to a large extent the risk of silver-leaf (*Stereum purpureum*).

Fireblight.

A fairly comprehensive note was given last month on this subject. The danger period (blossom) for a general or wide infection will now be passed. However, the danger of local infection will be present as long as sucking and biting insects are allowed to move about at will.

Fireblight is very much more virulent on pear than apple trees. Branch canker on the latter is not usual, infection being confined more to the blossoms and laterals. On pear trees, however, the organism spreads very rapidly to the larger limbs, and when this occurs there is little or no hope of saving the tree. Therefore it is recommended that such infected trees be taken out by the roots and destroyed by fire at the earliest possible moment.

Cultivation.

This important operation should not be overlooked on any account. Keep the soil well pulverized by harrowing, &c., in order to maintain the capillary attraction of the soil, keep weeds down, and generally improve soil conditions, so as to give the trees every possible chance to thrive and produce a maximum of top grade fruit.

When each implement used for cultivation is finished with for the season it should be stowed away in a dry shed in readiness for use when again required. The plough or any implements with a bright surface should be thoroughly greased so as to prevent rust setting in during the period they are not in use. This precaution will incidently save much time and annoyance when such implements are again brought into use. The easiest and simple way is to heat a piece of unsalted mutton fat and thoroughly rub over such surfaces as mouldboards, &c.

—J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

As soon as the early spring rains have ceased and the weather seems more settled cultivation of the soil round the trees should be given attention, in order to conserve moisture as much as possible and assist the trees to function. Cultivation should be such that a fine tilth is obtained, but should not be deep enough to disturb the surface-feeding roots.

Owing to the past winter having been comparatively free of severe frosts spring growth should now be well started, and any undesirable shoots may be rubbed out, which will save time later on. All newly planted trees should receive particular attention, and any water shoots which may be growing on the inside of the tree must be entirely removed, also all growths which may have started from below the original budding. A strong and vigorous tree must be aimed at, and this can only be obtained by building on a good foundation.

A careful watch should be kept for any signs of fungus disease. Prevention is better than cure, so an application of bordeaux 4–4–40 as soon as the main crop of blossoms has set will assist in the control of verrucosis; and as the blossoming extends over a long period further

applications will be required as occasion arises. Should thrips be in evidence nicotine sulphate 1–800 can be applied in combination with the bordeaux. Scale insects should be dealt with as mentioned in last month's notes.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Special Care for Late-hatched Chickens.

ALTHOUGH the current season for hatching chicks of any breed has now passed, it is safe to say that in many cases where poultry are kept in small numbers, and where broody hens were not previously available, hatching operations will be continued for some time yet, as in such circumstances it means late-hatched chicks or none at all. While it is true that the chicken brought out later than the end of October is always more or less undesirable as compared with the early-hatched bird, yet where the majority of the adult stock kept are old, and have probably passed their best period of usefulness, the question of hatching out some chicks is worthy of consideration, as the late-hatched pullet, if given proper food and attention, can be depended upon to return a better profit than could an old worn-out hen.

The one and only way to counteract the drawbacks of late hatching is by judicious management, so that the birds will be encouraged to develop without check. The first thing necessary is to give a liberal supply of good palatable food, and if the chickens are to make the best growth the greater proportion of this food should be provided in moist form. This applies to the early-hatched birds as well as the late ones. At this period of the year in particular, too much hard dry food tends to retard rather than to advance growth. Even where a prepared commercial food is being used the chickens will do better, except perhaps for the evening meal, if it is moistened with milk (preferably) or hot water and left to swell before being fed.

The importance of placing late-hatched chickens on fresh ground whenever possible to do so cannot be urged too strongly. Too often these birds make poor growth, and a common cause of this is that they have to follow stock hatched earlier in the season and are compelled to run on stale and tainted ground. The coop should be repeatedly shifted to fresh ground, and good shelter from wind and shade from summer heat should be arranged, while a constant supply of clean water, charcoal, and grit should be kept before the young birds, and green stuff should be fed in abundance. Cleanliness and the protection of the birds from vermin are also requirements of special importance.

Incubator Chicks dead in the Shell.

Many complaints have reached me of late regarding the death of fully developed chicks in the shell. This is the problem of problems to advise upon in connection with the work of artificial incubation. A definite cause is apparently unknown, and indeed it is safe to say from a general standpoint that not one cause but a combination of causes is responsible for this common trouble. On close examination of such eggs for the failure to hatch, sometimes the chicks are found to be in such a position that it would be impossible for them to make the natural turn in order to cut their way out, while in others the chick may be so large that it cannot make the necessary movements to break the shell. Breeding from overfat hens that have had insufficient exercise, or birds that have been forced for heavy egg-laying after being mated, are undoubtedly common causes of the trouble.

