The New Zealand

Journal of Agriculture.

VOL. XVIII.—NO. 2.

WELLINGTON, 20TH FEBRUARY, 1919.

TESTING OF PUREBRED DAIRY COWS.

THE CERTIFICATE-OF-RECORD SYSTEM IN 1918.

By W. M. SINGLETON, Assistant Director of the Dairy Division.

THE progress of the New Zealand dairy industry is one of the most gratifying phases of the development of our primary production. This growth during the period of stress caused by the war affords tangible evidence of the efforts of the dairymen to do their share. Not only has a great effort to maintain and even increase production been crowned with success, but there is evidence of a more general inclination to build up the industry on the best known methods. In the *Journal* for March, 1918, the writer referred to the estimated annual value of the increased production per cow as between the 1910–11 and 1916–17 seasons. This increase, relating to our exports of cheese and butter, was valued at more than a million and a quarter sterling for the 1916–17 season.

Our dairy-farmers could doubtless considerably further their interests by doing more accounting. The importance of selling a weaner calf to a grazier has been much overestimated by many of the farmers.

Those cows which will produce calves most sought after by the grazier will carry more flesh than does a special-purpose dairy cow during her milking season. This extra flesh has to be vitalized and transported wherever the cow travels, in the pastures or to the milking-shed. The grass required to produce the necessary energy in this connection would, if fed to special-purpose dairy cows, yield a cash return that would more than counterbalance any premium likely to be obtained for calves that will fatten readily.

EXPORTS OF PUREBRED DAIRY CATTLE.

The forecas made early in the history of the C.O.R. system that our butter-fat records were likely to attract buyers from outside New Zealand is being fulfilled. A trade has been initiated with Australia which will, we trust, be to the advantage of both countries. Buyers have visited New Zealand and returned, taking with them representatives of some of our best dairy strains. Inquiries have also been received by letter from which business has resulted. It is satisfactory to note that our breeders connected with this export are men of integrity and high principles. This is a first essential in laying the foundation of a trade that should prove most profitable to the breeders as well as to the Dominion generally.

We must also recognize that the war has depleted the cattle population of Europe by probably thirty-five to forty millions. There should therefore be a good demand for dairy-products for many years. The distance of New Zealand from Europe may negative any idea of exporting cattle to countries north of the Equator, although, if import regulations permit, we should not be surprised to see limited exports even to Britain.

PROGRESS OF C.O.R. WORK.

The spring months of 1918 evidenced an even greater demand for the testing of purebred dairy cows than had hitherto been experienced. During the latter part of 1917 some 118 breeders were being visited regularly by the Division's testing officers. For the corresponding months of 1918 there were 155 breeders on the list for monthly visits.

We have no hesitation in advising dairymen that before purchasing a bull elsewhere they should carefully peruse the authenticated records of butter-fat production which many breeders now have to offer. The records of C.O.R. cows are obtainable from the secretaries of the respective breeders' associations, who are pleased to reply to correspondence in this connection. In this review the results of the year's testing appear under the names of the respective breeds concerned.

The utility of the testing of purebred dairy cows must not be estimated on any one year's work. The benefits are cumulative, since the records affect the pedigrees for generations. This enables our breeders to use more intelligence in working out their breeding-plans. Their work is becoming less haphazard as more information becomes available. The breeder has now a better knowledge of the strain that will beget the class of animal he desires to breed. This is conducive to

singleness of purpose which induces very considerable thought and study in planning the matings. Such work must, in the aggregate, yield results such as are in the best interests of our dairy breeds, to which we must look for the sires that will improve the production of the average dairy cow in New Zealand.

This is the sixth calendar year during which the Division has issued certificates of record. It is gratifying to note that during that period we have issued certificates on the production of 1,001 cows. In addition, 108 repeat certificates have been issued. The details are set out in the following table, which shows the number of certificates issued during each calendar year since the commencement of the system :—

Breed.	1913.	1914.		1915.		1916.		1917.		1918.	
		Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey ..	67	104	14	91	4	94	11	94	13	113	8
Friesian ..	48	67	11	62	9	44	5	62	14	57	14
Ayrshire ..	..	17	1	12	1	9	..	4	3	4	..
Shorthorn ..	..	..	..	2	..	7	..	21	..	22	..
Totals ..	115	188	26	167	14	154	16	181	30	196	22

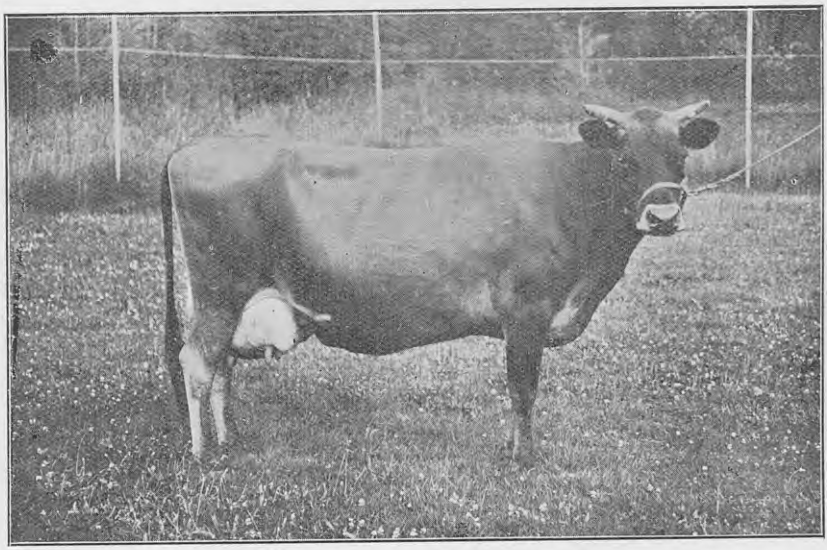
Not only should the breeder have his breeding-plan, but it is time that the average dairyman studied the records of purebred cows intelligently and selected a strain of pure breed on which to build up his future herd. Quite a number of dairymen use purebred dairy bulls, but have not yet considered the advisability of adhering to one strain, although in the majority of instances they probably have found that the strain they have been using is good.

JERSEYS.

The certificates issued on the production of Jerseys during 1918 show an increase of fourteen over the preceding year. This is equal to 13 per cent., and while the actual number may be small the percentage of increase is very acceptable, more especially when the conditions obtaining with respect to labour are considered.

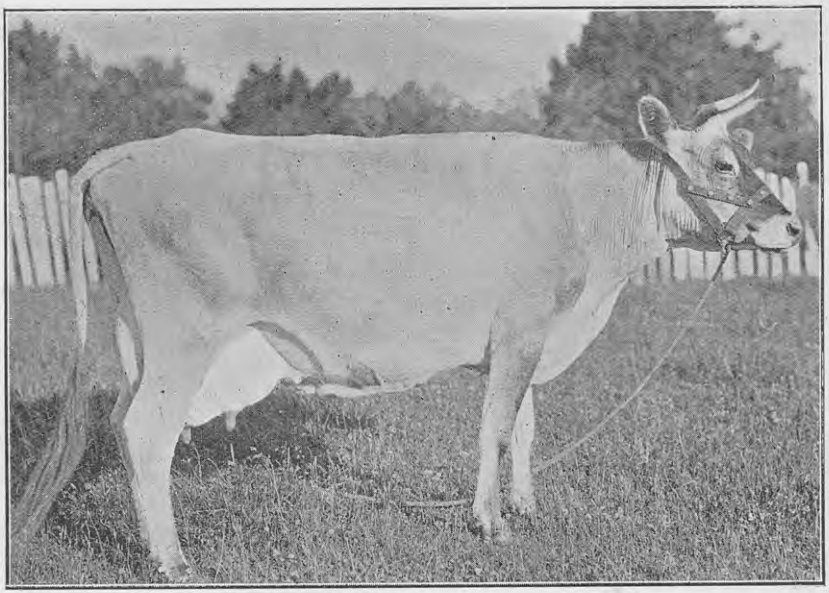
Class-averages.

During the year certificates for first records have been awarded on the production of 113 cows and heifers. In addition, eight certificates have been issued on repeat records. Splendid work has been accomplished in effecting an increase in the average production of all classes save the junior two-year-old, which shows a slight decrease. The maximum class increase in average production is shown by the four-year-olds, where the figures have been raised from 410·53 lb. butter-fat in 1917 to 448·41 lb. in 1918, an improvement of 37·88 lb.



LADY PEGGY.

Leader of the Jersey senior two-year-old class.



PRETTY POLLY.

Made highest mature Jersey record for 1918: 11,016·5 lb. milk, 648·51 lb. butter-fat.

fat per cow. The class-averages for the two years respectively are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1918.		lb.	lb.
Junior two-year-old ..	50	343	6,321·85	356·29
Senior two-year-old ..	14	341	7,332·20	408·34
Three-year-old	17	345	7,451·60	416·66
Four-year-old	14	340	8,062·94	448·41
Mature	26	344	8,604·01	475·26
	1917.			
Junior two-year-old ..	39	345	6,429·10	360·62
Senior two-year-old ..	9	323	5,912·40	318·82
Three-year-old	19	328	7,176·40	398·21
Four-year-old	9	340	7,926·60	410·53
Mature	31	347	8,454·99	460·92

Class-leaders.

Although no new class-leaders have appeared in the lists during the period under review, some individual records of exceptional merit have been authenticated. The 700 lb. butter-fat class has an accretion of one name, the 600 lb. class of five names, and the 500 lb. class of eleven names. Comments have been made on many of these records in connection with the lists as they have appeared in the *Journal* from time to time.

Inasmuch as there are no new class-leaders the 1917 list is reproduced as standing for 1918, as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Mere	F. S. McRae, Palmerston North	1 346	240·5	365	12,164·00	663·64
Senior Two-year-old.						
Lady Peggy ..	E. Griffiths, New Plymouth	2 357	276·2	365	9,625·50	650·00
Three-year-old.						
Sultan's Clematis ..	Percy Jones, Woodville	3 344	311·4	365	11,508·30	641·29
Four-year-old.						
Lady of Collingwood	F. E. Hellyer, Dunedin	4 86	322·1	365	12,096·50	736·07
Mature.						
Madam Mayflower ..	H. B. Curtis Estate, Inglewood	5 307	350·0	365	11,793·20	763·41

C.O.R. Bulls.

The names of Jersey bulls who have at least four C.O.R. daughters from as many different dams form a roll that continues to increase

each successive year. It now comprises the names of some thirty-two bulls, six of which were added during 1918. The list that follows gives the names of those that qualified during the past year together with those that qualified previously. Not only have six new bulls been added to this list, but a reference to the table shows that eight bulls in the 1917 list have gained in their number of C.O.R. daughters. The greatest increase is credited to Majesty's Fox, whose number now stands at twenty-four, which constitutes a record for New Zealand.

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1918.	Name of Bull.	Tota of C.O.R. Daughters.	Number of Daughters qualified during 1918.
Majesty' Fox ..	24	6	Mabel's Dairyman ..	6	..
K.C.B.	22	1	Molina's General ..	6	1
Eminent's Fontaine	19	1	Lord Lepperton ..	5	..
Roberts	13	4	Silver King (Stuckey's)	5	..
Starbright ..	9	..	Belvedere Butter Boy*	5	2
Admiral of Puketapu*	9	6	Charm's Lord Twylish*	5	4
Rozel's Sultan ..	9	..	Good Luck ..	4	..
Campanile's Sultan ..	8	1	M.H.R.	4	..
M.L.C.	8	..	Glory	4	..
Blizzard	7	..	Brighton Twylish ..	4	..
Fancy's Lord Twylish	7	3	Young Emperor III	4	..
Pride of Egmont ..	6	1	Fancy's Carnation's Fox	4	..
Stevenson ..	6	..	Bilberry's Goddington*	4	1
Frisky Campanile ..	6	..	Mayflower Magnet* ..	4	1
Goddington ..	6	..	Knight Commander*	4	1
Golden Swan ..	6	..			
Grand Duke ..	6	..			

* Qualified during 1918.

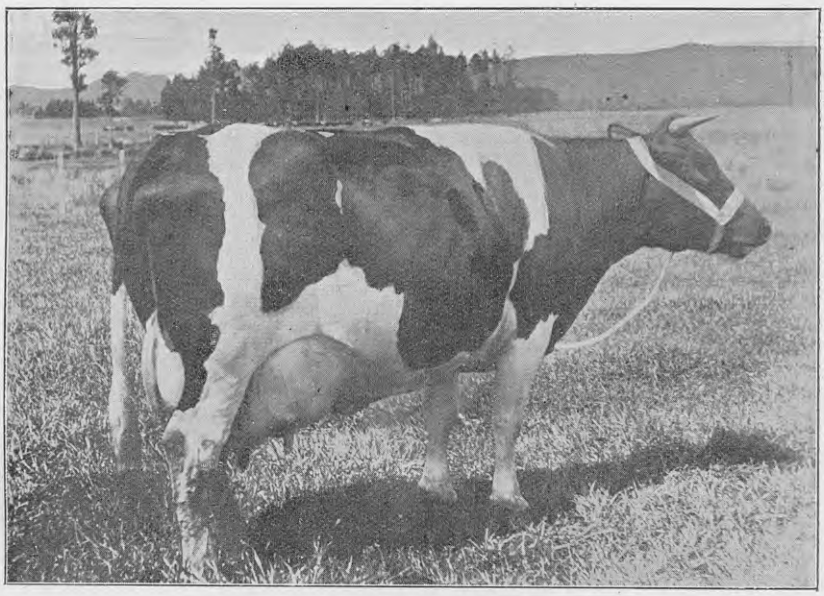
FRIESIANS.

In 1918 the Friesians completed records for seventy-one certificates, of which fifty-seven were for first record and fourteen for repeat records. For the previous year fourteen repeat and sixty-two first certificates were granted, but of the latter, eleven were granted on production completed prior to 1917. The past year therefore shows a true increase of six first certificates, while the number of repeat certificates remains unaltered.

Class-leaders.

The leaders of 1917 have been superseded in three of the seven classes. In the junior two-year-old class the 1917 leader, Friesland Park Buttergirl, with a C.O.R. for 553·21 lb. butter-fat, was displaced by Mr. J. Hart's Lady Pauline, with a record of 603·85 lb. fat. Before the year was out Lady Pauline was herself displaced by Mr. R. Melvin's Princess Pietertje de Kol, a photo of whom is here shown, with a credit for 15,577·8 lb. milk, containing 626·82 lb. butter-fat. Princess Pietertje de Kol is a double granddaughter of Paul Pietertje, and is a close relative to the other high-record cows bred and tested by Mr. J. Donald, who also bred Princess Pietertje de Kol.

In the senior four-year-old class a new leader appeared early in January, 1918. This cow, Woodcrest Johanna Tehee, was imported



PRINCESS PIETERTJE DE KOL.

Leader of the Friesian junior two-year-old class.

MUTUAL PEARL OF ROCK.

Made highest mature Friesian record for 1918: 19,640·1 lb. milk, 736·38 lb. butter-fat.

by Mr. J. Donald, and made her splendid record of 21,483·1 lb. milk and 754·96 lb. fat under Mr. Donald's supervision and ownership. She displaced Salma Johanna Lyons, who produced 730·19 lb. butter-fat. Woodcrest Johanna Tehee held the championship milk-record on this production until displaced by her herd-mate, Westmere Princess Pietertje.

Westmere Princess Pietertje successfully contested not only the championship milk-record but the leadership of the junior four-year-olds and the New Zealand championship for butter-fat as well. In the junior four-year-old class her record of 24,199 lb. milk, containing 939·78 lb. fat, displaces as leader Messrs. H. North and Son's Burkeyje Sylvia Posch, who has a C.O.R. for 679·86 lb. fat. Not only does Westmere Princess Pietertje's record entitle her to the junior four-year-old leadership, but it also entitles her to the distinction of highest-record milk and butter-fat cow of New Zealand.

The class-leaders for the last two years are as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	1918.					
Junior Two-year-old.		Yrs.dys.	lb.		lb.	lb.
Princess Pietertje de Kol	R. Melvin, jun., Masterton	2 102	250·7	365	15,577·80	626·82
Senior Two-year-old.						
Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19,621·60	805·77
Junior Three-year-old.						
Ethel of Friesland Park	F. W. Koberstein, Taonui	3 37	280·7	365	17,663·20	638·85
Senior Three-year-old.						
Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	J. Donald, Westmere	4 156	329·1	365	24,199·00	939·78
Senior Four-year-old.						
Woodcrest Johanna Tehee	,, ,,	4 325	346·0	365	21,483·10	754·96
Mature.						
Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20,629·90	755·78
	1917.					
Junior Two-year-old.						
Friesland Park Buttergirl	W. McLachlan, Doylestown	2 131	253·6	365	13,966·20	553·21
Senior Two-year-old.						
Netherland Princess IV	J. Donald, Westmere..	2 341	274·6	365	19,621·60	805·77

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	1917.					
Junior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Ethel of Friesland Park	F. W. Koberstein, Taonui	3 37	280·7	365	17,663·20	638·85
Senior Three-year-old.						
Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
Junior Four-year-old.						
Burkeyje Sylvia Posch	H. North and Sons, Omimi	4 69	320·4	365	20,016·70	679·86
Senior Four-year-old.						
Salma Johanna Lyons	W. Barton, Featherston	4 322	345·7	365	21,439·80	730·19
Mature Class.						
Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20,629·90	755·78

Class-averages.

Pleasing as it is to report new class-leaders, it is equally if not more satisfactory to refer to increased average productions in the various classes. An increase is shown in the average yield for each class save that of the senior four-year-olds, which was specially high for 1917. The junior four-year-olds have a high average this year, and the junior two-year-olds have also produced higher figures by a wide margin. The figures for the two years are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1918.		lb.	lb.
Junior two-year-old ..	18	349	11,281·00	407·32
Senior two-year-old ..	10	345	9,982·30	374·06
Junior three-year-old ..	5	351	13,101·10	465·05
Senior three-year-old ..	6	331	14,493·50	487·38
Junior four-year-old ..	5	365	15,779·10	576·13
Senior four-year-old ..	7	363	13,469·30	480·97
Mature	20	349	14,600·40	528·14
	1917.			
Junior two-year-old ..	12	346	9,887·60	353·73
Senior two-year-old ..	11	323	9,655·90	326·08
Junior three-year-old ..	4	361	12,797·10	455·98
Senior three-year-old ..	4	343	13,711·84	480·37
Junior four-year-old ..	9	353	13,615·90	475·72
Senior four-year-old ..	6	359	17,250·00	601·57
Mature	30	333	14,123·04	495·08

C.O.R. Bulls.