Probably, however, more fully developed chicks die in the shell owing to the air-cell not being dried down to the right degree than from any other cause. If the air-cell dries down too rapidly in the incubator the lining membrance of the shell becomes too tough, while the membrane between the air-cell and the chick is also hardened, hence the condition of the air-cell is such that the chick cannot get through, and as a consequence it dies in the shell. On the other hand, if through improper management of the incubator the moisture in the eggs has not been absorbed sufficiently the beak of the chick comes in contact with fluid when turning, and consequently it becomes smothered or drowned. The management of the air-cell is therefore a matter of vital importance, for upon this being brought down to the correct degree, and the membrane at the same time being of the desired condition, the success of the incubation process largely depends.

With the hen there is a natural force always in operation to provide the eggs with just the amount of moisture they need for safe incubation. If there is an excessive supply of moisture in the surrounding atmosphere the hen is capable of restricting the supply of this to the eggs; whereas, notwithstanding any dearth of humidity in the atmosphere, or moisture in the grass and surroundings, she appears to be quite capable of controlling just the amount of moisture needed by the eggs. With the artificial system it is left entirely to the operator to decide the amount of moisture that should be supplied, and, being devoid of the natural instinct of the hen mother, it is not to be wondered at if he sometimes fails to gauge correctly the moisture required at all stages of the incubation process, especially where the climate is variable and the degree of atmospheric moisture is difficult to determine.

Artificial incubation, being merely a substitute for a natural process, requires generally to be better understood than it is, and this can only be done by much study and investigation, as even the best makes of incubators require to be managed in accordance with different local and surrounding conditions. A study, however, of the moisture and the ventilation process appears to be the only means of improving our knowledge of incubation and of making it a more reliable means of hatching chicks. In view of these facts, and considering that local climatic conditions and the room in which an incubator is being worked play such an important part in incubation work, operators would be well advised to keep a strict record of weather conditions, the range of temperature both in and outside of the incubator, the amount of moisture supplied and the time, and the process of the air cell from day to day. In saying this, I quite realize that nothing can counteract a weak germ due to lack of vigour in the parent stock. The breeding birds should have ample exercise, and the freer the range the better the results.

Deformed Incubator Chicks.

Not only is the excessive drying down of the air-cell, and the consequent effect of making the shell membrane tough, a frequent cause of chicks failing to hatch, but it is probably responsible for more deformed chicks being hatched in an incubator than all other causes put together. When the membrane, or the skin on the inside of the shell, becomes tough and the chick has difficulty in piercing it, the constant working in the shell during the effort to get out, and being too long in the shell, cause the delicate legs and feet, and sometimes the beak, to become injured. To the observant person, a chick thus affected will usually show an inflamed condition surrounding the hock joints for at least a day after being hatched, indicating that undue pressure was necessary during the final effort to break out of its shell.

Once a chick becomes affected in this way little or nothing can be done for it, and usually the limbs will become more and more deformed as the

bird grows older; therefore the wise course is to destroy it at the outset. The only way of dealing with this trouble is to prevent it, and the great essential is to prevent, by the application of added moisture, the air-cell from drying down beyond a desired line. It will generally be found that if the air-cell dries down in accordance with the diagrams contained in the book of instructions supplied with incubators the desired moisture is being obtained. Where washed and unwashed eggs or those of different ages are put into the same incubator it is often a difficult matter to secure uniform air-cells, as obviously the older the egg the larger will be the air-cell. If washed and unwashed eggs or those of different ages are used in the same incubator, a more uniform air-cell can be struck by placing moisture in the machine for the first three or four days.

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

THE APIARY.

Artificial Increase.

MANY methods are in vogue relative to what is commonly termed "increase." The word increase in this case means adding to the number of colonies. Strong stocks are built up by early feeding, and then are divided, the portion containing the old queen being removed to a new location. As nearly as possible an equal part of brood and stores is given to each, and the remaining space is filled with frames of foundation. Early queens must be reared and introduced to the half that is queenless, or, failing this, a ripe cell should be inserted. For rapid increase this method is perhaps the best known in bee-culture, and is highly recommended. It should always be remembered that a good spring is necessary to ensure the young queens mating in time. If a large number of colonies are required those already divided may be further fed with sugar syrup or sealed stores, until sufficient strength has been gained for a second division. Just here judgment is required as to whether some stocks are too weak for a second division, for only the very strong should be so broken down.

Queen-rearing.