One Friesian bull, Prince Pietje Paxton, owned by Mr. C. C. Buckland, has been added to the list on the basis of four C.O.R. daughters from different dams. This bull has now seven C.O.R. daughters, only one of which was old enough for the senior two-year-old class. His best record daughter is Monavale Madeline Paxton, who commenced her record at 2 years 65 days and received a C.O.R. for 14,207·5 lb. milk and 526·6 lb. butter-fat, or 279·6 lb. over her requirement to qualify. To King Segis Wild Rose Homestead's list of C.O.R. daughters two names were added during the past year. The lists of daughters for five other bulls were each increased by one, as is shown by the complete list of C.O.R. bulls, which is as follows :—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1918.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1918.
Cliffside Laddie ..	15	1	Mutual Piebe de Kol	7	1
King Segis Wild Rose Homestead	14	2	Prince Pietje Paxton*	7	4
Kruger II	13	1	Colonel Manor of Riverside	6	..
Sir De Kol Inka Pietertje	13	..	King Fayne Segis II	5	1
Grace's Netherland of Riverside	10	..	Dominion De Kol Domino	5	..
Longbeach Van Tromp	10	1	Oak de Kol II Homestead Fobes	5	..
Nazli de Kol ..	10	..	Netherland King ..	4	..
Paul Pietertje ..	9	..	Colantha Johanna Lad	4	..
De Kol Pontiac Burke	8	..	Pietertje Boy ..	4	..
Edinglassie ..	7	..	Longbeach Dutchman	4	..

* Qualified during 1918.

MILKING SHORTHORNS.

The Milking Shorthorns during 1918 sustained their effort with respect to the number of certificates granted. Twenty-two cows and heifers gained the C.O.R. distinction, as against twenty-one for the preceding year. Only the mature class received satisfactory patronage, however, the number receiving certificates in the two-year-old, three-year-old, and four-year-old classes being two, one, and two respectively.

Among the seventeen mature records are one in the 600 lb. and three in the 500 lb. butter-fat class. The highest honour was won by Mr. S. G. Morgan's Willowbank Beauty, with a C.O.R. for 655·22 lb. fat, while Lilly and Grassmere Dolly, owned by W. Brady, and Waimea Rose, tested by R. V. Brown, produced records for 590·34 lb., 518·56 lb., and 500·34 lb. butter-fat respectively.

The class-leaders for this breed remain as for 1917, with the exception of the mature class. In the latter the 1917 leader, Mr. J. R. Anderson's Beauty, was first displaced by Lilly, who was superseded within the year by Willowbank Beauty, whose record raises the leadership to the 600 lb. class, with an increase exceeding 100 lb.

of fat over the 1917 maximum. The 1918 list of class-leaders is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Joyce II of Hillview	W. Wright, Matapu, Hawera	2 215	263·0	365	9,860·00	365·34
Three-year-old.						
Dominion Daphne V	Central Development Farm, Weraroa	3 303	307·3	354	11,033·60	427·90
Four-year-old.						
Cora	Ruakura Farm of Instruction, Hamilton East	4 233	336·8	365	10,931·50	469·25
Mature.						
Willowbank Beauty	S. G. Morgan, Ngawapurua	*	350·0	365	15,725·80	655·22

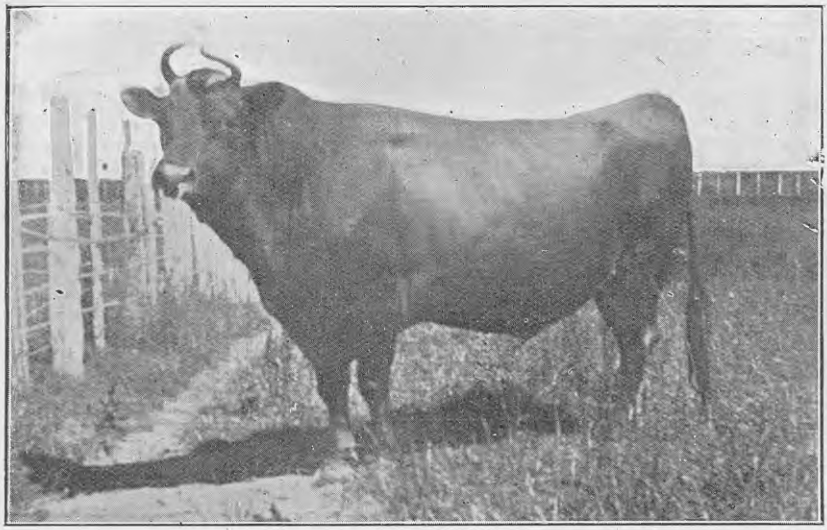
* Mature.

AYRSHIRES.

Three breeders of Ayrshires patronized the C.O.R. testing this year. It is, we consider, unfortunate for the welfare of this breed in New Zealand that its patrons do not to a greater extent take advantage of the opportunity the system offers in popularizing their cattle among the dairymen of New Zealand. Within the Dominion are districts to which the Ayrshire is specially suitable, and we believe there are special strains of the breed that could be further developed with benefit to the owners and to the country in general.

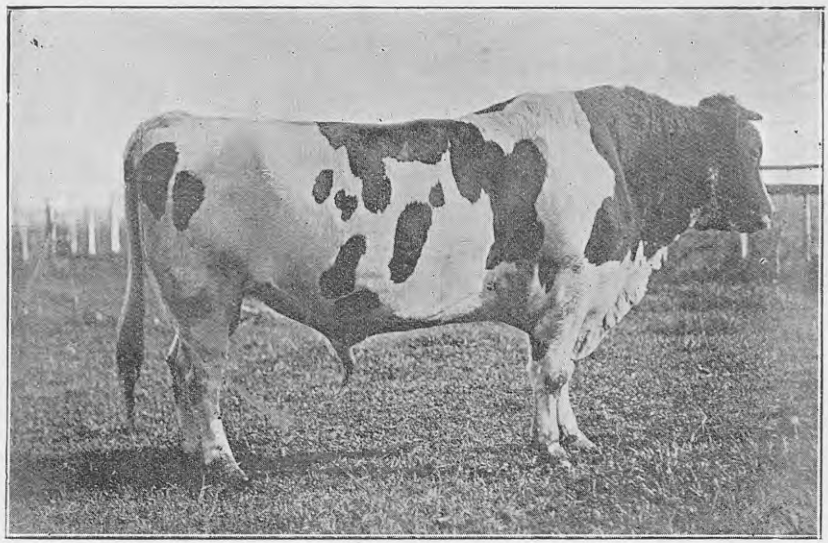
In the two-year-old class the only certificate issued went to Mr. A. H. Hansen, of Te Rehunga. One certificate was issued in the three-year-old class to the Moumahaki Experimental Farm on a record that was completed during a previous year. No certificates were issued in the four-year-old class, while only two were issued on records in the mature class. One of these went to Mr. C. B. Morgan, on the record of Sprightly III of Haydowns, who received a credit for 9,382·4 lb. milk, containing 459·64 lb. butter-fat. Nancy Lee of Ayrshire Moor won the other certificate of this class for Mr. A. H. Clement, with a production of 10,169·8 lb. milk, containing 374·3 lb. fat. The 1917 class-leaders stand for 1918 as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Kanadale Linda ..	Cockburn Bros., Mataura	2 348	275·3	365	12,583·00	502·55
Three-year-old.						
Adelaide II of Waipapa	F. Mills, Waipapa, Hawera	3 321	309·1	365	11,604·20	426·68
Four-year-old.						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348·3	365	14,348·60	591·16
Mature.						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	6 354	350·0	365	14,636·00	582·47



FANCY'S LORD TWYLISH.

Jersey bulls' list: Seven C.O.R. daughters.



PRINCE PIETJE PAXTON.

Friesian bulls' list: Seven C.O.R. daughters.

We trust that with the cessation of the war and the return of a number of young men who are known to be interested in Ayrshires the authenticating of the records of more cows of the breed will be undertaken and carried to a successful issue. Until some such movement takes place the breed must largely depend on show-ring results for advertising material, whereas the other dairy breeds have not only show-ring records but are rapidly compiling production records that admittedly count for more with the average dairymen among whom breeders of all purebred dairy cattle must look for their principal market.

APPRECIATION.

The co-operation of the four breeders' associations connected with the C.O.R. work has again been very helpful to the Dairy Division during the past year. As the work increases from year to year more devolves on the secretaries of the associations. The enthusiasm of these officers and of the executives augurs well for the interests of purebred dairy cows in New Zealand.

CLOSING LIST OF RECORDS FOR 1918.

The appended list completes publication of the records made up to 31st December, 1918, supplementary to the list given in last month's *Journal*:—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Miro Meadows Ruby	A. A. Ward, Miro ..	2 21	242·6	365	5,778·2	384·73
Disdain's Twilight ..	F. Gough, Gisborne ..	2 50	245·5	365	5,509·6	379·52
Riverside Gem ..	J. T. Belcher, Cardiff..	1 345	240·5	365	5,870·1	353·95
Glen Tui's Aroha ..	A. Wigg, Hamilton ..	1 291	240·5	326	5,983·5	307·18
Pride of Riverside ..	J. T. Belcher, Cardiff..	2 50	245·0	365	5,106·2	291·75
Riverside Lady ..	J. T. Belcher, Cardiff..	2 26	243·1	327	4,629·0	283·79
Bilberry of Sherwood	E. Hodges, Waimana	2 29	243·4	301	4,591·4	272·66
Noble Girl.. ..	R. D. Harkness, Te Horo	2 12	241·7	348	4,490·4	242·03
Senior Two-year-old.						
Mangere Belle ..	R. Harper, Woodhill..	2 139	254·4	365	6,778·7	359·56
Three-year-old.						
Worksop Primrose ..	T. Dixon, Masterton ..	3 176	294·6	365	10,413·1	570·45
Orange Bird* ..	S. R. Lancaster, Palmerston North	3 8	277·8	365	8,265·0	446·93
Unique	R. D. Harkness, Te Horo	3 351	312·1	345	7,196·6	352·01
Mature.						
Pretty Blossom ..	Curtis Estate, Inglewood	5 9	350·0	364	8,891·9	473·40
Madam's Fox ..	A. C. Jones, Papatoetoe	5 133	350·0	365	8,845·05	448·62
Melia Ann's Campanile	W. T. Luxton, Waitara	6 337	350·0	316	7,463·2	445·60
Greenfield's Kate ..	C. A. Care, Cambridge	6 207	350·0	288	5,611·5	357·71

* A twenty-eight days' milk-sheet for this cow was lost by the owner, and no credit for this weight s included in the record.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old.		Yrs dys.	lb.		lb.	lb.
Rosevale Colantha ..	H. North and Sons, Omimi	2 142	254·7	365	14,001·9	490·96
Curly Queen Segis ..	W. I. Lovelock, Palmerston North	2 30	243·5	365	10,922·8	420·03
Glenlassie de Kol of Te Ngutu	S. Clements, Rototuna	1 300	240·5	365	11,116·8	342·79
Soldene Bonnie ..	S. Clements, Rototuna	2 65	247·0	365	10,194·8	332·43
Lady Hunga Mercena	S. Clements, Rototuna	1 311	240·5	303	7,912·5	304·88
Senior Two-year-old.						
Colantha Tirania de Kol	W. I. Lovelock, Palmerston North	2 240	264·5	365	14,051·9	520·72
Segis II Morning Rose	P. Nisbet, Rata ..	2 265	267·0	362	12,311·8	426·29
Junior Three-year-old.						
Oakwood Polly ..	W. D. Hunt, Invercargill	3 43	281·3	294	10,947·1	408·17
Senior Three-year-old.						
Lady Van Friesland Park	W. I. Lovelock, Palmerston North	3 305	307·5	365	17,583·1	628·93
Junior Four-year-old.						
Alcartra Rozine de Kol	P. Nisbet, Rata ..	4 22	315·7	365	13,106·5	471·72
Senior Four-year-old.						
Friesland Lady ..	W. I. Lovelock, Palmerston North	4 364	349·9	365	17,153·4	571·19
Mature.						
Pride of Waihi ..	Muggeridge Bros., Manaia	5 305	350·0	343	13,705·1	556·55
Dominion Mutual Mercedes of Rock	Central Development Farm, Weraroa	7 36	350·0	264	13,368·0	451·26
Mierlo	Ditto	9 119	350·0	346	13,068·5	434·43
Woodcrest Aaggie Grace	,, ...	6 321	350·0	346	11,369·75	392·32
Woodcrest Daisy ..	,, ...	6 243	350·0	346	10,886·25	364·17
	AYRSHIRES.					
Two-year-old.						
Count's Princess ..	A. H. Hansen, Te Rehunga	1 291	240·5	364	5,915·8	240·60
Three-year-old.						
Dominion Blair Athol	Moumahaki Experimental Farm, Waverley	3 38	280·8	361	9,226·0	353·26
	MILKING SHORTHORNS.					
Two-year-old.						
Dominion Mirth of Ruakura	Ruakura Farm of Instruction, Hamilton East	2 286	269·1	365	8,720·7	296·58
Mature.						
Willowmoor Fascination	T. H. Verry, Konini ..	*	350·0	311	10,356·8	437·57
Willowmoor Maud II	T. H. Verry, Konini ..	*	350·0	328	12,362·2	432·48
Dominion Bertha IV	Central Development Farm, Weraroa	*	350·0	365	9,488·75	377·97
Willowmoor Jewel ..	T. H. Verry, Konini ..	*	350·0	279	9,129·6	365·21
Willowmoor Sunbeam	T. H. Verry, Konini ..	*	350·0	321	9,184·6	354·90

* Mature.

ECONOMIZING PHOSPHATES.

THE USE OF LIME.

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

Now that the price of fertilizers has soared so high it seems almost out of place to attempt to discuss their respective merits. Moreover, some kinds of fertilizers, such as potash salts, are altogether unobtainable, and others are so scarce that with certain limitations the choice of the farmer as to the kind he will use is extremely limited and guided by what he can purchase in a very uncertain market. Hence, although lime cannot replace phosphate, which will always be required for certain purposes—notably, for the stimulation of the turnip crop—lime in one or other of its forms is such a great and general ameliorator for all soils, and deposits of limestone are so generally distributed throughout New Zealand, that it seems only natural that we should turn to lime to maintain and increase the productiveness of those lands which are threatened by the fertilizer shortage.

The word "lime" is commonly used in two senses, having either a general or special application. In the general sense it is used to denote many compounds of lime, such as carbonate, sulphate, oxide, and hydrate. All of these are white compounds of earthy texture when in the powdered or in the amorphous (non-crystalline) form, and their external character and feeble solubility in water are such that lend themselves readily to the general designation "lime." This has the sanction of usage, and there is also the fact that they all contain calcium oxide, combined, however, with acids or water to form totally different substances from lime properly speaking. If we want to speak very accurately and to limit the word "lime" to one body of definite chemical composition we must apply it only to the oxide of calcium, also popularly called "quicklime," "shell-lime," "roche-lime" (or "rock-lime"), and "cob-lime," and retain the word "limestone" for the commercial substance which contains the lime in the uncalcined state and therefore present as carbonate of lime. It is preferable to use the term "ground limestone" when speaking of this substance. To call it "carbonate of lime" is somewhat hyperbolical. Although it contains carbonate of lime or, more properly speaking, calcium carbonate, many samples on the market contain as little as 60 to 70 per cent., the balance being clay or other siliceous matter In any case it is desirable that chemical terms may be restricted to substances which are fairly pure chemical products, otherwise if the farmer learns to call such stuff as a 60-per-cent. ground marl carbonate of lime he may also learn to pay the price of carbonate of lime—in the same way as he would if he asked for sodium chloride when he only wanted common or rock salt.

Lime or calcium oxide is the oxide of the metal calcium, in the same way as rust is the oxide of the metal iron when the latter is combined with the oxygen of the air. Calcium is one of the most abundant metals contained in the crust of the earth. Clarke estimates

the average percentage of iron present in the known terrestrial matter as 4·43, but calcium is present to the extent of 3·44 per cent. Hence it might be thought that there is no necessity to worry about adding more lime, but calcium is largely present as very refractory insoluble silicates, and where it is present as the available carbonate it has generally been washed out of the surface soil owing to its ready solubility in soil-water containing carbon dioxide, better known as carbonic-acid gas. It can thus easily be seen that a country with such a copious rainfall as New Zealand must, generally speaking, need liming if it is accepted that the soil must contain lime in the state of carbonate. Even if the soil rests on limestone rock the leaching has been sufficient when continued over hundreds of years either to remove all the lime carbonate from the top soil or to convert it into insoluble compounds comparatively unavailable as plant-food.

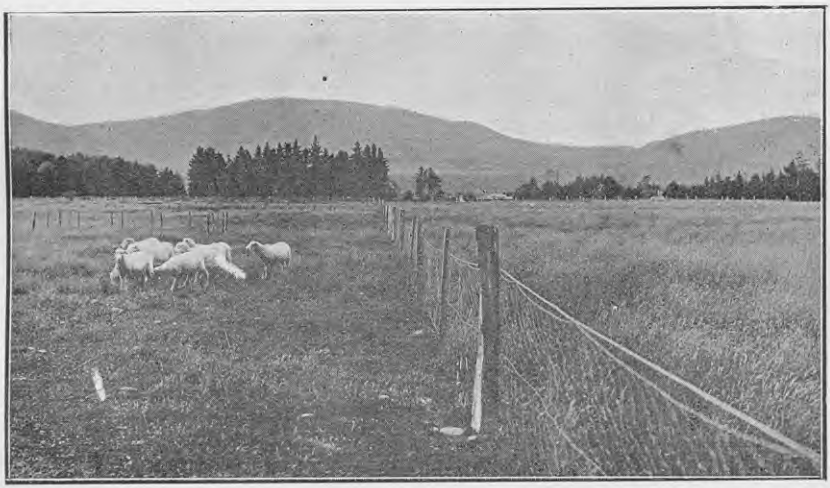
Attention may now be briefly directed to phosphates. The theory of their fate in the soil, which is supported by much direct and indirect evidence, is that when a phosphate becomes soluble in the soil-water—and it must become soluble in order to be absorbed by the root-hairs—it becomes finally precipitated by the other metallic constituents of the soil, which are either calcium, iron, or aluminium In the case of calcium it precipitates a phosphate which is easily redissolved, but in the case of iron or aluminium the compounds formed are unavailable or soluble with difficulty in the soil-water. If, however, there is an excess of calcium carbonate in the soil the phosphate will combine with this in preference to iron or aluminium, and this is another reason for keeping a supply of carbonate of lime in the soil. It will now be obvious that to obtain the most economical result from phosphate it must either be soluble in water or else in the case of phosphate insoluble in water it must be ground extremely fine. This is what is found in actual practice. In America it has become quite a well-established practice to apply insoluble phosphates as long as they have been ground to an almost impalpable powder, and this practice has been largely adopted in New Zealand.

It has always appeared to the writer that fineness of grinding in respect to limestone was not such an important matter as the fine grinding of phosphates, and this idea has been set forth in the *Journal* from time to time. It seems fairly obvious that there is not the same necessity for finely grinding a substance which becomes more soluble in the soil-water as there is for grinding one which becomes more insoluble under the same conditions. Accordingly we find a well-known American agricultural chemist advocating the use of a ground limestone which passes a $\frac{1}{4}$ in. sieve and contains all the finer particles which have been produced in reducing the stone to that state of subdivision.

There are in New Zealand so many deposits of soft marly rock, or easily fractured hard limestone which on quarrying easily breaks down into small fragments, that the writer has in the past advocated using these in the same way as marling or chalking is conducted in England—that is, by distributing the rough quarried stone on the land, leaving to the weathering influences of the atmosphere and the soil, and to a less extent the tillage operations of the farm, the task of reducing these rough particles to the state in which they may be made available for their work in the soil. Successful experiments have been carried out in furtherance of this idea on the poor gum-lands near Albany, Auckland,

where a soft marl containing 70–80 per cent. carbonate of lime, dug from a roadside cutting at a cost of a few pence per ton royalty in addition to the cost of cartage and labour, was used with striking results. (See January, 1916, *Journal*, p. 10.)

The matter of ground limestone was discussed in an article in the *Journal* for April, 1914 (see also a note in the issue of November, 1914, p. 328), where it was suggested that the screenings from limestone quarries should be used on the land. On visiting the Mauriceville lime-works the writer found a large dump of rejections from the quarry. Similar material is also to be obtained at Te Kuiti, and no doubt at other quarries. The labour in handling and carting such rough moist material is at present the only bar to its use. The pasture top-dressing



A CONTRAST DUE TO THE USE OF LIMESTONE.

Paddock on right of fence top-dressed with rough rubble limestone and phosphate; paddock on left untreated. At the period the photo was taken the dressed paddock was carrying twenty-eight sheep, as against eight on the undressed, both paddocks being 5 acres in area. See account of pasture top-dressing experiments at Wallaceville Laboratory Farm (paddocks 2 and 3) in last month's *Journal*.

experiments conducted at the Wallaceville Laboratory Farm, as recorded in last month's *Journal*, supply a convincing record as to the value of limestone used in the rough state.

CONCLUSIONS.

The outstanding deficiency in New Zealand soils, which has been proved by agricultural practice and also by chemical analysis, is that of phosphates—nitrogen and potash being usually present in fair amount, and addition of these fertilizer constituents to ordinary crops not having usually proved remunerative.

Enormous quantities of phosphates have been imported and used, especially on the North Island lands, during the past decade or so. The practice still survives as strongly as ever, but now neither the quality

nor the quantity of the phosphates are so easily or so cheaply obtained, on account of the war. These phosphates have only in very small part been taken off the land in the shape of crops or stock, and they have not been leached out of the soil, as that is impossible. There is only one explanation of the disappearance of the effect of the phosphate after a few months which renders it necessary to apply a fresh dose, and that is undoubtedly that the phosphate is changing in its character from an available to a less available form. Is there any way in which this change can be prevented and the full effect of the whole phosphate as applied by the farmer obtained in crop or stock ?

In the writer's article in the *Journal* for April, 1914, he stated, " Probably the most important function of carbonate of lime on New Zealand soils (especially those deficient in phosphates), which are usually well supplied with nitrogen and potash and are not too difficult to work,* lies in the favourable influence which a good supply of carbonate of lime exerts both on the phosphates naturally present in the soil and on those which are artificially added ; for in the first place it decomposes the phosphates of iron and alumina, which are with difficulty available as plant-food, with the formation of calcium phosphates, which are easily available ; and, further, if acid phosphates such as superphosphate are applied, lime prevents the formation of the unavailable phosphates."

The great American soil chemist, Hilgard (see *Journal* just quoted), pointed out long ago that where carbonate of lime was in excess phosphates might be present in very small amount, and yet more satisfactory returns be obtained from the land than when the converse was the case.

In New Zealand there is a great dearth of phosphate deposits, but an abundance of limestone—soft and hard—also of water-power. The inauguration of a comprehensive water-power scheme for the Dominion by cheapening the cost of grinding limestone will enable larger quantities to be used and thereby render less phosphates necessary. The utilization of hydro-electric power for grinding limestone was suggested by the writer some years ago (see *Journal* for November, 1915, p. 393).

It also seems plausible to predict that with the advent of cheap hydro-electric power in districts where the roads are good—and the roads may be improved by similar methods—electric traction will play a part in cheapening limestone to the farmer; that by the employment of electrically driven lorries provided with suitable distributing apparatus the ground limestone may be delivered from the works to the fields in one operation, thus eliminating the present great cost of handling, bagging, and railage.

* In a heavy clay soil difficult to work probably quicklime would be more economical to use than ground limestone in the first instance.

Elephant-grass.—Very favourable reports having been received as to the immense amount of fodder produced by this plant (also named " Napier's Fodder-grass "), the Department has obtained a supply of roots from the Grafton Experimental Station, New South Wales, through the courtesy of the Director of Agriculture of that State. The grass will be tested at Ruakura and at the Albany experimental plots.

ROTATION OF CROPS.

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

ALL good farmers adopt a rotation of crops that suits the special conditions of soil, climate, locality, and market with which they are associated. To do so is decidedly in the interests of productive agriculture and conservation of soil-fertility, upon which two important factors may be said to depend the perpetual welfare of a State. Unfortunately, however, for some countries systematic crop-rotation is not universally adopted, and the result is the eventual abandonment of farms once the homes and means of sustenance of prosperous families. A standard example of this is to be found in the hundreds of abandoned farms in the New England district of the United States of America. In certain districts of New Zealand, too, depletion of soil-fertility has gone on apace for many years, due to the growing year after year of cereal crops and no attempt being made at crop-rotation. It is to these districts especially that this article is directed.

SOME REASONS FOR CROP-ROTATION.

There are many reasons why crops should be rotated. The following embrace the most important:—

(1.) Plant-food required in abundance for one crop is not wanted in the same quantity by another crop. Hence a rotation of crops utilizes stores of certain forms of available plant-food that would in the main go unutilized were the same crop grown year after year. Thus the natural food-supply of the soil and the manures and fertilizers required are economized. A proper balance is also maintained among the fertilizing constituents of the soil.

(2.) Soil-fertility is conserved. By growing continuously the same crop definite forms of plant-food in the soil are more or less rapidly exhausted, but where a rotation system embodying a leguminous crop (clover, peas, &c.) is adopted fertility is conserved, for nitrogen, the form of plant-food most readily depleted from the soil, is obtained from the air and stored for the use of subsequent crops. This assimilation of atmospheric nitrogen and its fixation is brought about by bacteria associated with the roots of legumes. This process of mutual sustenance of plant and bacteria, as the result of the activities of both, is known as symbiosis. The practice of crop-rotation is made possible as the result of this far-reaching discovery. Scientific crop-production and maintenance of soil-fertility are thereby rendered possible, and farming practice is accordingly placed upon a permanent footing.

(3.) Deep-rooting crops, interchanged with shallow-rooting crops in the rotation, draw upon the stores of plant-food existing in the lower portions of the soil and in the subsoil. By so doing they bring up to the surface, also to some extent leave unassimilated in the upper

portion of the soil, nutrients that eventually become available for the shallow-rooted crop embodied in the system of rotation.

(4.) Production from the soil is increased, for, owing to the greater availability of plant-food in form suitable to the varying requirements of each crop in the rotation, more vigorous crops obtain, and hence high yields from the individual crops are secured as compared with the mediocre and gradually declining yields obtained from the same crop grown year after year on the same area of land. The nitrogen accumulated in the soil as the result of the growth of the leguminous crop in the rotation, whether alone or as clover in the pasture, plays an important part in promoting this increased production; and to this important plant-food constituent, continuously augmented by the growth of the legume or legumes, is largely due the perpetuation of high or satisfactory crop-production and of a high degree of soil-fertility.

(5.) Weeds are eradicated or kept in check as the result of the various methods of cultivation necessary for preparing the land for crops under rotation and for promoting a satisfactory growth of these crops. Prominent among the rotational crops valued from the point of view of cleaning the land is the hoed crop—roots, maize, or other crop calling for intercultivation. If more attention were paid to systematic crop-rotation in New Zealand there would be fewer weeds to contend with.

(6.) Pests, both insect and fungus, are kept in check to a large extent. The vigour of the crop grown in rotation is increased, and the crop is thereby fortified to a degree against the ravages of such pests, whereas a crop grown continuously on the same land suffers a loss of vigour and readily succumbs to attack by insect and fungus parasites when prevalent. The change of food provided by varying the crop under a rotation system does not suit the particular attacking pest, and the result is either the death of the pest or its transference to more congenial environment. Notable examples of this phenomenon are to be found in the aphis being as a rule markedly numerous where turnip crops are grown on the same land for a few years in succession; in club-root being prevalent where cruciferous crops (turnips, swedes, &c.) are raised without lengthy intervals between the growing of members of this order, particularly when sown in a soil inclined to be sour and known to be affected by the club-root organism; and in rust being most marked, as a rule, where only a poor growth in a cereal crop obtains. In the latter case the crop is too weakly to resist attack by the fungus parasite. Evidence of this phenomenon is to be found in the comparative freedom from rust in a cereal crop grown on land where a good growth of clover had been ploughed under. The humus added to the soil thereby, also the moisture conserved and better distributed by this incorporation, results in a vigorous cereal crop, fortified to withstand invasion from the rust when the latter ultimately begins the attack under suitable conditions of temperature and moisture. A further example is that of the grass-grub often being decidedly bad in light porous soils where a short rotation of crops is not followed. Breaking up the land fairly frequently, rolling heavily, and substituting red clover for grass will greatly reduce this pest, if not rid the land of it.

(7.) A more even distribution of labour is promoted on the farm. As the crops under rotation are seeded and harvested at different times there is work for farm labour the year round; hence the rush attendant upon the seeding and harvesting of one particular crop grown regardless of rotation is avoided, and the regular employment of satisfactory labour is assured where such is available. More stability is thus given to farming because of this regular employment of labour under a farm crop-rotation system.

(8.) A variety of crops for market and live-stock requirements is provided. Indeed, it is hard to conceive of live-stock being kept and satisfactorily fed without the adoption of a system of crop-rotation, unless resort is made, under favourable conditions, to pasture continuously as a means of feeding and finishing farm animals. Diversity in crops grown on the farm means greater resource in the feeding of various classes of stock, also greater control of fluctuating conditions connected with the market prices of farm animals and their products and of farm crops subject to sale.

(9.) The location of live-stock used for feeding off farm crops is changed every year, thus improving the health of farm-animals as well as promoting increased production through the more vigorous crop-growth, due to change of soil and to distribution of animal manure, and through the increased vigour of the stock fed on new ground.

(10.) Heavy loss, due to failure or destruction of the crop grown repeatedly without regard for rotation, is avoided when a systematic rotation of crops is practised. In adhering to the latter the farmer "has his eggs in more than one basket," and hence failure of one crop in the rotation system means only partial loss of the product of the farm during a single year.

(11.) Seed is kept from deterioration under a rotation system because it is raised each year on a fresh area of land, whereas if grown regardless of rotation on the same land year after year it rapidly deteriorates. Of course, fresh seed could be obtained each year from off the farm but this system has its inconveniences, and is a means of introducing weed-seeds periodically, and there is perpetually presented the defects due to growing the same crop on the same area annually. By these remarks it is not suggested that farmers should always save their own seed, but in most cases, and especially with certain crops and strains of seed thereof, it is decidedly advantageous.

The foregoing constitute the chief benefits derivable by the farmer from the adoption of a systematic rotation of crops suitable to his special conditions. In view of such benefits it is difficult to conceive of any tiller of the soil to-day refraining from practising a rotation of some kind, much less his neglecting to ascertain the crop-sequence that best suits his special circumstances.

THE NORFOLK SYSTEM.

A type of rotation common to farming in various parts of the world, but particularly in England, is what is known as the Norfolk system. It is a four-year rotation consisting of wheat sown in the autumn on land ploughed out of lea; a cleaning crop or crops, such as turnips, swedes, and potatoes; barley or oats sown in spring; and a leguminous

crop, such as clover (alone or in a mixture), peas, or beans. The wheat crop is sustained and encouraged by the nutrients (nitrogen principally) that accumulate as the result of the growing of clover or other legumes. The root crop is shallow-rooted, and hence feeds in the surface layer of the soil and not so deeply as the wheat crop. The following barley or oat crop profits by the residue from the phosphatic manuring of the root crop. The exhausting effect of the cereal crops, particularly as regards nitrogen, is offset by the growth of the succeeding leguminous crop.

Many of the longer rotation systems are based upon the Norfolk system. While it is the longer rotations that best suit New Zealand conditions, yet the short or four-year rotations are of decided value where the land is high-priced and limited, as usually obtains in the vicinity of our cities. Under such conditions the land needs must produce the most possible; and the product has always a ready sale, or it can with profit be readily stored in the form of hay, ensilage, &c., for consumption during the period of least growth. A maximum production is required, and one of the following short rotations (chosen according to the conditions prevailing in a particular locality) will provide such:—

No. 1.—(i) Roots (swedes, mangolds); (ii) barley; (iii) legumes (clovers, peas, or clover in mixture); (iv) oats.

No. 2.—(i) Oats; (ii) legumes; (iii) maize (for ensiling); (iv) roots.

No. 3.—(i) Wheat; (ii) roots; (iii) oats; (iv) legumes.

Under such a rotation a liberal supply of artificial fertilizer suited to the conditions of soil, climate, and crop is, as a rule, all that is required in the way of manure. The soil-renovating leguminous crop, together with proper and timely cultivation, do all that is further required for keeping the crops growing satisfactorily and the soil always in good heart.

SOME OTHER ROTATIONS.

For purposes of intensive farming on high-priced land of limited area near a city, or on land that will not hold pastures for any length of time, the following four-course five-year rotation of crops would also be suitable:—

No. 4.—

First year: (i) Oats; (ii) green feed; (iii) temporary pasture; (iv) temporary pasture.

Second year: (i) Green feed; (ii) temporary pasture; (iii) temporary pasture; (iv) roots.

Third year: (i) Temporary pasture; (ii) temporary pasture; (iii) roots; (iv) oats.

Fourth year: (i) Temporary pasture; (ii) roots; (iii) oats; (iv) green feed.

Fifth year: (i) Roots; (ii) oats; (iii) green feed; (iv) temporary pasture.

In this rotation oats, green feed, and roots are each in turn missed every five years, thereby providing for the greater part o the time a

plentiful supply of temporary pasture, also green feed for feeding out to stock or for ensiling, and roots for feeding during winter with hay and ensilage.

A longer rotation, suited for dairy farms and holdings suitable for sheep- and cattle-fattening purposes, especially for land that calls for breaking up fairly frequently and not removed far from factory or market, is to be found in the following :—

No. 5.—(i) Forage crops (rape or mixtures suitable for ensiling or feeding off) ; (ii) roots (mangolds, swedes, turnips) ; (iii) oats ; (iv) grass and clovers ; (v) grass and clovers ; (vi) grass and clovers.

No. 6.—(i) Oats ; (ii) grass and clovers ; (iii) grass and clovers ; (iv) grass and clovers ; (v) roots ; (vi) forage crops.

No. 7.—(i) Forage crops ; (ii) grass and clovers ; (iii) grass and clovers ; (iv) grass and clovers ; (v) roots ; (vi) oats.

In No. 5 the grass-mixture is sown with the oat crop. The legumes grown in the pasture mixture, also in the forage-crop mixtures (if grown), add nitrogen to the soil and so benefit the non-leguminous crops grown in these mixtures, also the succeeding root and oat crops. In No. 6 the root crop cleans and ameliorates the soil for subsequent satisfactory growth of the forage and oat crops. Should it be preferred, owing to the nature of the soil or other cause, to sow the grass-mixture alone this can be done after the forage crop is off, provided the weather and seasonal conditions are favourable. No. 7 provides for such a contingency, as also for sowing the grass-mixture on rape land (unploughed) when fed off, if conditions suit such an economy. Under average conditions of soil-fertility the only manure required for these six-year rotations is that applied—liberally—with the root crops, and with rape if grown as the forage crop. When the land does not carry a long grass lea, owing to lightness of soil or other deficiency, these six-year rotations are also adaptable. If desired, the length of grass lea could be slightly reduced.

For conditions such as remoteness from market, and difficulty or disinclination towards breaking up the lands owing to labour and other causes, the long rotations embodied in the following should be considered :—

No. 8.—(i) Oats ; (ii) grass and clovers ; (iii) grass and clovers ; (iv) grass and clovers ; (v) grass and clovers ; (vi) roots (turnips) or rape.

No. 9.—(i) Roots or rape ; (ii) grass and clovers ; (iii) grass and clovers ; (iv) grass and clovers ; (v) grass and clovers ; (vi) oats.

No. 10.—(i) Wheat ; (ii) roots or rape ; (iii) grass and clovers ; (iv) grass and clovers ; (v) grass and clovers ; (vi) grass and clovers ; (vii) grass and clovers.

No. 11.—(i) Roots or rape ; (ii) wheat ; (iii) grass and clovers ; (iv) grass and clovers ; (v) grass and clovers ; (vi) grass and clovers ; (vii) grass and clovers.

In each case the grass lea can be varied (lengthened or shortened) according to the conditions associated with the farmer. In No. 8 provision is made for sowing the grass-mixture with the oats if soil

and climate permit, while No. 9 provides for seeding the mixture on rape ground or the ground properly prepared by the growing of a turnip crop liberally manured. This latter provision is also found in No. 10, designed for wheat areas not handily situated. In No. 11 the wheat crop is grown on land well prepared by the previous growing of turnips or rape. In these latter six- or seven-year rotations the manure required for maintaining the soil in good heart is also supplied liberally with the turnip or rape crop.

CONCLUSION.

The foregoing discussion of definite rotations suitable for New Zealand conditions is, of course, not to be regarded in the light of finality, for local differences in conditions sometimes cause marked variation in the required rotation. Nevertheless, these rotation systems embody the principles of rotation viewed from the standpoint of the general conditions prevailing in New Zealand in respect to arable land.

Finally, the writer would emphasize the fact that rotation of crops is the foundation of modern farming. The responsibility of maintaining that foundation rests upon present-day farmers individually and collectively.

SILVER-LEAF DISEASE IN FRUIT-TREES.

By W. H. TAYLOR, Horticulturist.