During the summer months every attention should be paid to raising a stock of young queens to replace old and failing ones. Buying new queens each successive season is too expensive, and with a little attention and care good queens can be raised by the beekeeper in his own yard. An apiary should be requeened each year, and queens should not be tolerated for more than two seasons at the most. In the long-run it is the queens that tell in the production of big crops, and unless the beekeeper takes the trouble to requeen in the summer only a small proportion of the stocks will yield a surplus.

Perhaps no branch of apiculture receives less attention than the production of young queens; and yet if the beekeepers who get the big crops of honey are asked what counts most in their production the reply is invariably "young queens." In New Zealand it has been proved over and over again that the best period for raising queens is from November to February. During these months everything is favourable for the operation, as the hives are at their highest state of prosperity, and under normal conditions the workers and drones are at their best.

It is best to breed only from pure Italian queens whose correct mating has been assured. Novices can judge the mating by noting the uniformity of the hatching brood as regard colour. Should the young worker bees show diversity of colour—some being yellow-banded and others quite black—the mating has not been correct. The question of mating is always a difficult one, as queens mate on the wing, and therefore it is impossible for the apiarist to select the sires. But as purebred queens, even though mismated,

throw pure drones, it only takes a comparatively short time to eliminate crossbred drones from an apiary. There is, however, still the chance of contamination from other drones in the neighbourhood.

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

Methods of queen-rearing are legion, but may be roughly divided into two classes—those which use the naturally built queen-cells, and those which necessitate the provision of artificial queen-cups into which young larvæ are transferred. The former method is most suitable for beginners, or for use early in the season, as it minimizes the risk of chill to young larvæ; while the second method is used largely by beekeepers who want to rear queens in greater numbers.

The Alley System.—A simple, efficient, and easy method for raising queen-cells may be found in the Alley plan. It must be understood, however, that when raising queen-cells they require to be large and well shaped, and that any cells not up to size should be cut out. Procure a frame of young larvæ from the breeding-hive, and with a sharp knife proceed to cut every second row of cells down to the midrib of the foundation. Next kill two out of every three larvæ, and cut the comb into strips about 1 in. wide and full length of the frame. These strips are fastened with melted wax to cell-bars that hang about midway in a standard frame. The cells are pared down to about ⅝ in. in height, which gives the bees room to construct a solid base for the queen-cell. The frame or frames containing these bars, with the strips attached, may now be put into the hive previously prepared for their reception.

The Miller Method.—This method of raising queen-cells will be especially useful to the novice or to the beekeeper wishing a few cells at one time. It is simple, easy, and under normal conditions never fails. No extra appliances are needed as described in systems previously mentioned. Perhaps no better outline of the Miller system can be given than the original one which appeared in the *American Bee Journal* for August, 1912, as follows: "Into an empty brood-frame, at a distance of 2 in. to 3 in. from each end, fasten a starter of foundation about 2 in. wide at the top, and coming down to a point within an inch or two of the bottom bar. Put in the hive containing your best queen. To avoid having it filled with drone-comb, take out of the hive, either for a few days or permanently, all but two frames of brood, and put your empty frame between these two. In a week or so you will find this frame half-filled with beautiful virgin comb, such as bees delight to use for queen-cells. It will contain young brood with an outer margin of eggs. Trim away with a sharp knife all the outer margin of comb containing eggs, perhaps a few eggs next to the youngest brood. This you will see is very simple. Any beekeeper can do it the first time of trying, and it is all that is necessary to take the place of preparing artificial cells. Now put this 'queen-cell stuff,' if I may so call the prepared frame, into the middle of a very strong colony from which the queen has been removed. The bees will do the rest, and you will have as good cells as you can possibly have with any kind of artificial cells. You may think that the bees will start 'wild cells' on their own comb. They won't. At least, they never do to amount to anything, and, of course, you needn't use those. The soft, new comb, with abundant room at the edge for cells, is so much more to their taste that it has a practical monopoly of all cells started. In about ten days the sealed cells are ready to be cut out and used wherever desired."

Nucleus Hives.

In order to facilitate the work of queen-rearing a few nucleus colonies should be run in conjunction with every apiary. In these small colonies queens can be raised and cared for until they are mated and laying. It is an easy matter, once the queens are laying, to transfer them to the larger hives in the apiary.

The best style of nucleus hive to adopt is the four-frame one. This size will give the young queen a chance to lay once she is mated, and will, besides, hold sufficient bees to care for relays of queen-cells throughout the season. To form a nucleus colony take one frame of well-capped brood with adhering bees, and one frame containing honey and pollen, the remaining space being filled with an empty comb and feeder. If the number of bees on the comb is not sufficient to form a good cluster, one or two frames of young bees may be shaken into the nucleus, this being done to replace the field-bees which return to the old hive. Place the frame of brood in the middle of the hive and close the entrance until the following day, when the bees may be released. In the course of a day or two the small colony will settle down, and will then be ready to receive the first queen-cell.