SILVER-LEAF or silver-blight is one of the most formidable diseases which orchardists have to encounter. Most diseases of fruit-trees can be controlled more or less effectively, though in some cases adverse weather conditions ake control very difficult. But up to the present time all efforts to find a cure for silver-leaf have failed.

It has been long known that the disease is caused by a fungus (*Stereum purpureum*), which is regarded as a wound parasite. The wounds by which the disease enters a tree need not be large; insect-punctures are considered to be sufficient. If this is true—and there is no reason to suppose it is not—it becomes abundantly evident how enormous are the risks of infection to pruned trees. The study of the working of the disease gives rise to many curious problems. For instance, why is it that in many instances the disease attacks the scion-growth on trees that have been headed down and reworked? This in some districts occurs with such pertinacity with worked-over apples that the system has practically been abandoned, while in other districts infection in this way is far less frequent. Some orchardists claim to have prevented infection by at once painting the scars so as to seal them up, and there is certainly warrant for the contention, whether it is wholly true or not.

Another instance of severe attacks occurs when peach-trees are headed down, the succeeding growths being attacked though the disease may not have been prevalent before. This, again, occurs in some districts and not in others. The problem remains whether the infection

is due to shock, caused by depriving a tree of its head and so destroying the natural balance between root and top, or whether it is caused by the large scars left uncovered. It is a matter on which there is no general agreement. About one thing, however, there is no room for doubt, and that is the deadliness of the disease once it gets a firm hold on a tree: it is bound to kill the tree in a few seasons.

It may be as well to refer here to another affection often mistaken for silver-leaf. This occurs on ornamental shrubs—rhododendrons, laurestinus, and many others. In these cases the appearance is due to insects sucking the chlorophyll from the leaves, leaving them whitish-looking but without the glassiness exhibited on fruit-trees suffering from silver-leaf. The insects responsible are most commonly thrips, but a species of red mite is sometimes responsible, and more rarely mealy bug. Instances of this have come under my notice.

Referring to the serious condition of plum-orchards in Britain due to silver-leaf disease the *Gardeners' Chronicle* of a recent date remarks as follows:—

There is no doubt but that this pernicious disease is increasing at a rapid rate. Not only is this the case, but it is also spreading to apple-trees; and although its progress on the apple is less swift than on the plum it is probably only a matter of time for the fungus (*Stereum purpureum*), which is the agent of the disease, to make itself as fully and as disastrously at home on this fruit-tree as it has done on the plum. For it is to be remembered that parasitic fungi have a considerable power of adaptation, and can gradually so organize their attack as to break down defences which for a time sufficed to offer a strong resistance to attack.

One factor which we are convinced from personal observation contributes to the spread of the disease is the slight regard which is often paid to the disease in its early stage. This, perhaps, is due more than anything else to the curious aspect of the silvered leaves. In that stage there is nothing to suggest the deadly nature of the attack; and, moreover, the next stage, in which the branch dies back, is often not associated in the mind of the grower with the first, silvery stage. If he cuts away the dead branch at all the grower often fails to cut it back far enough, and hence leaves the fungus to renew its attack. Even in the case of a dead tree which is cut down growers often omit to grub up the roots, and hence and particularly if the stock is the mussel plum, suckers are thrown up, every one of which is apt to be silvered, indicating that all unwittingly the grower has left a source of infection from which the disease spreads to other trees. Nothing short of a crusade against this pest will suffice to rid our orchards and gardens of it, and, much as we dislike "orders" and scheduling of pests, we are inclined to believe that steps in this direction will have to be taken before the disease can be brought under control. In the meantime, much can be done by spreading information as to the symptoms and mode of treatment of silver-leaf disease. For of all common maladies of fruit-trees it is the easiest to recognize, and drastic treatment in the early stage, when the disease is confined to a single branch, may often save the tree. Once the infection is general throughout the branches no remedy avails, and the only course is to leave the tree no longer to cumber the ground. Vigilance should be exercised, not only with respect to plum and apple trees, but also to other plants, since this disease is known to attack many different species common to gardens—among others, the peach and laburnum. Wherever found it should be treated surgically, for there is no known medical treatment which can be counted upon to effect a cure.

The practical man should have a sound working knowledge of economic insects, and consider that not only is he tampering with nature when he opens up virgin territory, but also that he cannot expect to fully develop his resources without forestalling the possible outbreak of any noxious forms.—*D. M.*

SHEEP AND THE HIGH-COUNTRY RUNS.

By H. T. TURNER, Fields Supervisor, Timaru.

It has been difficult to estimate the losses sustained through last winter's heavy snowfall in the high pastoral country of the South Island. Little could be known until after shearing, and even then the stragglers' muster has to be made before any accuracy can be arrived at. Those living on agricultural country where snow rarely, if ever, amounts to more than a passing inconvenience have little conception of the enormous difficulties and the harrassing anxiety experienced by those who occupy high country when a heavy fall of snow occurs, especially when it comes in the dead of winter and consequently with little prospect of an early thaw.

There has been a good deal of talk about cutting up the back-country runs. Indeed, a lot of the better class of pastoral country has already been cut up, with beneficial results to the country generally. But in subdividing the high and more dangerous class of country a good deal of judgment will need to be exercised. No doubt a good deal of the high country is capable of being cut up into smaller areas than it is at present, but at the best it can only carry a very scanty population. For nine months in the year the greater part of the back country may be considered safe for sheep, and the obvious suggestion would appear to be that the sheep should be brought down on to safe country during the three dangerous months. This is feasible to some extent, and is done by some runholders with regard to a portion of their flocks. But, unfortunately, the area of the high country is so large, and the extent of the low country available for additional sheep during the winter is so relatively small, that the transference of sheep from high to low country during the winter on anything like a wholesale scale presents what appears to be insuperable difficulties. Practically all that is done at present is to get the sheep as much as possible on to the lower or warmer faces before the winter sets in—and then hope for an open winter. A hundred acres of good turnips may represent more feeding-value than some thousands of acres of mountainous country, even when it is not covered with snow; but to bring merino sheep from high country down on to turnips would not improbably mean that they would starve in the midst of plenty. Merino sheep from the hills do not take readily to turnips, and yet it seems hardly likely that the present system will continue for all time without some modification.

Under the present system all that can be done after a heavy snowfall is to send out as many men as can be got together—generally an insufficient number—to get the sheep on to the sunny faces, where a certain amount of thaw may have taken place, or, at any rate, where the snow is likely to thaw first. This is what is generally known as "snow-raking," and most toilsome, tedious work it is, and at the same time most unsatisfactory to the owners of the sheep. The days are short, long distances have to be traversed to get at the sheep, and the frost at high altitudes when the whole surrounding country is all under snow is most intense. The sheep are sometimes frozen to the ground or to the snow in their camps.

It is a pitiful sight to go over country that has been devastated by an unusually severe fall of snow, after the snow has cleared away, and to come across the remains of sheep lying in their camps in tens, twenties, and even hundreds—knowing that the animals were probably some weeks in starving to death. It is not at all unusual to find that snowed-up sheep, in the stress of extreme hunger, have eaten the wool off each others backs. It is remarkable the length of time it takes to starve a merino sheep to death in the snow, providing that it is in good condition when the snow falls. After a week of starvation it will come out as fresh and lively as ever, and one hears occasionally remarkable accounts of the length of time during which sheep have been known to be absolutely without food and still survive.

The liability to loss from severe snow varies considerably in different parts of the back country. Some runs are much more liable to snow than others of an equal or even greater altitude, but much, of course, depends on the aspect. If a heavy fall of snow was a thing to be looked for every winter the present system of dealing with the high country could not continue; but our winters are very erratic. Take the Mackenzie country, for example; it is one of the coldest parts of Canterbury. Heavy snow falls every winter on the summits of the higher ranges, but the sheep are never left up there during winter. Below a certain altitude, however, there may be no destructive snow for several successive winters, as had been the case for the last eight or ten years, and there is therefore a great temptation to chance the weather. Seasons, good or bad, appear to have a tendency to run in groups; winter after winter may remain mild, but there are bound to be extreme weather conditions at intervals, and then the loss may be so great that it will take the profits of perhaps two or three good years or more to make it up. There are many instances in past experience where men with small capital have taken up back-country runs and have been set back for life by experiencing a heavy snowfall within the first couple of years.

It is a great question if there are any practicable means that can be taken to avoid or modify this serious trouble. The extent of our high back country is large, and it is important to the whole community, not only to the present occupiers, that it should be put to the best possible use, the matter being one for all time. There cannot be any question that merino sheep, or sheep containing a large strain of the merino, will always be the most suitable class of stock for the country under consideration. The runholders are very reluctant to incur any large expense in bringing the stock down to the low country every winter as a regular thing, but if it were customary to bring down a portion of the stock—say, the hoggets—much of the sweeping loss which occasionally takes place under the present system would be avoided. It is contended that as a lot of the runs have now been subdivided into smaller areas this will get over a certain amount of the trouble. But much depends how the country is divided. If one man gets most of the warm faces and another most of the back faces it would not tend to improve matters much. If modified conditions of tenure were given as regards compensation for improvements more might be done in the way of growing fodder for emergencies. The growing of different kinds of fodder—principally in the form of hay—should be gone in for more than it has been in the past, and a big supply would have to be kept

on hand ready for any contingencies. Even if the fodder is kept for three or four years it will come in all right in the long-run. This applies more especially to half-bred and crossbred sheep, also Romneys, which are being increasingly run on the high country. The aversion of merinos to any form of artificial feeding is well known.

CONCRETE FOR ROADS AND PATHWAYS.

By the Public Works Department.

CONCRETE for the formation of roads and pathways must be hard, strong, and solid, for the purpose of standing wear and distributing the load over the foundation. The foundation on which the concrete is to be laid should be, if necessary, consolidated by rolling.

The thickness of the concrete is determined by the nature of the traffic, varying from 8 in. down to 1½ in. If, however, the layer of concrete is to be as thin as 1½ in. the size of the large stones must be reduced to less than that specified hereafter.

The cement should comply with all the requirements of the British standard specification. As packed in New Zealand each bag contains 124½ lb.—that is, eighteen bags per ton. Cement weighs a little more than 90 lb. per cubic foot, but for ease of calculation and to facilitate memorizing it is convenient to adopt 90 lb. as the weight of a cubic foot. One bag of cement will therefore contain 1·38 cubic feet.

The sand must consist of sharp, angular grains of evenly graded sizes; such that the whole will pass through a riddle having holes ¼ in. square, and be retained upon a standard sieve containing 2,500 meshes to the square inch. It should be derived from hard, tough rock, and be perfectly clean.

The coarse material in the "aggregate" may consist of either broken stone or shingle, broken stone being preferred. The dimensions will vary, but the whole should pass through a riddle having apertures 1½ in. square in the clear, and be retained upon a riddle having apertures ¼ in. square in the clear. The stone must be hard, tough, and perfectly clean.

The materials are gauged by measure in the proportions of one of cement, two and a half of sand, and five of stone or shingle. They should be mixed together with a minimum quantity of fresh, clean water until they assume an even colour throughout, so as to provide for the concrete being placed in position and compacted with a moderate amount of ramming.

The foregoing specification will provide a roadway or pathway suitable for moderate traffic and restricted loads. If the wheeled traffic is likely to be heavy, then the surface will require protecting by a carpet of bituminous asphalt. If it is desired to omit the asphalt and rely upon the concrete, then a surface dressing of cement mortar consisting of one part cement and two parts sand should be applied.

It may be added that the whole subject of concrete roads is still under study, most of the work carried out up to date being of an experimental character.

PROPAGATION OF PLANTS.

METHODS IN REGARD TO CUTTINGS.

By W. H. TAYLOR, Horticulturist.

THERE is no plant that is not amenable to propagation in some way; it is a provision of nature that every living thing shall be capable of increase. In most cases plants increase with the greatest freedom, though that may occur only in their native habitat. It is said that every portion of a tree or plant contains all the necessities for the making of a counterpart of itself, but in very many instances the nature of the wood of the plant renders it impossible to cause such development.

In nature plants are mostly propagated by seed. Under artificial conditions resort must in many cases be had to other means. In some instances propagation can be carried out almost without limit in numbers by means of cuttings, which, after seed, is the most prolific mode of propagation. Other methods of propagation are by layering the branches; by division of the rootstock, as in the case of fibrous-rooted iris, perennial phlox, and many other herbaceous plants; by division of the tubers, as with dahlias, tuberous-rooted iris, alstromeria, and plants with like roots; by dividing the rhizomes, as with Solomon's seal; by increase of the bulbs, as with lilies, narcissi, and other bulbous-rooted subjects; by using leaves as cuttings, as is done with foliage begonias, sometimes tuberous varieties of begonias, and gloxinias; by budding and grafting—though these two operations are rather to preserve and increase varieties than to make a plant, for the plant must exist before either operation can be performed, and therefore neither budding nor grafting really effects an increase, though possibly this may be a new point of view. Lastly there is propagation by cuttings of roots—the best means in some few cases. There may be mentioned apple-tree roots to make stocks, some tecomas, *Ailanthus glandulosus*, many herbaceous plants, amongst them *Anchusa italica* and *Verbena venosa*, which are most easily increased in this way. Those lovely flowering-plants, bouvardias, are easily progagated by root-cuttings, and the greatest increase as well as the strongest plants are secured in this way.

PROPAGATION BY CUTTINGS.

To be successful in the general propagation of plants by cuttings some knowledge of the nature of the plant dealt with is necessary, also the theory of plant-growth must be understood. It must be recognized that top growth makes roots, not roots make top. The growth of a cutting proceeds in the same sequence as the growth of a seed. The seed-leaves appear before roots are made, and so it is with a cutting—roots do not begin to form until some top growth has been made. There may be some cases where this statement may appear to be open

to question, but investigation will show it to be right, and the statement stands.

Success in getting cuttings to root depends very much on the recognition of the truth just stated, for it is only by keeping life in the cutting until roots are formed that success can be attained. Cuttings that are struck in the open ground or in boxes without protection are mostly put in at a time when sun-power is low. Cuttings that take a long time to root cannot possibly succeed at any other time, because they perish for want of roots to supply them with moisture. Pelargoniums, which have fairly solid yet succulent wood which stores up a lot of moisture, are successfully struck early in the year—February—while the sun is hot, but besides their structure fitting them to bear heat without perishing they root quickly. But pentstemons would fail at that time, April being a better period for them. Cuttings of shrubby calceolarias should not be put out till May, when every cutting will root. And here an apparently curious thing may be mentioned. Delay putting in the cuttings till mid-June and the chances are they will fail; but if at that time they are planted in boxes and placed in a cold frame all will root. One need not look far for the reason. The plant loves cool conditions, and during hot weather it is only surviving; therefore cuttings separated from the plant while the weather is hot wither away at once. Take the cuttings in May and the cool conditions enable them to keep alive for some time without roots, which are not made until the days begin to lengthen and the weather becomes warmer. In the meantime the callus has formed; this prevents loss of sap, and roots soon come when the days lengthen. But put the cuttings in much later and the callus will not have formed in time to make roots before the weather becomes too warm for them to survive without roots. In a cold frame, however, the cuttings are protected from the weather and in a moist atmosphere which feeds the leaves, consequently they succeed.

This is the general principle which guides the propagator of plants by cuttings. Most trees and shrubs that are quite hardy have qualities that are strongly resistant to decay, and can survive without roots for a considerable period, provided the soil and atmosphere are both moist. Cuttings of these will root in the open air during the period of short days. The kind of cuttings, and the time of taking it is a matter of varying importance. In the case of the more difficult plants, such as heaths, success is impossible of attainment unless there is a full understanding on these points.

Many plants, such as the common fuchsia, can be propagated at any time when young growths are obtainable, though the means required vary according to the time of year. A little bottom heat is required in winter or spring, while a sheet of glass over the pot is sufficient during the summer months. These plants can also be increased by cuttings of older wood put out in the open ground, but the resultant plants are less vigorous than those from young shoots, which alone provide plants suitable for pot culture. Most hardy shrubs can be propagated by cuttings of fairly young compound tops made 8 in. to 10 in. long, the base cut square across just below a joint. Others will root only if smaller shoots are taken, and with a heel of the old wood. This is the case with conifers, most of which, other than the pines, root quite freely. In other cases it is necessary

to take the same kind of cutting—that is, with a heel, but before the growth is quite matured—"half-ripe" is the term used. *Clethra arborea* and *Choisya ternata* are instances of this. There are also other methods, chiefly economical, which need not be mentioned, as they are not conformable to conditions in this country.

SOIL FOR CUTTINGS.

Soil that will not set hard during dry weather nor run together in wet weather, and that will hold a fair amount of moisture in summer-time, is suitable for open-ground work. Light manuring is advisable if the soil is poor; most of the plants raised from cuttings in the open ground have to pass a year in the cutting-beds, and little growth would be made in poor ground. Cuttings of soft-wood plants that are struck in pots or boxes usually remain in them but a short time, and in this case the quality of the soil, apart from being mechanically right, is of very little consequence. When, however, the cuttings are a long time rooting it is almost a necessity to employ poor soil. The term "poor" here implies absence of manure or fertilizers rather than natural soil of the poorest description, though that description of soil would answer better than naturally rich soil. For cuttings struck in artificial heat soil ordinarily used for potting does very well, with the usual surfacing of sand, of course. For boxes intended for conifer-cuttings which will not be disturbed for a year anything of a perishable nature, such as leaf-mould, should be avoided. Fairly good and clean garden soil will answer, its quality not being of much consequence, as it will have a covering a good inch deep of sharp sand. For pot-work for shrub-cuttings which will occupy the pots for about a year the quality of the soil is of more importance; either good fibry loam or a mixture of loam and peat (when it can be got) will answer well. What is required is soil that will keep sweet as long as the cuttings remain in it. Very little top growth will be made in the boxes or pots, for the young plants are to be taken out when rooted and placed where they will make growth. As top growth will not be made to any extent richness of soil would be wasted. Moreover, the constituents which would make it rich would tend to make it sour. And equally important is the fact that plants make more roots in poor than in rich soil.

STRIKING CUTTINGS IN THE OPEN GROUND.

For the striking of cuttings in the open ground it is absolutely necessary to make the base of the cutting firm; soil must come in close contact with it and be trodden firm. The plan is to first dig a narrow strip, keeping a good trench open in front of the spade. When a sufficient width is dug to accommodate a row of cuttings draw a line along the strip clear of the trench. Then, holding the spade perpendicular, strike a straight wall along the line, the displaced soil falling into the trench. The depth to strike the wall depends on the length of the cuttings, which should be uniform. The cuttings are then placed along the line, their bases entering the soil deep enough to keep them in position. When a row is filled with cuttings a light spit of soil is dug against them and trodden firmly down. Then proceed to dig another strip, filling the soil up to the proper level as regards the tops of the row of cuttings, breaking all lumps and leaving

the soil in good tilth. Digging proceeds till there is room for another row. The line is then lifted and brought forward, and work proceeds as before.