Nuclei thus formed should be placed in a shady position until the bees are released. It is a good plan to set them a fair distance apart from each other and away from the main part of the apiary.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Culture.

IMPORTANT operations during December include the planting out of the winter crops of late celery, leeks, savoys, broccoli, cauliflower, and brussels sprouts; also sowing shorthorn carrots, globe beet, salads, spinach; and early-maturing turnips and peas. This applies chiefly to the cooler districts; the following month will be soon enough in the warmer localities, especially if they also happen to be dry.

The area devoted to crops of the cabbage family should receive a good dressing of lime broadcast and hoed in before planting. This is specially important in the case of heavy land. Young plant beds should be well-watered a day or so before lifting the plants, which should also be watered in after planting them out. The celery trenches should also be well watered shortly before planting out; the young plants should then grow away without flagging. Set the leeks deep without firming them with a dibber of generous diameter; it is sufficient to merely water them in.

Crops that are specially likely to suffer under dry conditions are marrows, pumpkins, melons, cucumbers, celery, runner beans, and salad crops. Such crops should be generously watered where necessary at intervals of about a fortnight. On light soils a mulch of fermented grass, stable manure, or vegetable matter of any kind will greatly assist in retaining the necessary moisture. On heavier land frequent hoeing until the crops spread sufficiently to cover the ground will have a similar effect.

Grass and weeds growing in hedge bottoms, along headlands, under trees, and in odd corners should now be mown with a scythe before seeding, and neatly and firmly stacked with other waste organic matter to ferment. The material should then be sealed with a layer of six inches or so of soil over the top. If it is firmly stacked and kept moist it will ferment and turn out in good condition for spreading and turning under during the winter digging. Such material often makes a useful addition to the supplies of humus which are so necessary to maintain fertility in the soil. It also checks the spread of weeds and many fungus diseases and pests for which they may act as hosts as well as garden crops. Other sources of humus are barley or oats, and vetches usually grown during the winter for turning under; but farm manure of all kinds, and especially fowl manure, is of great value and should be carefully conserved for this purpose.

In dry weather aphides of different species may be expected to attack many crops. Overhead watering occasionally is a considerable deterrent. A light spraying at intervals with a strong solution of soap is also a good

remedy; and if a little nicotine is added to the soapy solution it will deal effectively with the more persistent attacks, as also will a kerosene emulsion used at the rate of one part of emulsion to twenty parts of water, dissolving the jellied emulsion first with a little warm water. Where spraying is not convenient, a dusting with soot or tobacco dust, if applied early, will make conditions distasteful and prevent the insects establishing new colonies. But a close watch and prompt action are necessary, or considerable damage will be done before they are perceived, and the pest will be well entrenched in the curled leaves they create, and control is then difficult. For caterpillar larvæ and those that eat their food, instead of sucking the juices of the plants as in the case of the preceding, a solution of arsenate of lead is a most successful remedy. Such pests also are likely to be troublesome if fine weather is fairly continuous.

The Tomato Crops.

Harvesting the crop in unheated glasshouses will now be fairly under way; consistent packing with fruit of even maturity is always appreciated, and, if maintained, will soon win recognition on the market. Uneven maturity is a serious fault in fruit packing; it should be carefully avoided.

Setting out plants for the late crop outside is now done in the warmer districts, and trimming and tying the early crop will require close attention if the crop is to be developed without delay. The little tomato moth, *Gnorimoschema melanoplintha*, that did so much damage to these crops a few years ago, is still with us; it has been well controlled since by means of sprays of arsenate of lead. This spray should be applied especially during December and January, when the danger is greatest, remembering that should dry weather be experienced it is greatly to the advantage of the pest. Winter had hardly gone when a geranium plant badly attacked by caterpillars was brought to this office. The plants, growing outside, were infested with the light greenish larvæ of the moth *Plusia chalcites*. It is of interest here because this pest was prevalent last summer and did considerable damage to tomatoes and many vegetable crops by eating the blades and leaving the larger ribs of the leaves. It indicates the wide range of food plants for this pest and its hardihood, which must greatly assist its increase. Thus we have another reason for keeping a close watch and including arsenate of lead when mixing sprays for early summer application.

When examining the crops, under glass or outside, keep a look-out for plants of superior type for seed saving. A seed strain suited to the district is of great value, and it is best obtained by very careful selection each year. A plant of good type well set with fruit in a clean crop is ideal, and every care should be taken to allow the fruit to ripen without interference. Ideals are not often realized, but when this one occurs the most should be made of it by taking a rather large quantity of seed, as it remains viable under good conditions up to nine years, and may generally be used with satisfactory results for four years. In this way bad seasons for seed saving may often be met by falling back on such stocks.

Small Fruits.

Many plantations are spoiled by allowing vigorous young growth to crowd the plants, with a result that it is poorly ripened and unfruitful. This tendency must be curbed to obtain good crops, by thinning out superfluous young growth, permitting light and air to ripen what is left, and strengthening it by diverting supplies of plant foods. For this reason surplus suckers in raspberry plantations should now be suppressed, and vigorous young wood commonly found about the centre of gooseberry bushes should be removed completely, also all sucker growth. Red and white currants should receive a similar attention, but in their case lateral growth on the main framework of the bushes may also be shortened, as

they are spur-bearers. This treatment also has the effect of preventing these laterals being broken out by strong winds; some varieties commonly suffer badly from such injury.

Where new plantations are to be made during the coming autumn or winter the land is very possibly carrying a vegetable crop or green crop for turning under. As these plantations remain down usually for some years, every attention should be given to the preparation of the land. Where grassland has to be broken up for the purpose, it cannot be commenced too soon now, as fallowing to thoroughly clean it, ploughing in manures and green crops to increase its fertility, and cultivation to produce a good tilth, take up much of the time before planting.

Consideration should also now be given to the plants which are to be set out, especially as to the most suitable kinds and variety for the local conditions. Carefully locate clean, strong, well-rooted young stock that is suitable for the purpose, book up the order with the nurseryman, and arrange to receive delivery as soon as the plants are ready for removal. They can then be heeled in and planted out at the first favourable opportunity. Where permanent crops of this kind are concerned, success depends chiefly on the care taken in carrying out the above-mentioned operations.

The Homestead Garden.

As we all have much to learn, and experience is the best teacher, it is well to consider that of the springtime and the present early summer period when bulbous plants and flowering shrubs have made, or are making, a fragrant, bright display in herbaceous and shrubbery borders. Careful consideration of the results with a view to amendment during the planting season will improve the appearance and facilitate the management of the garden in the future. It will also enable one to plant new gardens more understandingly and avoid disappointing mistakes that are often expensive. The mistakes commonly made are to set out plants in an unsuitable environment where they give poor results and look out of place. Each kind has its special preference for sunshine or shade and moist or dry conditions, and this it must have if it is to thrive and look its best. Another mistake is in the arrangement of colours, but this has usually more to do with quantity than kind. The area in one colour is sometimes excessive, but more often it is not large enough. Adjustments made during the planting season will contribute very much to the successful garden, but it is only by careful consideration of recent experiences that the decisions may now be made as a sound basis for future adjustments.

In rather dry, sunny borders freesias, sparaxis and watsonias have made a good display, and agapanthus in large groups is preparing to continue it. These and other African plants delight in such conditions, and grow and flower well from season to season with very little attention. In rather moister conditions many varieties of daffodils enjoy the sun; and wood-hyacinths or bluebells, *Scilla campanulata* and *S. nutans*, also the fragrant lily of the valley, flourish in the shade. Planted in large groups in such an environment, and left alone, they will be quite happy and look their best. An occasional top-dressing of well-decayed humus or leaf-mould is all they ask. Along these lines an attractive and useful garden may be made which will require a minimum of attention.

Where new gardens are to be made, the subject should now be given very careful study, and the lay-out and planting planned in detail so that the work, which should be commenced early in the new year, may be carried out effectively without waste of time.

Many shrubs, and especially climbers, are disfigured by the leaf-roller caterpillar. This can be readily checked by spraying the plants with a solution made by dissolving 2 oz. of arsenate of lead paste, or 1 oz. of powder, in 4 gallons of water. It is sufficient to merely give all parts a coating of the spray; it is best done in dull windless weather or during an evening.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: OCTOBER, 1933.

Dominion Meteorological Office.

OCTOBER was a very dry month. Though the first twenty days were mild, some very cold weather for the time of year followed. The snowfalls between the night of the 20th and the morning of the 23rd, in addition to being heavy, were most unusually widespread for October. The frosts following the snow caused serious damage. The cold and rather windy weather combined with the lack of rain checked growth. The Nelson District and Marlborough were especially unfortunate in missing the rains when other areas had moderate amounts.