Gooseberry and currant cuttings are put out in this way, as well as a great number of evergreen shrubs, such as euonymus, escallonia, eleagnus, and olearias. Speaking of escallonias, I am reminded of that fine autumn-flowering species *Escallonia montevidensis*. So far as I know, this species does not propagate at all freely from cuttings of the kind taken for the others, but small heel-cuttings inserted in pots and kept in a cold frame root freely. In practice hardy shrub-cuttings are set out at any convenient time from the middle of April till the end of August, and it appears to make little difference. The popular shrub known as "musk-tree" is an exception. I find that in the conditions of my own place it does not like to be long in the soil without roots, and dies; but rather long heel-cuttings put out in September root like pieces of willow.

METHODS WITH SOME WELL-KNOWN PLANTS.

Some brief details of methods of rooting cuttings of a few well-known plants will now be given.

Among the roses, hybrid perpetuals and most hybrid teas root freely if firm wood without branches is cut to lengths of about 8 in. and two-thirds of the length buried in the soil. The last week in April to the middle of May is the best time. Tea roses root with equal freedom, but with them compound sprays must be taken. Tear these off with a heel of old wood, lightly trim the tops, bury them rather deeply, and nearly all will root.

Many shrubs, of which *Clethra arborea* and *Choisya ternata* are types, can be freely propagated by taking heel-cuttings early in April. Insert them in pots surfaced with sand, water well, and place them in a cold frame.

With daphne, take heel-cuttings about 3 in. long about Christmas, bed them fairly close together in boxes in free sandy soil, water well, allow the surplus water to drain off, place the boxes in a close frame in a greenhouse, and ventilate for a few minutes daily. Be careful not to give water except it be actually needed.

Regarding erythrina (coral-tree), my experience is that the old wood will not make roots. Cut pieces of firm shoots of last year into lengths of 12 in. or so, lay them flat on a box of soil in a hotbed, doing this at any convenient time early in spring. Side shoots soon spring from them, and these can be cut off with a little bit of the old bark and used as cuttings; they soon root in the hotbed, from which they must be gradually hardened off.

Clematis of the garden species will root from cuttings of the young shoots when ripe, but a departure from ordinary methods of cutting-making is necessary. The usual plan is to cut just below a joint. If a clematis-cutting is so made it makes such a large callus that roots cannot get through. Leave from ½ in. to ¾ in. of internode and no callus will be formed; roots will come from the joint. I know these plants are usually raised by grafting, but there is a very strong crusade now being carried on in England against that method, great numbers dying, it is claimed, through being grafted. They are also raised by layers.

Passion-flowers of the flowering species are readily rooted in a close frame in a greenhouse. The long vines may be cut into lengths of two joints, the lower to be trimmed to form the base, the other forming the top. Place the cuttings as close as they will go in 5 in. pots. Any time of the year is suitable.

For diosma the style of cutting usually employed is young tips during summer. A better way is to wait till April, then take small sprays about 3 in. long, each with several branches, tearing them off with a heel of the older wood. Insert these close together in boxes surfaced with sand, water well, and place in a cold frame, or in a sheltered position outside where they will not get too much rain. Remove them to a greenhouse or frame when winter sets in. Smaller cuttings, just single shoots, also with a heel, will root, but they must be kept under shelter, and require a little more skill.

Cuttings of heaths are made about 1 in. long of the last growths. Use 7 in. or 8 in. pots with a good amount of drainage—crocks in the bottom, coarser in the next layer, finishing with finely broken brick or potsherds; blind with old sphagnum, coconut-fibre, or fibre from loam. Fill the pots half-way with drainage material, and fill up to within an inch of the top with clean sandy peat or loam, surfaced with clean silver-sand. The cuttings are usually made with a small pair of scissors, cutting just under a joint, and carefully removing a few of the lower leaves. The cuttings may be placed as close together as they will go without actually touching each other. After the pot is filled with cuttings water through a fine rose. Let the water drain off and the cuttings dry, then cover with a sheet of glass. It was formerly the custom to use bell glasses, but propagators now prefer a sheet of glass. When bell glasses were used they had to be wiped out every day to dry them. The sheet of glass has merely to be turned over—a great saving of time. The cuttings are inserted so that their tops are just clear of the glass. The cutting-pots are stood on a bench in the greenhouse, not in a propagating-frame. The time for taking cuttings necessarily varies; growth must be in a certain condition or they will not succeed. The months of September and March are periods when most cuttings are taken. Cuttings must be well ripened; soft fleshy growths will not root. The thing of most importance is that the growth of the shoots taken must be finished. If the leaves at the top look soft and are bunched together they are not ready. When ready the leaves on the point of a shoot are distinctly separate and fully formed, and their colour is uniform with that of the rest of the leaves.

The time for boronias is the month of March. Cuttings about 1 in. long are prepared as with heath-cuttings, but with the extreme tip nipped off. Strike in a frame in a greenhouse. Every day just raise the light and close it; this will effect a change of air and is all that is wanted in that way.

Cuttings of young bouvardia-shoots root readily in a little artificial heat. A more prolific source of increase, and one that requires less skill, is by cuttings of the roots. In early spring lift a plant from the ground or knock it out of a pot, as the case may require. Remove all the soil from the roots and cut off as many as may be required; those that are as thick as a lady's hairpin will do, but a little thicker will answer as well. Cut the roots into ½ in. lengths. Seed-pans are handiest to put them in, but shallow boxes will answer. Fill the pan

with light sandy soil and lay the pieces of root flat upon the surface, keeping the pieces just clear of each other. Just cover the pieces of root with fine compost and place in mild bottom heat—a hotbed answers well. The young plants will break through in about a fortnight, the time they take depending on the amount of heat. When they are strong enough, which will be before many days have passed, prick them off into boxes and return to heat. The plants so raised usually have several stems, and soon make fine plants, the after-treatment being to pot them up and gradually harden them off.

Carnation-cuttings—"pipings" they are termed—can be rooted at any time of the year provided the means are adapted to the weather. In spring-time they can be rooted on a hotbed or in a propagating-case in a heated house. During summer the process is carried out under hand-lights or bell glasses in the open ground, selecting a spot sheltered from the midday sun; the soil should have a covering of sand. In autumn, when sun-heat is not strong and the soil is moist, they will root anywhere in the garden (or better in boxes) in a semi-shaded position, but plants so raised are slow in growth and do very little the first year. Pipings are made from flowerless shoots taken off where the substance is firm. Remove a few of the lower leaves and cut square across just below a joint; cut off the tops of the grass, but be careful not to injure the young grass breaking up in the centre. Layering is the best way to propagate carnations, layers providing strong plants straightaway. For layering clear away a few leaves from the base of a shoot, then with a sharp knife make an incision on the under-side, starting just below a joint. Taper the knife in till it reaches near the centre of the shoot, carrying it upward for a little more than ½ in. Peg the layer firmly into the soil, making the grass stand nearly perpendicular, which will keep the cut open. Pegs may be made of wire in the form of a lady's hairpin, but thicker, or, which is much better, from the ripe fronds of bracken-fern. Layers root in four or five weeks. They should be then lifted and planted in nurse-beds where the soil is of a free nature. When speaking of pipings it was said that the tops of the grass must be cut off. This is done to stop their demand for sap, which there are no roots to supply; the young leaves in the centre are sufficient to promote the formation of roots. But on no account cut the grass on layers; the half-divided stem is able to support it, and it effects a rapid formation of abundance of roots. If the grass were cut, nearly all the advantage of layering would be lost.

Pinks—near relatives of the carnation—are easily propagated in autumn by tearing off the shoots with a heel of old wood, bedding them closely in boxes of garden soil with a good surfacing of sand, well watering, and standing in a semi-shaded position sheltered from strong wind. Practically every piece will root.

Milk-products Investigation.—The officer of the Dairy Division selected to visit the United States and Canada for the purpose of acquiring first-hand information regarding the preparation of milk-products, such as milk-powder and sugar of milk, is Mr. W. Dempster, Dairy Instructor, Hamilton. Arrangements have been made for Mr. Dempster to leave for America in April.

THE SCIENCE CONGRESS.

AGRICULTURE WELL REPRESENTED.

THE first Science Congress of the New Zealand Institute was held at Christchurch from 4th to 8th February, under the general presidency of Dr. L. Cockayne, president of the Institute. The formal opening was performed by the Governor-General, Lord Liverpool; the Minister of Internal Affairs, Hon. G. W. Russell, also addressed the gathering.

The Congress, which was well supported as regards attendance, papers, &c., was organized in four sections, representing (1) Biology and Agriculture, (2) Geology, (3) Chemistry, Physics, and Engineering, (4) General. Plenary sessions were held as required. Evening public meetings were also held, at which popular addresses on various scientific subjects were given by leading authorities. All meetings were in the Canterbury College buildings.

Dr. C. J. Reakes (Director-General of the Department of Agriculture) and Hon. G. M. Thomson, M.L.C., were elected president and vice-president respectively of the Biology and Agriculture Section, with Dr. F. W. Hilgendorf (Lincoln College) and Dr. C. Chilton (Canterbury College) as honorary secretaries. The prominent position which this section occupied in the Congress proceedings may be noted with satisfaction as befitting the predominance of agriculture in New Zealand.

Contributed papers of direct agricultural interest included the following: "Agriculture's Debt to Science," by Sir James Wilson; "Control of Transmissible Animal-disease in New Zealand," by Dr. C. J. Reakes; "Yellow-leaf Disease in *Phormium tenax*," by Dr. L. Cockayne and Mr. A. H. Cockayne; "Plant-breeding," by Dr. F. W. Hilgendorf; "Control of Succession in Surface-sown Grassland," by Mr. A. H. Cockayne; "Cold Storage in relation to the Fruitgrowing Industry," by Mr. E. G. Loten and Mr. W. C. Morris; "Seed-testing in New Zealand," by Mr. E. B. Levy; "Nitrification in relation to the Calcium-carbonate Content of Canterbury Soils," by Mr. L. J. Wild; "The Status of Entomology in the Economy of the Dominion," by Mr. D. Miller; "Compatibility of Spray Mixtures," by Mr. W. C. Morris; "Die-back and Bud-dropping Diseases of the Peach and Nectarine," by Mr. G. Brittin; "Need of a Comprehensive Dominion Herbarium," by Mr. D. Petrie. Dr. Cockayne's opening presidential address also made reference to several agricultural subjects in relation to science. Papers were contributed in the General Section on "Afforestation in New Zealand," by Mr. W. Skinner, and "Forestry in High Country," by Mr. W. G. Morrison.

Among excursions made by the Congress was a numerously attended one to the Canterbury Agricultural College at Lincoln, where the visitors were shown over the farm by the Director, Mr. R. E. Alexander, and Dr. Hilgendorf.

Resolutions of the Congress having a direct bearing on agriculture included the following: That the Government be urged to pass a Pure-seeds Act; that a soil survey be undertaken as soon as possible; that

the Government be asked to introduce legislation to provide for the purity and standardization of spray compounds; that a New Zealand herbarium be established in Wellington.

The arrangements for the meeting of the Congress had been entrusted to the Philosophical Institute of Canterbury, of which Professor C. C. Farr is president and Mr. W. Martin honorary secretary. Mr. Martin, who also carried out the multifarious duties of general honorary secretary to the Congress, holds the position of Agricultural Instructor under the Canterbury Education Board.

The Congress, which may be recorded as a distinct success, cannot fail to give a stimulus to science and applied science in the Dominion, and the New Zealand Institute will doubtless feel encouraged to hold similar gatherings at periodical intervals in future.

TEACHERS' FARM SCHOOL AT RUAKURA.

ANOTHER successful farm school for teachers was held at the Ruakura Farm of Instruction, from 20th to 24th January. The school followed generally on the lines of last year's initial gathering, being organized under the auspices of the Auckland Education Board by Mr. J. P. Kalaugher, Supervisor of the Manual and Technical Branch, in co-operation with the Department of Agriculture. Forty-five men and seventeen women teachers attended throughout the course, and many others visited the school. The course of lectures and demonstrations included the following:—

By officers of the Department of Agriculture:—Lucerne and other Forage Crops; Shorthorns and Jerseys (A. W. Green, Manager, Ruakura Farm of Instruction): Lime and Experimental Work at Wallaceville (B. C. Aston, Chemist): Pastures (A. H. Cockayne, Biologist): Plant-propagation; Shelter Hedges (W. H. Taylor, Horticulturist): Diseases of the Cow; Dissection of the Cow (W. T. Collins, Veterinarian): Herd-testing; Dairy Sanitation (W. Dempster, Dairy Instructor): Orchard Work (L. Paynter, Orchard Instructor): Poultry (C. Cussen, Poultry Instructor): Potatoes; Plant-breeding (J. Beverley, Assistant Agriculturist): Bees (A. B. Trythall, Apiarist, Ruakura): Kitchen-garden (T. B. Roach, Horticultural Overseer, Ruakura).

By Education Board's Instructors in Agriculture:—Weeds and Farm Crops; Lime (R. P. Connell): Farm Crops; Manures (F. R. Callaghan): Insects (J. J. Stevenson): Dairy Science (W. Hudson).

By Inspectors of Schools:—Correlation of Nature-study and Agriculture with other School Subjects (N. R. McKenzie); School-garden (N. T. Lambourne); School Agriculture and the Farming Community (J. W. McIlraith); Rural Course Work in the District High School (M. McLeod).

Addresses were also given on "Beef Cattle *versus* Dairy Cattle," and "Friesians," by Messrs. R. Reynolds and C. C. Buckland, of Cambridge, respectively. An auxiliary evening programme at Hamilton included demonstrations in fruit and vegetable bottling by Miss A. B. Juniper, Organizer of Domestic Science under the Education Board.

Due time and opportunities were afforded the participating teachers to view the whole range of the many-sided Ruakura establishment and its seasonal operations (or such sections they were specially interested in) for observational purposes. Several improvements in organization and method suggested by last year's experience were given effect to with good results in connection with this year's school.

The school was brought to a close by a social gathering at the homestead, on the invitation of Mr. and Mrs. A. W. Green, when about 125 persons were entertained to afternoon tea.

RUAKURA HOMESTEAD (REAR VIEW).

The French Mission and New Zealand Agriculture.—During the stay of the Mission in the Dominion special measures were taken by the Department to well acquaint the agricultural representative, M. Henri Corbière, with our agriculture in its various branches. A series of visits to representative farms, breeding establishments, &c., chiefly in the Wellington and Canterbury Districts (owing to the limited time available), was arranged, Dr. Reakes, Director-General of Agriculture personally accompanying M. Corbière on most occasions. Special written information was also prepared by the Department for M. Corbière and the Mission generally.

Injurious Insects in New Zealand.—Our injurious insect fauna is comprised not only of exotic forms but also of some indigenous species which have forsaken their natural food-supply for the more succulent products of the settler. Of these insects 82 per cent. are exotic and only 18 per cent. indigenous. Most of the former originated from Europe, and a few from Australia, North America, Pacific islands, and South Africa. The greatest number are orchard pests, but are held in check by rigorous spraying methods; about 22 per cent. affect live-stock and man, but cause no appreciable loss in New Zealand; stored products and household goods are attacked by about 21 per cent. Field and vegetable crops are damaged by about 19 per cent., and, although this is the smallest group, the greatest loss probably occurs amongst these crops, due, perhaps, not only to there being no legislation necessitating the control of these insects as in the case of some of the other groups, but also to the comparative absence of information regarding them.—*David Miller, Entomologist.*

SHEEP-DIPPING POINTS.

SHEEP-DIPPING, properly carried out, repays its cost many times over. Dipping not only improves the condition of the wool, but it stimulates a healthy action of the skin, and consequently increases the rise of yolk and the weight of the fleece.

Whatever dip is used, carefully follow the directions accompanying it. These directions are arrived at after years of careful study by the manufacturers, and are not given to be improved upon at the discretion of the users.

Dip at least twice a year. Ewes and lambs may be dipped with a non-poisonous dip after the ewes are shorn. Another dipping with a poisonous dip about two months after shearing may be sufficient for the ewes ; but the lambs (hoggets) should be dipped twice in the autumn, first with a non-poisonous dip, and then with a poisonous dip, and not less than fourteen days nor more than a month should intervene between the dippings. The whole flock should be dipped twice similarly, with the exception of the ewes dipped off the shears, for which one autumn dipping with a poisonous dip may be found sufficient.

Care should be taken to immerse thoroughly. Keep the crutch going. The time in the bath should be one minute.

Do not dip ewes immediately before putting to the ram. Several weeks should intervene.

Dip when the sheep are in a normal condition, the wool dry, and the weather mild.

Dip rams early. On no account should they be dipped after they are in condition for the season.—*J. L. Bruce, Assistant Director, Live-stock Division.*

The French Mission at Ruakura.—A very interesting visit was paid to the Ruakura Farm of Instruction by the Mission while in the Waikato district. After entertainment at the homestead the visit was permanently recorded by the planting of a kahikatea tree by General Pau, at the top of the drive. Conducted by Mr. Green, Farm Manager, the party was then driven round the principal points of interest on the farm, which made a very fine showing in crops, pastures, stock, &c. The round concluded at the apiary, where the charming rural scene drew exclamations of delight from the visitors. Opportunity was given M. Henri Corbière, agricultural representative on the Mission, to inspect a good deal of the purebred live-stock on the place. M. Corbière, who is a keen authority, expressed himself as extremely pleased with the stock and farm in general.

Quarantine of Dogs.—The regulation concerning the quarantine of dogs imported into New Zealand from the United Kingdom has been amended by increasing the quarantine period from sixty days to six months, such time to include the period from the date of embarkation of the animal in Britain to its removal into quarantine in the Dominion. The amendment came into force on 6th February.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE mid-season crops of apples and pears are now ready for harvesting. For some months past the orchardist has been concerned in the raising of the crop, spraying, thinning, and other matters having been earnestly attended to with the one idea of bringing it to perfection. Following this comes the problem of marketing, the importance of which cannot be too much stressed, as upon it depends the financial position of the orchardist. In the larger districts growers are fortunate in having established fruit companies to deal with this question.

The Hawke's Bay companies have been established some time, and are doing really good work. Dunedin and Auckland have also co-operative distributing companies, and with the experience gained last year growers may expect to have their products put up in the most attractive manner and disposed of to very good advantage. A similar company has been formed and is operating in Canterbury this season.