Rainfall.—The only places where the total rainfall exceeded the average were in western districts of the South Island, and on the coast from Dunedin southward. Even in these areas excesses were not general. Over practically the whole of the North Island the deficit was considerable. In the South Island, in addition to Nelson and Marlborough, western Canterbury and Otago had, in many places, less than half the average.

Temperature.—The mean temperatures were almost everywhere below the normal for October, and in most places considerably so. Christchurch proved an exception, the mean there being 0°·8 above normal. Until the 20th, conditions were generally mild, and Christchurch's high figure was due to some very warm days experienced during this period. The cold spell from the 21st to the 24th was, however, among the worst known for October. Severe frosts occurred between the 22nd and 24th, the time of maximum severity being latest in the more northern areas. The most disastrous effects were in Central Otago, where the fruit crop in many parts was practically wiped out. At Stoke, near Nelson, also, much damage was done to orchards, but, on the whole, fruitgrowers in Canterbury, Nelson, and Hawke's Bay were fortunate and suffered comparatively little. Losses of potatoes, tomatoes, and small fruits were heavy in many districts. There were frosts again at many places a week later. Though not severe, they checked growth, and in the Nelson and Marlborough districts intensified the effect of the rain scarcity on pastures and vegetation generally.

Sunshine was generally much above normal. Nelson recorded 283·3, Blenheim 264·8, and Lake Tekapo 246·6 hours.

Pressure Systems.—At the beginning of the month the weather was controlled by a strongly developed high-pressure system, and fine conditions ruled throughout the first week. During the 7th and 8th a westerly depression passed, causing scattered rains. After a second spell of high pressure, a series of westerly depressions followed one another closely across the Dominion between the 11th and 17th. During this period rain was fairly general, but heavy falls were not numerous except in western districts. The deepest of the depressions, passing on the 14th, was accompanied in places by thunderstorms. Snow fell on the high levels of Canterbury.

The most important of the month's storms were the two which occurred between the 20th and 23rd. Both developed on the coast of New South Wales, where each was of cyclonic form though connected with a westerly depression passing in the South. While the first was crossing New Zealand on the 20th it deepened rapidly, and in its rear the southerly winds proved to be unusually cold for the time of year. Snow fell on much of the high country, particularly on the eastern side of the South Island and in Wellington Province. A temporary clearance followed at most places on Saturday, but the second depression passed rapidly eastward over the Dominion, deepening in the process as its predecessor had done. Again the southerlies were severe. Snow was widespread on all the high levels, even to the Gisborne district. There were falls also on the Canterbury Plains and coastal areas of Otago and Southland. During the 22nd and 23rd, hailstorms were very numerous in districts east of the ranges. Rain was practically general during this period.

The last series of depressions was experienced between the 28th and 30th. Comparatively little rain accompanied them, but they were followed on the 30th and 31st by cold southerlies.

RAINFALLS FOR OCTOBER, 1933, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·78	10	1·37	5·42
Russell	3·20	10	0·91	4·02
Whangarei	3·65	13	0·97	4·80
Auckland	2·91	16	0·69	3·72
Hamilton	2·63	11	1·14	4·67
Rotorua	2·38	7	0·73	5·24
Kawhia	2·54	14	0·59	5·18
New Plymouth	2·59	17	0·56	5·47
Riversdale, Inglewood ..	5·51	17	1·96	10·39
Whangamomona	2·45	5	1·51	8·45
Hawera	2·14	14	0·65	4·63
Tairua	3·75	8	1·29	5·86
Tauranga	2·56	8	0·65	5·31
Maraehako Station, Opotiki ..	3·10	15	0·92	5·30
Gisborne	2·25	8	0·95	2·70
Taupo	1·43	10	0·51	4·34
Napier	1·99	8	0·76	2·23
Hastings	1·36	9	0·58	2·18
Whakarara Station, Kereru ..	3·52	12	0·84	..
Taihape	2·02	13	0·48	3·66
Masterton	2·57	11	0·94	3·30
Patea	2·76	13	1·20	4·20
Wanganui	2·41	15	0·66	3·46
Foxton	2·93	9	1·02	2·98
Wellington	2·17	9	0·69	3·41
South Island.				
Westport	9·87	19	2·08	8·70
Greymouth	10·33	20	1·90	10·32
Hokitika	10·29	19	1·68	11·83
Ross	15·09	17	3·10	14·84
Arthur's Pass	12·69	16	2·44	20·48
Okuru	12·52	9	3·21	15·60
Collingwood	2·95	12	1·05	10·27
Nelson	0·42	4	0·27	3·49
Spring Creek	0·45	4	0·26	2·50
Hanmer Springs	2·54	8	0·93	3·87
Highfield, Waiau	2·00	10	0·53	2·74
Gore Bay	2·62	9	1·13	2·11
Christchurch	1·64	9	0·50	1·69
Timaru	1·80	11	0·63	1·92
Lambrook Station, Fairlie ..	1·73	7	0·46	2·02
Benmore Station, Clearburn ..	1·06	7	0·37	2·27
Oamaru	1·50	9	0·82	1·73
Queenstown	1·60	10	0·38	3·41
Clyde	0·99	6	0·49	1·62
Dunedin	3·92	14	1·68	3·12
Wendon	2·37	14	0·73	2·79
Gore	..	..	..	3·28
Invercargill	4·39	19	0·52	4·50
Puysegur Point	8·35	23	1·25	8·26
Half-moon Bay	5·81	19	0·83	5·32