The marketing situation in the Nelson District is perhaps more difficult, but one in which there is every prospect of success. The Nelson co-operative company has been fortunate in securing the services of Mr. D. H. Rundle, who has had experience in these problems both in America and Tasmania. Mr. Rundle's services in marketing should be of great value not only to the Nelson District but also to the industry throughout New Zealand.

Local growers will no doubt welcome the appointment of Mr. W. T. Goodwin, Orchard Instructor, Dunedin, to the Motueka end of the Nelson District. It has been recognized by the Department for some time that one officer could not carry on the work with justice to himself and the district. The services of Mr. Hyde are still available to the growers on the Nelson side.—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

March may be regarded as one of the busiest periods of the year. All hands will be engaged in harvesting and marketing the crops. The most important operations to be performed during the month may be summarized as follows:—

(1.) Continuation of sprayings on pip-fruits for the control of codlin-moth, leaf-roller, &c., also black-spot, and brown and bitter rots; on stone-fruits for brown-rot; on citrus fruits for scale and thrip; and, in cases where not already carried out, bordeaux, 4–4–40, may be applied for control of verrucosis.

(2.) Harvesting of fruit as maturity is attained.

(3.) Maintenance of sufficient cultivation.

(4.) Continuation of removal of shoots on tree-stumps of this season's grafting.

Should infection from brown-rot appear on peaches, nectarines, or plums which may be detected from time to time, the fruits should be immediately removed from the trees and destroyed by burning or burying. No rejected fruit should be allowed to remain about the packing-shed, as this is very frequently the means of spreading the spores to clean fruit passing through the shed.

In the case of pears, more especially younger trees up to seven and eight years, being attacked by the insect pear-leaf-rolling midge (*Dasyneura piri*) on this season's growth, growers are advised to remove all infected parts and destroy them by burning; also spraying the trees with nicotine sulphate, 1–800 or 1–750, or with kerosene emulsion, 1–15.

Citrus trees affected with scale or thrip should be sprayed now with red-oil emulsion, 1–40, provided the trees have not commenced young autumn growth, which in many localities this season will be rather irregular.

Spraying for the month generally is recommended as follows:—

Peach, nectarine, and plum: Commercial lime-sulphur, 1–125, or self-boiled, 8–8–50—as fruits commence to ripen and further as circumstances demand.

Apple, pear, and quince: Commercial lime-sulphur (33° tests), 1–100, in conjunction with arsenate-of-lead paste, 1½ lb., or powder, ¾ lb., to 50 gallons water—every twenty-one days.

Lemon and orange: bordeaux, 4–4–40—if not already applied when blossom petals have fallen from main-crop flowers; red-oil emulsion, 1–40—when a minimum of young growth is showing.

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

HAWKE'S BAY.

Very little can be added to my last month's notes for the control of orchard pests and diseases. Spraying for codlin-moth, leaf-roller caterpillar, and leech must be continued right through the month of March, as much fruit is often wasted by neglecting to spray late in the season. Keep woolly aphis well under control; spray a second time if this has not been already done.

Further sprayings for the control of fungus diseases will depend largely on the weather. Always anticipate trouble following any wet spell, and thereafter keep a sharp lookout for black-spot development. Spray even if the infection is the size of a pin's head. Spraying for powdery mildew, plum-rust, and fungus diseases of stone-fruits should be followed up.

The compounds and strengths indicated in last month's notes are recommended for the control of both insect pests and fungus diseases.

—G. Esam, Orchard Instructor, Hastings.

NELSON.

Cultivation: With the autumn rains and the busy picking-time, oppor unities to cultivate the soil when in proper condition are few and far between. Indeed, where cultivation has been thorough during summer less cultivation now will allow the young wood and fruit to ripen better.

Liming: Lime may be applied at this season with great advantage. Applied at the rate of 1 ton to the acre and harrowed in, it becomes assimilated during winter. Stone-fruit trees particularly require this dressing; a lot of fruit-dropping experienced in spring would be avoided if the application were made. It should be broadcasted over the whole area between the trees.

Cover-crops: With lessened cultivation the natural weeds will grow unless a cover-crop is planted. Should the soil possess plenty of humus and no troublesome weeds the latter will do no harm but, on the contrary, some good, specially on hilly country subject to scouring by winter rains. In other cases a cover-crop should be grown to feed the trees and smother troublesome weeds. The following cover-crops are grown successfully in Nelson orchards: Red clover, lupins, vetches, peas, white mustard, and oats. The legumes—red clover, lupins, vetches, and peas—require the land to be in good heart and well provided with lime; they should be sown without delay: blood-and-bone and superphosphate, about 3 cwt. to the acre, is a suitable manure on land that has been limed. Oats make a good and cheap cover-crop; they may be sown later than the legumes; the variety known as Algerian is rust-resistant and very suitable generally for the purpose. White mustard as a cover-crop has the advantage of being cheap and very quick-growing; under some circumstances it comes in very useful.

Spraying: Pip-fruits will require further applications of arsenate of lead to keep them clear of leaf-roller caterpillar. Black-spot fungus sometimes makes its appearance during March; an application of lime-sulphur should be made as soon as it is detected. The campaign against woolly aphis should be carried out energetically at this season, which is the most effective period of the year. Kerosene emulsion or Blackleaf 40 make good washes; if the latter is used alone the soap ingredient should not be omitted. After the apples are picked red-oil emulsion, 1–50, is excellent for control. Whatever spray is used, results are chiefly due to the *thoroughness* of the application.

Stone-fruit trees affected with fungus blight of any kind are much improved if sprayed after the fruit is gathered with bordeaux 2–3–40.

Raspberry, black-currant, and strawberry plants require spraying with bordeaux, 3–4–40, as soon as the crop is gathered. The prevalence of leaf-spot makes bordeaux-spraying a necessity.

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

OTAGO.

The weather during January was about the worst experienced in the memory of the oldest fruitgrowers in the district, consequently orcharding operations have been very much interfered with.

Black-spot is still persisting, especially on apples. Even where the fruit is not affected there is a good deal of infection on the foliage, which, if favourable conditions continue, will be transmitted to the fruit during February and March, and even up to ripening-time, especially on the Cleopatra variety, and to a lesser extent on Delicious, Sturmer, and others. Mildew is also giving trouble and spreading very rapidly. Continue the applications of lime-sulphur, 1–120; Cleopatra will stand 1–100. Combine Blackleaf 40 where woolly aphis is present.

Up to the time of writing red mite has not been noticed, no doubt the wet season having kept it in check, but there is still time for the pest to become troublesome. If so, spray with lime-sulphur as for the previously mentioned diseases or, as an alternative, atomic sulphur, 10 lb. to 12 lb. to 100 gallons.

Brown-rot so far has not made its appearance, but may do so in later varieties of peaches. Rust is becoming prevalent. Use lime-sulphur, 1–130, on peaches, plums, and nectarines, and repeat the treatment in later varieties, as the fruit is liable to be small, especially the Muir peach, where rust gets a good footing. The treatment for brown-rot is the same as for rust. Self-boiled lime-sulphur, 8–8–50, has given good results. Atomic sulphur, 10 lb. to 12 lb. to 100 gallons, is also recommended as a remedy.

There is evidence of neglect on the part of some growers in regard to pear and cherry slug. Development of fruit-buds and growth are retarded if the trees are allowed to become defoliated. Spray with arsenate-of-lead powder, ¾ lb. to 50, or paste, 1½ lb. to 50, gallons. Codlin-moth still requires attention, late apples being liable to infection. Early apples and pears are showing signs of grub, and several small lines on the market have been condemned and destroyed. Pick and destroy affected fruit at the orchard. Spray with arsenate as previously recommended.

Summer pruning can be carried out this month on all fruits. Get rid of the heavy growth inside the apricot and peach trees where it is excessive, so as to give the spurs and twigs a better chance to ripen up.

Budding can still be done. Choose well-ripened buds for this work, and in the case of apple-buds be sure they are free from woolly aphis.

A word about marketing: Keep the fruit picked up to time, though not too green. Avoid putting in stone-fruits overripe; grade to the standards set forth, and pack to the best advantage either in trays or cases according to quality, and discard diseased fruit. Instruction in the best packing methods is obtainable on application.

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

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

CULLING THE HENS.

It should be needless to remind readers that March is the best month to detect and cull out the hens not worth keeping for another year. Even in normal times when food was cheap heavy culling was necessary if a good profit was to be made from poultry. At the present price of food, however, it is imperative that no hen be retained on the place unless she is showing a profit, or is likely to do so in the near future.

Some poultry-keepers prefer not to market their cull hens until after they have moulted, as with their new plumage and a better appearance they command a higher price. This is a short-sighted policy. True, a few pence more per head may be obtained for the birds, but the extra food eaten during the moulting-period will probably cost double the increased market value received. There is another point—the culls are occupying space which could be given with advantage to the producing stock.

In the work of culling a good guide to distinguish the money-makers from the drones is to observe the time of moulting. It will usually be found that the hens which moult first are the poor layers and the weakest-constitutioned birds in the flock. Therefore these should be discarded and the late moulters kept for laying and breeding purposes. When culling on this principle individual conditions should always be kept in mind, especially in regard to the time the birds were hatched out, for it is obvious that the very early hatched bird will moult in advance of one brought out on the late side.

There are other signs indicating that a hen is going to take a long period of rest, such as loss of bloom and shrinkage of the comb, also a shrinkage of the abdominal region until the breast-bone comes into proximity with the pelvic bones. The latter also contract until the width between them will not admit more than one finger. In the case of yellow-legged breeds, such as Leghorns, Rocks, &c., the paleness or otherwise of the shanks and beak at this time of the year affords a good guide for detecting the heavy layers from the drones. With the heavy layer both the shanks and beak will have a well-bleached—in fact, white—appearance, while those of the drones will be a rich yellow. It must be remembered that this only applies towards the end of a laying season, as even with the best layers in the flock the shanks and beak will regain a rich yellow colour after they have gone through the moulting process. Especially does this apply where the birds are running on damp land or well-grassed runs. Of course, during the pullet stage all birds of the breeds mentioned should have yellow shanks, as any other colour indicates that they are not standard bred.

In culling a flock the wise poultryman does not let sentiment exist. He always keeps in mind the food bill—the most serious factor in the business. He not only culls all hens that have passed their second season of production (except, of course, a noted breeder), but he also culls hard the first-season layers. It should never be forgotten that after the first laying season a hen's value as a layer lessens, and that after the second year she may be fruitful but will seldom pay to keep. Many hens die in debt to their owners because they have been kept beyond their time of usefulness, whereas if they had been culled at the right time they would have shown a good margin of profit over their keep.

THE BREEDING COCKERELS.

On the majority of plants a rough selection will already have been made from the early-hatched cockerels, with a view to maintaining on the plant the best specimens for future breeding purposes. This is how it should be, for it is seldom that a late-hatched bird proves to be a desirable sire. In making the final selection of the birds previously set apart the greatest care should be experienced to choose only those that

give evidence of developing a good-sized frame combined with constitutional vigour. The chief signs indicating good health and vigour are a bold, bright, clear eye, tight feathering, a deep body, a well-developed crop, short strong shanks (the bone to be flat), and the legs set wide apart. The ideal breeding male should be active in his habits and carry himself in a proud manner. No male should be selected for the breeding-pen that is lacking in these important points.

Each bird should be carefully examined for breed defects, as these are apt to be reproduced in the progeny, and probably in an exaggerated form. Never breed from a cockerel that has matured at a very young age. These are usually pleasing to the eye when young, having a well-developed comb, well-furnished plumage, and a sprightly appearance. Such birds seldom or never grow to a desired size, and are more like bantams than the breed they represent. Obviously they will produce stock of poor quality. As a rule, the cockerel that makes the best sire is somewhat ungainly in appearance during the growing-stage, and does not catch the eye so readily as his more precocious brothers.

A common mistake made, even by those who realize the importance of breeding only from robust stock, is that after choosing the best cockerels they later are placed in too-confined quarters, such as a small run, coop, &c. This means that they become overforced, like hothouse plants, which not only weakens the constitution but brings on leg-weakness, abnormal development, and falling-over of the comb, as well as other serious troubles.

The careful breeder who is intent on raising the productive capacity of his flock pays special care to the selection and management of the cockerels intended as future stock birds. He is guided by the sound principles upon which the successful breeding of all classes of stock rest. The A B C of this is that "like produces like," and that no trouble is too great to have the right class of stock in the breeding-pen. It is advisable in poultry-keeping to neglect no detail in regard to exercise, cleanliness, proper feeding, and general management, but with the cockerel intended for next season's breeding-pen this attention to detail is imperative.

THE APIARY.

By G. V. WESTBROOKE, Apiary Instructor.

BEEKEEPERS should be optimistic, always expecting a good crop. It is better to have a good supply of spare supers and combs, even if not required, than to experience a shortage during a good flow of honey. If, however, the beekeeper should find the bees filling up the supers and brood-nest and have no spare combs, he must keep the extractor going continuously to cope with the supply, replacing the wet empty combs on the hives at night in order to avoid starting the bees robbing.

In districts where there is a variety of flora from which honey is obtained it is advisable to keep separate the different extractings, marking the tins accordingly. This is necessary where two or more colours or grades of honey are obtained.

REMOVING HONEY FROM THE HIVE.

Beginners should be careful to remove only well-ripened honey for extracting. The bees are the best judges of this; they seal the cells of ripe honey only. The beekeeper should therefore see that not less than three-quarters of the comb is capped over before attempting to extract. Some beekeepers try to save the bees the trouble of capping over the cells by extracting the honey while "green." This practice is not recommended, and can only be carried out by experienced beekeepers, and then only in hot, dry climates.

If the atmosphere is inclined to be damp, honey will quickly take up moisture. Under such conditions it is advisable to tin it off as soon as it is strained. Honey being more easily extracted when warm, it is better to leave it on the hive until one is ready to extract. In order to handle it as expeditiously as possible it is advisable to have two persons doing the work. If done systematically they can move more honey in much less than half the time one person would take. One person takes the barrow on which is one or more empty supers, and manipulates the smoker and bee-brush. The other has the hive-tool, and removes the combs one by one, giving each a vigorous shake in front of the hive to dislodge the adhering bees. He then hands the comb to the one in charge of the barrow, who brushes off the remaining bees and places it in the super. When sufficient has been obtained to keep the extractor going for several hours both return to the honey-house to commence extracting.

Where only one person is available to remove the honey he should use a cloth to cover over the combs on the barrow. It may be damped with water containing a weak solution of carbolic acid; this will assist in keeping away robber-bees. Where the supers contain well-spaced frames of fully capped combs an easy method of removing the honey is to pour a few drops of crude carbolic on the fuel in the smoker, taking the precaution of seeing that it is first well alight. The carbolic fumes mingled with the smoke will quickly drive down all the bees from the top super. It can then be removed bodily from the hive and placed on the barrow. This method is recommended where one person is doing the work.

TESTING HONEY FOR RIPENESS.

Before tinning off the honey make certain it is ripe. There should not be much difficulty about this where combs were well sealed over. The only certain way of ascertaining if the honey is ripe is to test it with a hydrometer. If on testing with a Twaddles No. 4 hydrometer the instrument does not sink below 84 it indicates a well-ripened honey. This is equal to a specific gravity of 1·42, the test being made at a temperature of 60° F. As the temperature of honey in the summer rarely sinks so low, the test may be taken at 70° or 80° by adding 1 point to the hydrometer-reading for each 10° of heat over 60°. Thus, if the hydrometer sinks to 82 at a temperature of 80°, it would register 83 if taken at 70°, and 84 if taken at 60°. To arrive at the specific gravity multiply the hydrometer-reading by 5; thus $84 \times 5 = 420$; add 1 for the gravity of water and it will equal 1·420. This method is only reliable up to a temperature of 90°.

TESTING THICK HONEY.

Sometimes honey is so dense that the hydrometer will not sink. When such is the case take equal parts by volume (not weight) of honey and water, mix thoroughly, test with a No. 2 Twaddles hydrometer, and then multiply the result by 2. This will give the same result as if taken with a No. 4 instrument by the direct method. Thus, if the No. 2 instrument sinks into the honey and water to 42, this multiplied by 2 = 84. Perhaps the quickest and simplest method to test thick honey is to have a deep glass or beaker on which is a mark to contain about 4 oz. of water. Fill up to the mark with water, then pour it into another vessel; now fill up to the mark with liquid honey, add the water previously measured, and mix thoroughly; then place in it the No. 2 hydrometer, note the number to which it sinks, and multiply by 10; place the decimal point before the result, and add 1. Thus, if it registers 43, 43 × 10 = 430; place the decimal point before the 430 = ·430; to this add 1, which is the specific gravity of water, the result being 1·430.

EXPORT CASES AND TINS.

Honey is worthy of being put up in good containers, therefore new tins should be procured. As these are now available, do not be content with benzine-tins. See that tins are free from nail-holes or faulty soldering. Weigh the cases and tins, and note same in order to arrive at the net weight of the honey. Fill the tins to hold as near 60 lb. as possible. Do not fill them to the top; honey coming in contact with the raw edge of the iron at the inlet is liable to set up a chemical action, leaving a black precipitate. As the export regulations prohibit more than 120 lb. net in a case, do not put more than 60 lb. in each tin. Store the honey in a dry place until it has granulated hard; do not send it to the grading-store while liquid or soft.

VITICULTURE.

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

THE COMING VINTAGE.

THE weather up to the present has not been such that we can look forward to an early ripening of the grapes. A late ripening means generally a lower percentage of natural sugar in the fruit. There is, however, still a chance of getting a warm autumn that may to some extent make up for the unusual want of summer heat experienced. It is well, therefore, to be prepared for making provision to assist as far as possible the ripening of the fruit. This can be done by keeping the soil of the vineyard perfectly free of weeds, thus obtaining all the heat possible radiated from a dry soil. Weeds prevent this; so also do too many leaves below the fruit. When the fruit has attained its full size it will assist its ripening to take off a limited amount of the lower foliage—that is, the leaves below the fruit. This permits a

greater circulation of air and more light. It also assists a more rapid drying of the bunches after rain.

As the time of the vintage draws near the vigneron will test the grapes with the saccharometer. If the sugar-content is below 20 per cent. the grapes should be left longer on the vine if possible. They can probably be left with advantage till the end of March. After that time they do not increase in sugar-content unless in exceptional seasons. A further advantage can be gained by drying the grapes before crushing. With proper accommodation for spreading out the fruit thinly a good deal of moisture can be driven off. A certain amount of the acid is converted into sugar by this process. The grapes must not be allowed to mould, however. A dry westerly or north-westerly wind would greatly assist drying the grapes, but with a close, damp atmosphere there would be no advantage gained by spreading them out. Assuming that the ripening of the grapes is not up to that of the average season, greater care is required to immediately remove all green, rotten, or otherwise spoiled grapes. Attention to these details may add a few per cent. to the sugar in the grapes, and they will certainly improve the keeping-qualities and general excellence of the wine.