LIVE-STOCK IN NEW ZEALAND.

Land District.	Horses as at 31st Jan., 1933.	Dairy Cows as at 31st Jan., 1933 (in Milk and Dry).	Total Cattle as at 31st Jan., 1933 (including Figures in previous Column).	Number of Sheep shorn, Season 1932–33.	Number of Lambs shorn, Season 1932–33.	Number of Lambs tailed, Season 1932–33.	Total Sheep (including Lambs) as at 30th April, 1933.	Pigs as at 31st Jan., 1933.
North Auckland ..	29,696	342,708	670,015	985,425	141,592	501,501	1,023,832	100,619
Auckland ..	44,138	561,492	1,020,421	1,415,382	282,862	897,510	1,453,431	197,334
Gisborne ..	16,309	58,910	392,734	2,740,362	660,017	1,399,748	3,040,560	18,958
Hawke's Bay ..	13,255	61,942	244,297	2,692,998	278,749	1,701,378	3,053,099	16,653
Taranaki ..	17,722	254,912	428,733	826,564	176,406	482,097	850,193	60,423
Wellington ..	35,530	258,302	735,796	5,176,828	1,037,774	3,006,335	5,625,790	83,861
Nelson	5,913	34,030	72,460	386,345	9,676	159,376	441,585	15,313
Marlborough ..	6,118	18,421	47,572	1,016,042	11,964	452,152	1,072,402	6,744
Westland ..	2,039	15,875	44,882	69,333	5,411	52,734	79,449	6,036
Canterbury ..	52,031	86,450	190,233	4,369,297	14,347	2,954,738	4,901,577	47,783
Otago	30,149	65,536	152,710	3,324,891	5,541	1,877,524	3,798,911	23,332
Southland ..	23,997	87,394	192,170	2,065,942	5,498	1,530,535	2,415,137	14,526
Totals, 1933 ..	276,897	1,845,972	4,192,023	25,069,409	2,629,837	15,015,628	27,755,966	591,582
Totals, 1932 ..	280,994	1,702,070	4,072,383	26,032,534	2,542,470	14,974,991	28,691,788	513,416

—*Census and Statistics Office.*

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.

PROLAPSE OF THE RECTUM IN PIGS.

A. E. K., Puniho :—

Amongst our herd of pigs there have been a number of both large and small pigs whose rectums have come out, making a big red bulge under the tail. What is the cause of this, and what measures can be taken to control against it ?

The Live-stock Division :—

Prolapse of the rectum in pigs is attributed to some irritant factor such as chronic constipation, diarrhœa, or internal parasites. Certain diets may cause a chronic constipation, as, for instance, a diet composed entirely of whey or skim milk. On the other hand, a diet containing an excess of fibre may cause irritation of the bowel, enteritis, straining, and eventually prolapse. Barley meal containing a high percentage of husks causes irritation of the bowel in young pigs and may lead to this condition. Pollard is more suitable for young pigs, as it is free from husks. A diet of milk may be rendered more laxative by the addition of bran, roots, or other green feed. The two extremes of constipation and diarrhœa require to be guarded against, and the diet should be regulated accordingly. The condition is mainly a dietetic one, and good results have been claimed when affected young pigs have been allowed a free range on pasture. The possibility of internal parasites causing the condition cannot be overlooked. If worms are suspected in the young pigs, fasting and dosing with worm medicine in the food is recommended. As treatment of affected pigs is often unsatisfactory, prevention along the lines already indicated should be undertaken.

MANAGEMENT OF PADDOCKS FOR HAY OR ENSILAGE.

H. J. F., Hawera :—

Kindly inform me on the following points : (1) Should a hay or silage paddock be mown very short—say, 1½ in. high ? (2) Should roughage be mown 3 in. or 4 in. high, or the same as a hay or silage paddock ? (3) Should all the roughage be cleaned off before top-dressing the paddock with super or slag, &c. ? (4) Has super when freshly applied to a paddock any harmful results on stock grazing the paddock ?