Cleanliness is as important in winemaking as in dairying. The press-house teems with harmful bacteria at this time of year. If the weather is warm the greater the danger. Everything is sticky and provides a favourable condition for the spread of the acetic and other harmful germs. Therefore all utensils should be kept strictly clean. Do not allow the grape-juice to come in contact with anything iron, such as iron buckets or shovels. Certain acids attack iron very readily, forming poisonous salts and giving white wines an inky appearance. Only wooden tubs and buckets should be used.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THERE is no planting to be done at the present time, with the exception of lettuce and silver-beet. The latter is usually established by sowing, but transplanting is quite successful. Sowing during the next four weeks will be confined to spinach, turnips, lettuce, and radish. Turnips being for winter supply, a good breadth should be sown about the middle of March. A white variety is best for first use; the yellow-fleshed varieties stand longer. Yellow-fleshed turnips are essentially winter varieties. It is only during winter that their flavour is good, and at that time they surpass the white-fleshed varieties in this respect. This is particularly the case after winter is well advanced, when the white varieties deteriorate by long standing. It is therefore advisable to sow two kinds, the white being lightly thinned and used first, the yellow to be thinned more severely to allow for development, as they will not be thinned by early pulling like the white variety.

Spinach should be sown at once if this has not been already done. Thin the plants as soon as they can be handled, to about 8 in. apart. Remember that this crop will stand through winter, and that single leaves are pulled for use, not the whole plant; therefore the better each plant grows the larger the leaves will be, and the more succulent and the greater the total amount of produce. Market-gardeners act differently; as it would be very difficult to tie the leaves in bunches they pull the whole plant; consequently they do not thin much; but every one knows that shop spinach is but poor stuff at the best. The soil should be frequently stirred between all growing crops, not only to suppress weed-growth but to keep the surface loose. A clean condition and loose surface has a very beneficial effect on plant-growth.

Cabbages, broccoli, and similar crops are greatly benefited by light dressings of nitrate of soda. Half an ounce per square yard is sufficient, repeating the dressing five or six weeks after, the two dressings being sufficient for any crop. As evidence of the effect of nitrate of soda it may be of interest to mention a case that recently came under notice. A grower of lettuce asked to be told of a lettuce that would not grow very large but would make a solid heart. It appeared that former crops had been watered every other day with nitrate of soda, the result being very large plants without hearts. This case affords evidence of the potency of the salt in forcing growth and the evil resulting from its excessive use. It has the same effect on cabbages. A proper amounts promotes healthy growth, an overdose makes the plants too leafy. Leeks that have commenced to grow after transplanting, and celery and lettuce, are also greatly benefited by light dressings of nitrate of soda. Sulphate of ammonia is another nitrogenous fertilizer, but is much slower in action than nitrate of soda.

Onions are ripening off, and should be lifted when the tops are dead or nearly so. When the bulbs are pulled they should be laid on their side, so that the root ends are not in contact with the soil. If they are, and rain should fall before the bulbs are dry enough to be carried off, new roots would soon push out and the bulbs be ruined for keeping. When the bulbs are reasonably dry they should be relieved of the tops and loose skins, and placed in a dry airy shed. Keep them in a thin layer till thoroughly dry, when they may be more conveniently placed in larger heaps. Where the quantity is small they are best kept for home use by stringing them and hanging them up in a dry shed. This may be done at first carrying if desired. Garlic and shallots should be thoroughly dried in an airy shed; they may then be kept in bags or in any convenient place that is dry.

Winter rhubarb will benefit by a good mulch of manure. It will keep the soil moist until autumn rains fall, which will wash the nutrient properties of the manure into the soil. Failing manure, give blood-and-bone, about 4 oz. per square yard, with a fourth that amount of sulphate of potash; or dress liberally with dry wood-ashes in lieu of the potash.

Summer rhubarb should be allowed to grow as long as it will without pulling. The purpose of growth at the present time is to form crowns for next season. If any of the stalks are pulled the spring crop, which is the most valuable, will be wanting, cropping being delayed till new crowns are formed.

Pumpkins and marrows that are to be kept for winter use should not be left to get too ripe. When the rind is hard enough to make it difficult to pierce with a thumb-nail the gourd is ripe enough to keep, and should be at once taken from the plant. They may be kept under trees where heavy rain and frost cannot reach them, but better in a shed.

Herbs such as thyme, savoury, and marjoram that run to flower every summer should be cut over to encourage new growth. The tops so cut may be dried for winter use by tying in bundles and hanging them in a dry room or shed. It is wise to pass the string by which the bundles are suspended through a sheet of paper, which should be wide enough to form a cover to the bundle: this will catch falling dust and keep the herbs clean. The best time to cut herbs for this purpose is when most of the flowers have opened, but not those on the tops of the shoots. Mint and sage can be kept in the same way. Sage is not of much consequence for drying, there being always green shoots in the garden. Mint, however, dies down in winter, and is very useful for flavouring during that season. Cut the stems down to the ground and hang up in bundles as with other herbs, or dry more thoroughly on the plate-rack of a stove. The leaves may then be rubbed to a powder and kept in bottles.

GREEN-MANURING.

Any ground that is cleared of crops and is not immediately required for another should be sown down to provide a green crop for turning under. It is well known that humus is necessary to maintain fertility in soil. Fertilizers are of very little value unless there is a fair amount of humus in the soil. White lupins, cow-peas, partridge-peas, horse-beans, and white mustard are useful green-manuring plants. Mustard is the least valuable of those mentioned, but has the advantage of growing to a useful size in a shorter time than the others, and also succeeds under colder conditions, so that in some circumstances it is the best of the series. Whatever is grown, it should be turned in before the plant becomes dry or woody, so that it may quickly decay and the soil become consolidated before being required for planting or sowing.

SMALL FRUITS.

Strawberries.—Where autumn planting is to be done the ground should be prepared at once. The preparation of the soil and fertilizing is fully described in the Department's Bulletin No. 79. Strawberries should not be grown more than two or three years on the same ground. They take something from the soil that fertilizers seem unable to make up for without a period of fallowing or a term under other crops. Runners on old beds should be checked. If plants are required for new plantings, not more than two should be kept on each runner; beyond that number they are weak and do not make good fruiting-plants the first season. If new plants are not wanted the runners should be suppressed altogether, as they weaken the parent plant. Those to be saved should be separated from the parent plant by severing the runner as soon as the plants have got a good root-hold.

The Ettersburgh strawberry: This variety has come a good deal under notice during the past two years, and much conflicting evidence has been forthcoming. From personal observations I conclude that it

is a failure on light soils in the North, making a lot of runners but bearing no fruit. At the south end of the North Island and in the South Island it succeeds admirably. The behaviour of the few plants I have grown in the neighbourhood of Wellington convinces me that it is an excellent variety, particularly for home use. The first fruits ripen two or three weeks later than most varieties, but it continues to bear all through the summer season—until, in fact, the weather becomes too cold to ripen the fruit. The plant is a strong grower, and soon makes a large plant, with fruit in proportion. The fruit averages small, but the numbers make up for size, and the flavour is above the average.

Raspberries.—Keep the soil in the alleyways well cultivated, not only for the benefit this alone is, but to keep suckers and weeds under. The old fruiting-canes should be cut out as soon as the crop is over. Clearing them away allows more air-space for the growing canes and improves the next crop. Gooseberries that have not been sprayed should be done at once to keep leaf-spot in check. Bordeaux, 4–4–40, is the best spray.

Currants.—If the young side-growths of red currants have not been checked cut them back to 6 in. Black currants should not be pruned till winter.

ANSWERS TO CORRESPONDENTS.

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

PROPAGATION OF LOGANBERRIES.

A. L. FROST, Huapai :—

Would you kindly advise me what time would be best to put in loganberry cuttings; also, will they fruit the following season? I presume the cuttings should be taken from old rods, not this year's growth.

The Horticulture Division :—

Cuttings taken from the rods of loganberries will root; new rods root as well as the old if the wood is ripened; May is a good month to take them. The most thrifty plants, however, are obtained by pegging down rods firmly to the ground. Plants from cuttings of the rods are slow to make growth, though they do very well afterwards. They will not in any case bear fruit the first year, however they may be raised. The second year should see a small crop if the plants are from layers, but not if from cuttings. You would be well advised to purchase plants; it would save at least a year, probably two or three.

CALVING-AGE FOR HEIFERS.

JOHN UDY, Pakuranga :—

For the dairy, at what age should a heifer drop her first calf?

The Dairy Division :—

Experience shows that this age will depend entirely on how the heifer has been grown. Provided she has been growing well and continuously she should have sufficient size to drop her first calf at a little over two years of age. If she has not grown normally well a later calving is recommended, which may be deferred until the heifer is two and a half or even three years of age if necessary. Experiments have indicated that it is not the carrying of a calf while the mother is small that causes her to be undersized as a cow: it is rather the giving of milk at a time when all her food is required for maintenance and growth.

CHESTNUT-TREES.

R. S., Waingaro :—

What is the reason of chestnut-trees in this locality bearing fruit but the nuts having no flesh inside them, being quite flat and empty?

The Horticulture Division :—

Without closer knowledge of the conditions in which your chestnut-trees are growing we are unable to say definitely why the nuts do not develop. The chestnut requires a deep, friable soil, preferably sandy loam, though not very rich. A dry subsoil is essential to success; if the soil or subsoil is wet the conditions are unsuitable. A thin soil overlying a hard subsoil would also be unsuitable. Seedling trees are frequently ten or twelve years before they bear perfect nuts. Where conditions are suited to the requirements of the trees chestnuts thrive and bear good crops without attention of any kind. All that is necessary is to keep the soil about them clean till they get a good roothold, and then leave them alone. The chestnut does not bear well in mixed plantations where it has to contend with the roots of other trees.

BLINDNESS IN SHEEP.

"MAIRE," Ohakune:—

A number of my sheep went blind at shearing-time. The eyeball and pupil became a whitish-grey, and round the eyelids there is a great deal of inflammation with a discharge. Can you inform me as to the cause and cure of it?

The Live-stock Division:—

Blindness in sheep may be due to a variety of causes, the simple forms being due to colds, injuries, bush-fires, &c., or results of constitutional derangements. Such animals should be placed in a well-sheltered place where they can avoid the light as much as possible. Local treatment consists of bathing the eyes with a 5-per-cent. solution of borate of soda once a day. When doing this see that the solution gets into the eye. Some forms of blindness are of a contagious nature, and the affected animals should be isolated where treatment can be adopted. In all cases of blindness the animals should be placed not only where they are sheltered from the weather and light, but where feed is plentiful, and given access to a salt lick. The remedy for contagious blindness is the same as for the simpler form, but add to it a 1-per-cent. solution of creolin. It is advisable in all cases to administer 2 oz. of Epsom salts when first treated.

MANAGEMENT OF WATTLES.

"SUBSCRIBER," Tauranga:—

I have a belt of black-wattle (*Acacia decurrens*) five years old, with an average height of 20 ft. The wind frequently breaks branches off, and very often whole trees are blown down. Could you advise me what month of the year it is best to top the trees, and how much should be cut off? Should they be thinned out, and also what distance apart? Can the seed be set in autumn as well as in the spring?

The Horticulture Division:—

The best method to follow for lightening the trees to prevent damage by wind would be to shorten branches to remove sufficient of the weight. They will bear shortening to a considerable extent, provided plenty of leaf-growth is left on the branches cut. The same principle may be applied to the tops. The best time probably would be the latter end of winter, just before spring growth begins, but it would not be likely to injure the trees whenever it might be done. Wattles appear to do well at any distance apart, from a few inches up to many feet. The best distance probably is 4 ft. apart. There appears to be nothing against autumn sowing in your district; the last half of March should be a good time.

CONTROL OF FIELD-DAISY.

"SUBSCRIBER," Poverty Bay:—

Which is the best method of eradicating the ordinary field-daisy? It generally grows in clumps, and just about ½ in. above the ground. It flowers in early spring, the flower being small with a yellow centre. I have tried cutting the roots, but they seem to come up again just as thick.

The Fields Division:—

The roots of the daisy are mere fibres which strike down perpendicularly into the soil. It is because of the abundance of these rooting side branches that daisies are so hard to destroy. Harrowing, spudding, or scarifying fail to produce the desired effect. Besides, every head of flowers allowed to ripen sheds a large number of oval hairy seed-vessels which burst open in a few days after they touch the soil, and from these seeds a fresh supply of plants spring. The labour of attending to ploughing, scarifying, &c., is, from the nature of the plant, endless. A better plan is to starve out the daisy by encouraging grass to overgrow it and by mowing seldom. This procedure is generally very effective, as the plant is very sensitive to shade. When, however, daisies have overrun the soil there is no remedy except draining, paring, and burning, and incessant tillage. Top-dressings of sulphate of ammonia are often effective, and tend to kill the weed.

SOIL-TREATMENT.

"GARDENER," Otaki Railway :—

The soil here (river-silt) cakes together almost like cement, except in newly broken ground. What would be the best crop to grow and dig in to correct this, and is there any other treatment you could suggest, apart from adding sand or other soil? Stable manure is not available.

The Horticulture Division :—

Either white lupin or mustard would be suitable crops for turning in. Probably mustard would best suit your purpose. It grows very quickly, so that two or three crops might be grown and turned under between now and next planting season. A dressing of burnt lime, 2 tons per acre, would be beneficial.

ABSCESS ON HORSE.

B. H. ANDREWS, Rotorua :—

I have a draught horse that this season developed a large water-bleb on the left shoulder. I bathed it, punctured the bleb at the bottom end, and got about a pint of watery fluid out of it, and after disinfecting the puncture allowed it to heal up. Now, although he has not been worked since with a collar, he has developed a still larger bleb. Kindly advise me how to properly treat this trouble.

The Live-stock Division :—

These serious abscesses invariably fill up again if the wound is allowed to close too soon. The proper way to treat a case of this description is to open the abscess at its most dependent part, making a large incision, and after all the contents have been evacuated syringe out with tincture of iodine. The wound must be kept open to permit of free drainage, and injections of antiseptics given daily.

ROOT-FUNGUS OF FRUIT-TREES.

H. WARD, Te Puke :—

Two years ago I planted fifty apple-trees on fern land. Half the trees have now died. A white fungus takes the roots, they rot off in a short time, and the tree dies. Could you let me know of any preventive or remedy. I limed the roots of the trees, but it has done no good.

The Horticulture Division :—

Root-fungus is proving a very difficult problem in circumstances such as yours. There is no doubt that the mycelium of the fungus is present on the fern, &c., ploughed under. Good results are claimed to have followed application of sulphate of iron. The method of application is to strip the soil from the roots and apply a handful of the sulphate close around the trunk. If the weather is dry the sulphate may be dissolved in water and applied in liquid form.

COWS CHEWING WOOD AND BONES.

A. C. GOODISON, Pukeatua :—

Could you advise me what to give milking-cows that spend half their time chewing wood and bones? I have plenty of feed and give them plenty of changes, but notice that those that are the worst seem to go off their milk and lose condition. They are all young cows. The land here has had a good deal of top-dressing this season with lime and super.

The Live-stock Division :—

In some cases this unnatural craving appears to be purely and simply a habit, the animals otherwise being in good health. In most cases, however, it

is due to some deficiency in the food which the animals are endeavouring to supply themselves with. This is usually the want of lime or phosphoric acid in the soil, consequently the grass has not the proper chemical constituents it should have. The general remedy is to top-dress the pastures with either basic slag or superphosphate. Should the top-dressing you mention not have this effect we would advise giving your cows 1 oz. doses of compound syrup of phosphates and iron (Parish's Chemical Food) every day in a pint of water; or you could give them 1 oz. doses of precipitated phosphate of lime in a feed of bran each day. Also it is sometimes advisable to place rock salt in an accessible position for the cows to lick.

STORAGE OF POTATOES.

"POTATO," Mahurangi:—

Please advise me how best to keep potatoes. I have tried storing them in a bin, but during the winter they decay or sprout and shrivel.

The Fields Division:—

Darkness and low temperature are primary requisites in storing potatoes. An important point is to reduce the temperature as low as possible directly after the product is stored. The ideal temperature is 35° F. If the ground is well drained, so that there is no danger from water in the winter, inexpensive potato storage may be made by merely digging a trench about 5 ft. wide and 4 ft. deep and as long as is needed to secure the required capacity. The roof should be given a pitch merely sufficient to shoot water, and a gutter dug to keep the rain-water from running into the pit. A rough cave hollowed out in a hillside is also a good plan. Potatoes have been known to keep fresh for over a year in an old mine-tunnel with a current of air passing through. The temperature in this case remained at about 40 F.

POLLARD POISON AND SHEEP.

"AMATEUR," Tuapeka Mouth:—

How long does pollard rabbit-poison retain its strength, after being laid, to be a danger to sheep?

The Live-stock Division:—

Under favourable conditions pollard poison will retain its strength for some weeks after being laid. Sheep, however, do not readily take this poison when laid in plough-furrow or after turning the sod with the spade. On the higher sheep-runs the general practice is to lay the baits on the bare spots, and there is little complaint of sheep being poisoned with it when laid thus. Like all other poisons, however, care requires to be exercised in laying it, and if on farm lands it is a good plan to turn back the furrow or sod before again turning on the sheep.

MUSTARD FOR GREEN MANURE.

"SUBSCRIBER," Neudorf:—

I have some mustard growing which I want to plough in for green manure. Will you please tell me what is considered the best stage in the development of the plant for ploughing in so as to get the greatest benefit, also the best means of covering, &c.

The Fields Division:—

Mustard should be ploughed in when the crop is succulent and about 12 in. to 18 in. high. To cover it properly it is often necessary to run a roller over the crop in the direction in which the plough follows, and attach a chain and weight to the coulter of the plough in such a manner that the weight may trail along the bottom of the previous furrow about the middle of the mouldboard.

BLOOD IN HEIFER'S MILK.

"INQUIRER," Methven:—

After separating the milk of a two-year-old heifer, calved about three months, there is a residue of blood left on the case of the bowl of the separator. When the heifer first calved she was easy to milk, but is now rather hard than otherwise. She is apparently in perfect health, and is not a heavy milker. I shall be glad if you will tell me the cause.

The Live-stock Division:—

Several causes may give rise to the presence of blood in the milk, but from your description of the case we are of opinion that the trouble may be due to mammitis. You might try fomenting the udder and applying camphorated vaseline after each milking for a week or so.

MUD-FEVER IN HORSE.