The Fields Division :—

(1) The average height of the stubble is generally from 2 in. to 2¼ in. A closer cut than this means a very slow recovery of the aftermath, especially if followed by dry weather, and in addition means a heavier draught on the mowing-machine and the risk of the fingers becoming embedded in the soil if the surface is uneven. (2) Roughage generally indicates that the stock have not been able to control the pasture, or it may mean that in patches the pasture has become tufty as a result of animal droppings not being scattered by frequent harrowing. Where pasture has not been adequately controlled by grazing it should be topped with the mower to a height of about 5 in. to 5½ in. This prevents the formation of seed-heads and roughage, and keeps the pasture in a fresh, growing condition. (3) If the pasture has become rough and long it should be cleaned up before applying any fertilizer. (4) Applied at the usual rate, super is not harmful to stock, but if the paddock has been properly cleaned up before applying the super, the usual practice is to spell before stocking.

Exportation of Stud Stock.—During the year ended 31st March, 1933, the following stud stock was exported from New Zealand : Sheep, 2,413 ; cattle, 79 ; swine, 9 ; horses, 47 (draught). There was the usual movement of racehorses to and from Australia.

FERTILIZER IMPORTATIONS: SEPTEMBER QUARTER.

FOLLOWING are particulars of fertilizers imported into New Zealand during the three months ended 30th September, 1933 :—

Nitrate of soda : Chile, 275 tons. *Sulphate of ammonia :* United Kingdom, 1,583 tons ; Canada, 100 tons. *Basic slag :* Belgium, 1,309 tons ; France, 15 tons. *Phosphatic guano :* New Caledonia, 1,491 tons. *Rock phosphate :* Nauru and Ocean Islands, 18,815 tons. *Other phosphates :* Belgium, 450 tons ; Netherlands, 105 tons. *Kainit :* France, 15 tons ; Germany, 20 tons ; Poland, 110 tons. *Muriate of potash :* France, 10 tons ; Germany, 5 tons. *Sulphate of potash :* France, 75 tons ; Germany, 45 tons. *Other potash fertilizers :* France, 325 tons ; Germany, 225 tons ; Netherlands, 1 ton ; Spain, 170 tons. *Other fertilizers :* United Kingdom, 12 cwt.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 21st September to 2nd November, 1933, include the following of agricultural interest :—

No. 70327 : Teat-cup ; J. H. Davis. No. 70660 : Manure sower ; W. H. Short. No. 70881 : Packing of eggs ; F. M. Brown. No. 69453 : Gardening tool ; T. J. Ryan. No. 69824 : Pasteurization of cream ; L. S. Barrell and G. Gilberd. No. 69963 : Potato harvester ; H. G. Daniels. No. 70356 : Hay stacker ; B. J. Fabish. No. 70622 : Weed extermination ; I. G. Farbenindustrie Aktiengesellschaft. No. 69204 : Top-dressing machine ; H. Eaddy. No. 69804 : Wool press ; V. E. Donald. No. 69846 : Milking-machine ; C. M. B. Olivecrona and C. C. Judge. No. 70249 : Separator-driving mechanism ; J. C. Reynolds and H. C. Plowden. No. 70591 : Milking-machine ; C. C. Beer and J. Johnson. No. 70758 : Removing wool from dead skins ; W. Dale.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

NORTH ISLAND LAMBING ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 91·23 per cent., compared with 89·16 per cent. in 1932. With 9,318,943 breeding-ewes in the North Island, as shown in the 1933 sheep returns, the number of lambs this season is estimated at 8,502,050. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

Liming Experience at Winton Demonstration Farm.—In the 1931–32 season at this farm a block 2 chains wide was dressed with burnt lime at the rate of 1 ton per acre on the furrow, being part of a total area sown in swedes. The resultant crop on the limed portion was not any better than that on the unlimed portion. In the following season (1932–33) the total area was sown with chou moellier, and the grown crop on the limed portion stood out very conspicuously, due to a greater height, robustness in growth, deeper coloration of leaves, and better texture of leaf.

Research Work on Meat.—Referring to the Cambridge Low Temperature Research Station, the Annual Report of the Empire Marketing Board for 1932–33 states : "Work is being developed along five main lines : (1) the state of the water in tissues ; (2) the changes in the state of the proteins during *rigor* and storage ; (3) spoilage due to the action of micro-organisms ; (4) chemical changes in fats ; and (5) the changes in muscle pigments *post mortem*. During the past year, knowledge obtained in each of these fields of work has been of immediate value in attacking a number of applied problems."