"RETURNED SOLDIER," Masterton:—

I have a draught mare which is affected with a kind of rash on her legs similar to horse affected with greasy heel. The rash extends to above the hocks and behind the knees. All the legs are more or less swollen, and the horse has gone very lame in the front legs. Can you inform me by this description what the disease is and treatment for same?

The Live-stock Division:—

The trouble affecting your mare is mud-fever. As the majority of the cases are the result of indigestion caused through improper feeding a change of diet is essential. Give a dose of physic—aloes or linseed-oil—wash the legs thoroughly clean, and then apply a lotion composed of carbolic acid, one teaspoonful to a quart of water. Small doses of Epsom salts given occasionally have a beneficial effect.

SEVERING NAVEL-CORD OF CALF.

"MILKER," Mangere:—

I shall be glad if you will tell me the correct way to sever a new-born calf from its mother when it comes into the world with the navel-cord unbroken.

The Live-stock Division:—

The proper way to sever the navel-cord is by applying a ligature about an inch or so from the navel and then severing the cord immediately below the ligature.

SCOURING TROUBLE IN CATTLE.

JOHN THOMASEN, Taihape:—

I should like to know the cause of a lot of my yearling cattle getting very bad with scour. They seem to pass nothing but nearly water. I have had some die with the complaint, and the other day I got one nearly dead, so I killed it and opened it to see what was the matter. All the lining of the inside of the stomach was about an inch thick, like frozen ice, but soft like jelly, and full of water.

The Live-stock Division:—

The trouble affecting your yearling cattle will no doubt be parasitic gastritis—in other words, worms in the stomach. Medicinal remedies are of little use in these cases. Prevention must be relied on. As the parasites are invariably found on low-lying, swampy, badly drained land, place the animals on dry pasture, and give an allowance of good nourishing food—crushed oats, bran, hay, &c.

HYDRO-ELECTRIC DEVELOPMENT.

POTENTIALITIES FOR NEW ZEALAND.

THE following matter is from the report on hydro-electric development by Mr. E. Parry, M.I.E.E., Chief Electrical Engineer, Public Works Department, presented to Parliament during the last session. The report as a whole covers the North Island scheme only, but the extracts here given are mainly general in character and of special interest to agriculture and other industries. Mr. Parry states:—

THE FUNCTION OF HYDRO-ELECTRIC POWER IN THE STATE.

The development, distribution, and marketing of electric power on a comprehensive scale has since the war come to be generally recognized as one of the most essential agencies in national reconstruction. Previous to the outbreak of war its importance in national life was but dimly sensed except by a comparatively few persons possessed of an unusual amount of imagination and foresight, and it is evident from reading *Hansard* of a few years ago that even the far-seeing ones regarded electric power more as a means of industrial development in the narrower sense in which the term is commonly used than as the nerve-system of the community and as touching every phase of national life.

Neither was it recognized at that time that national organization for production and the promotion of national efficiency was a function of a Government. The war has made it imperative that the nations shall be reorganized on a national scale, and that in future the marshalling of the forces of production must be a definite and conscious function of the Government of a country.

The change in the attitude of public men towards electric-power development is well illustrated by the recent action of the Government in Great Britain. Before the war the generation and distribution of power was left to private enterprise; it is now proposed to set up a body of Commissioners to co-ordinate the activities of the various power-supply authorities and to bring them into line for the advancement of the national interests, and by so doing it is recognized that the organization of power production and distribution will result in a national saving of not less than £100,000,000 per annum; or, putting it in another way which is very striking, the coal saved would be sufficient to generate continuously not less than fifteen million horse-power.

The largest hydro-electric system owned by the State is probably that of the Swedish Government, which has three large hydro-electric stations aggregating over 200,000 h.p., supplying power to a large system for electric smelting, railway electrification, and general industrial supply.

Another of the most notable instances of the development of hydro-electric power by the State is to be found in the Province of Ontario, where the system is managed by a body consisting of three Commissioners. They commenced operations in 1908, and the load has now attained a magnitude of 160,000 h.p. The total length of primary transmission circuits is about 1,500 miles, and of secondary transmission circuits about 1,600 miles. Altogether some 143 municipalities are supplied. The supply reaches to a distance of 254 miles from the main source.

Another notable instance is to be found in Tasmania. Originally a concession was granted to a company authorizing them to undertake the generation and distribution of power in Tasmania; but the company failed, and after some negotiations the State took over the works and completed them. They started with 10,000 h.p. of plant, which was augmented by 8,000 h.p. soon after, and a further 16,000 h.p. of generating plant is on order. Arrangements are being made for developing other sources, as the present source is quite unequal to the demand. The magnitude of the contracts entered into is a feature of this undertaking. One contract alone amounts to 25,000 h.p. for electro-metallurgical purposes, and it is significant that when the State took over the plant from the company such big demands were not anticipated. Nor was there any indication that the business of electric smelting would attain such proportions. The total contracts already

entered into amount to 42,000 h.p., and further contracts amounting to 50,000 h.p. are being negotiated.

New Zealand, now at the outset of its career as a nation, has a unique opportunity of securing the utmost possible efficiency for all time by developing its water-powers on such a scale and by providing for such a wide-reaching system of distribution that electric power shall become available to every householder throughout the Dominion, and available at any point where circumstances require the application of power.

The functions of that Department of State which deals with the generation and distribution of power is one involving great responsibility and wide range of knowledge, as it touches every phase of national life in its industrial aspect. It has to generate and transmit electric power; it has to make contracts with local authorities and other State Departments and individuals; it has to negotiate terms with industrial organizations outside New Zealand which may be desirous of taking advantage of the supply of hydro-electric power; it has to finance local authorities to enable them to reticulate their districts; it has to finance power-users to enable them to convert from steam or other power to electric power; it has to assist industry by carrying out experiments in industrial processes on a commercial scale, for the lack of which a great deal of talk concerning industry and science is lacking in cohesion. It may further be required to undertake the manufacture of a special class of product in the national interest.

ELECTRICITY IN AGRICULTURE.

The extension of the Lake Coleridge supply to the country districts in Waimairi, Eyre, Halswell, Paparua, and Springs has served to demonstrate its convenience, utility, and its effect in lessening the drudgery of farm life and in increasing production, especially so in dairying districts.

Electricity as a power agent is so flexible and adaptable, and its uses therefore so manifold, that there is scarcely an aspect of human activity to which it cannot be applied, the number of processes to which it is capable of being applied on farms being about 125. The supply of electricity to farms and homesteads has already attained considerable dimensions in some parts of the United States of America, the extent of which is not generally known. A census made by the Western Power Association of California in 1915 gives the total horse-power of electric motors on farms at 190,141, and the estimated figure for 1918 is 200,000.

Electric pumps are largely used in the districts mentioned for pumping water for irrigation purposes, which accounts for a large proportion of the power used, but after allowing for this there remains a substantial balance for other purposes.

One of the most remarkable and deplorable movements of the present day is the drift of the country population into the towns. Various reasons have been advanced to account for this tendency, but it will be admitted that the drudgery associated with farming is one of the main if not the primary cause. This drudgery will certainly be lessened when a general supply of electricity is available and the farming community has had time to become habituated to its various uses. In fact, the movement will then be in the opposite direction, as the stimulation given to production and the improvements made possible in the conditions of living will result in closer settlement of the country areas. At the same time these districts will be brought more closely into touch with the towns by the construction of light railways, made possible by a general supply of electric power.

ELECTRICITY AND INDUSTRY IN GENERAL.

Using the word "industry" in a more restricted sense of manufacture, the importance of supply of cheap electricity for manufacturing purposes is one of paramount importance. It places at the disposal of the manufacturer a subtle and flexible form of energy which is adaptable to every kind of power, to heating, or to electro-chemical and electro-metallurgical uses. He is able to extend and adjust his business to the growth of demand without being hampered with the many considerations which a manufacturer has to face if he has to provide a generating plant or increase its capacity.

These advantages are of course well known and appreciated, but what is not appreciated enough is the importance of a general supply of electricity available for use anywhere in the Dominion. At present if a manufacturer wishes to avail himself of a supply of electric power he has to locate his works in the vicinity of a town where he can get a supply, or he has to consider the question of the coal-supply and the cost of coal, with the result that the factory is not always placed where it is best suited for the exigencies of the business. Moreover, it is quite

certain that a number of industries which might be carried on are neglected altogether owing to the element of power being difficult to procure.

We have abundant evidence of the effect of a supply of cheap electrical power in Christchurch and district: within a comparatively short time—less than a year in fact—the preliminaries were settled and contracts made for supplying power to every factory within an economical radius of supply from Christchurch. But what is more noticeable is the way in which a cheap supply of power has stimulated the industrial mind into activity in many directions, such as the manufacture of caustic soda, hydrochloric acid, calcium carbide, and steel smelting. Another fact worth noting is that for the lack of sufficient machinery in the Government power-house one large electric-smelting industry which contemplated starting at Christchurch or wherever power was available was lost to the Dominion—which is regrettable, as it promised to be the beginning of a large development.

The general distribution of electric power makes possible a much larger use of the electrically propelled battery vehicle which has proved so successful in the Christchurch district, and has already been adopted by some of the dairy companies in the North Island for the collection of their cream, with pronounced success.

WOOD-PULP INDUSTRY.

The wood-pulp industry is one which has assumed large dimensions in Sweden and Canada, and, whilst forest reserves have been set apart in New Zealand for this purpose and preliminary steps taken to establish the industry, no actual work has been done up to the present. The provision of electric power at suitable points would greatly assist promoters in overcoming the initial difficulties, and would no doubt lead to the establishment of a wood-pulp industry and of allied industries using wood-pulp in its various forms.

ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES.

Such industries as employ electricity as a heat agent or chemical agent are distinguished from the general industrial uses of power by the fact that the cost of power forms the largest item of expenditure, whereas in general the power expenses are small in proportion to the total expenditure upon production. Such special industries cannot, for the reason stated, afford to pay the same price as the average obtained for general industrial purposes. Nevertheless provision has to be made for such industries, as they have a very important place in national production and development. Such industries range from comparatively small magnitudes, from the power standpoint, to very large dimensions. As a rule they are local in character, depending upon the occurrence or deposit of a mineral, and it is essential that a supply of power should be available wherever the circumstances are such as to favour the establishment of an industry of this kind. It will even be found that in some cases it will be profitable to bring raw material to a convenient locality where an abundance of cheap power is available, and to have it treated there.

ELECTRIFICATION OF MAIN-LINE RAILWAYS.

The provision of an adequate and dependable supply of electric power which shall be available when and as required at such points as may be desired by the Railway Department is indispensable to them if they are to be enabled to keep pace with the development of the country.

It should be clearly understood that railway electrification does not mean the displacement of steam locomotives altogether and at once, but the gradual substitution of electric haulage for steam haulage on grades and in tunnels when and as the limits of steam haulage are reached, after making every possible improvement short of entire duplication and extensive regrading.

The steam locomotive is easily the most economical tractor under ordinary railway conditions, but its speed becomes severely limited on grades because there is a limit to the power which can be accommodated on a steam locomotive. The electric locomotive, on the other hand, does not generate the power, but merely converts electric power to mechanical power, which it draws from a power-station situated elsewhere. The electric locomotive, being able to draw on a large central generating-station for its power, can when required supply large amounts of power and so maintain higher average speed and increase the capacity of the line for traffic.

For example, let it be supposed that the limit under steam haulage has been reached in some portion of the division of the Main Trunk line between Taumarunui and Taihape—that is to say, no more traffic can be conducted over it. This means

that if this constitutes the critical section the whole Main Trunk system and its tributaries, and to a lesser extent all other lines, are limited by the capacity of the section or division mentioned. If now electric haulage be substituted for steam haulage on this section it would enable possibly twice the amount of traffic to be conducted over it, and by so doing at once double the traffic capacity of the whole Main Trunk system, and substantially enhance the value of the whole of the New Zealand railway system, without any further expenditure than that necessary to electrify the section in question—assuming, of course, that there are no other sections with the same or approximately the same limitations. The only alternative to this would involve regrading and reconstruction, which would inevitably introduce longer tunnels, which in themselves would offer an obstacle to an increased traffic, and at the end it would be found that recourse would have to be had to electrification. The point to be noticed is that a general system of electric-power distribution is necessary in order to enable the Railway Department to deal with any tunnel or section with steep grades as soon as the capacity under steam haulage is reached, and that if a supply of electric power is not available for use when and where required the development of the country will be retarded and progress hindered.

SUBURBAN-RAILWAY ELECTRIFICATION.

The question of suburban-railways electrification is already an urgent one in some cases, as, for instance, between Wellington and the Hutt. There is no doubt in my mind that had the law permitted of it an electric tramway would have been in operation between these two centres long ago, and it is evident that before long the need of a more frequent service will become so great as to necessitate a removal of the present legal obstruction, unless a service of the same general character is provided by the Railway Department. In course of time, in all probability, as a result of the growth of the population, an electric service on both the road and the railway will become a necessity. There is, of course, no question as to the advantages of electricity where frequent service is required—this is a matter of common knowledge; but at the same time, although the necessity may be great, it will be found that the actual conversion is postponed until the matter becomes an acute one, unless facilities in the way of obtaining a supply of power are available. These delays may not have the same direct retarding influence as delays in main-line electrification, but the argument in favour of a provision of electric power is equally valid.

AGRICULTURAL RAILWAYS.

Another branch of electric haulage which may possibly have an important influence upon the destinies of New Zealand is the construction of light railways, by which I mean railways constructed with grades usually adapted for a good class of road; or, in other words, a tramway, which shall serve the country in the same way as a tramway serves a town and its suburbs, except that farm-produce would be conducted over it as a matter of course. These would not take the place of main or branch railways, but would act as feeders thereto. They would relieve the roads of heavy traffic, and would promote exchange between town and country and form an important link between producer and consumer. It is possible, of course, that there is no immediate use for this class of railway in New Zealand, but if there is no system of general electric supply the matter cannot be put to a test, as it would never pay to provide a separate power-station for each line. In any case it is quite certain that there is a future for rural railways where the population is closely settled, as we have the example of Belgium before us, and it is only a question of time before the necessity for them will arise in New Zealand.

Yield of Wheat, 1917–18 Season.—The Government Statistician has issued the following statement: According to returns received from threshing-mill owners throughout the Dominion up to the 30th November, the quantity of wheat threshed during the past season was 6,437,002 bushels. The actual yield of wheat from all holdings of an area of one acre or over (exclusive of those within borough boundaries) as given by farmers in connection with the annual collection of agricultural and pastoral statistics amounted to 6,807,536 bushels. The difference of 370,534 bushels may be accounted for by some stacks still unthreshed and by small quantities threshed otherwise than by regular threshing-mills for which no threshing returns have been received.

WOOL-PURCHASE BY IMPERIAL GOVERNMENT.

DURING the recent session of Parliament a comprehensive statement was made in the House by the Prime Minister (Mr. Massey) regarding the purchase and distribution of New Zealand wool by the Imperial Government, also as to the share of the surplus profits on the 1916–17 clip payable to growers. The position given remains unaltered in the main, except that the 1916–17 clip is now practically all shipped from the Dominion. The statement is as follows :—

The purchase of the New Zealand wool clip of 1916–17 by the Imperial Government, approved by the Woolgrowers' Conference of the 22nd November, 1916, was on the basis of the average price realized for each quality of wool for the season 1913–14, plus 55 per cent. thereon. In addition thereto half the profits on the sale of all surplus wool not required by the Imperial Government or our Allies for military purposes would be returned to New Zealand, and if, on the other hand, there was any loss, such loss would be borne by the Imperial Government.

A schedule of average sale-room values of the main sorts of New Zealand greasy wool in January, 1914, was approved by the Conference as representing the average 1913–14 values, and subsequently agreed to by the Imperial Government. In addition, the Imperial Government agreed to pay for the wool in cash, free of exchange, on the fourteenth day after day of valuation, and to pay all charges incurred for exhibiting for valuation, storage, &c.—the valuation of the wool constituting the net return to the owner for the wool delivered into the broker's store.

In 1917 the purchase was extended on identically the same terms to cover the 1917–18 clip, and negotiations have now been practically completed for the purchase to be extended for the period of the war and for one year subsequent to the 30th June after the cessation of hostilities. Valuations have been made on the basis agreed upon, and the result for the 1917–18 clip to the 30th June shows the total purchase for all classes of greasy wool to be 522,325 bales for £11,854,822, equal to an average price of 14·96d. per pound. A comparison of the actual sales of wool made in New Zealand during the 1913–14 season with the prices paid to growers for the 1917–18 clip shows the following difference in favour of growers :- 1913–14 sales of wool in New Zealand at auction (comprising fleece, lambs, pieces, bellies, locks, and crutchings), 264,834 bales ; average weight per bale, 347 lb., equals 91,897,398 lb. ; gross return, £3,407,934, less brokers' charges (estimated), £127,797 ; net return to growers, £3,280,137, equal to 8·57d. per pound ; 8·57d. plus 55 per cent. equals 13·28d. per pound. 1917–18—522,325 bales, net weight 190,101,424 lb. ; purchased for £11,854,822, equals 14·96d. per pound ; valued at 8·57d., plus 55 per cent., would equal £10,526,699 ; advantage to the growers, £1,328,123. This excess of approximately 1¾d. per pound is accounted for by the basis prices taken being higher than the actual sales made in New Zealand in 1913–14, and by the saving of brokers' charges for commission, cataloguing, storage, &c., borne by the growers prior to the requisition of wool by the Imperial Government.

DISTRIBUTION OF WOOL.

On the arrival of the wool in the United Kingdom all wool that is suitable for combing goes to the top-makers direct, and is combed on commission, and practically all of it is made into cloth for military purposes. The scoured wool and wool for woollens are reappraised in the United Kingdom, and are issued at fixed prices put upon them on that side. About 75 per cent. of the total crossbred wool, including the British clip, consumed in the United Kingdom during the year ended 30th June last was used for Government purposes. About 20 per cent. New Zealand wool is used for civilian purposes, but it is impossible to say the exact proportion, as New Zealand wool is frequently blended with Australian. The Imperial Government, in addition to selling in original packages, is engaged in carbonizing, blending, scouring, and top-making processes, and issues such wool at fixed prices. The Imperial Government control over profits for all wool up to the spinning stage is complete, but not State control over later stages of

civilian goods, partly owing to diversity of processes, and also practical difficulties in the way of extending similar control to other trades.

SURPLUS PROFITS.

The War Office is now engaged in completing its wool accounts for the year ending 31st March, 1918, and it will be understood that it is a complicated, lengthy, and laborious task. Such figures will include the greater quantity of the New Zealand 1916–17 clip, but not the whole. In fact, a portion of the 1916–17 clip has not even yet left New Zealand. In the making of tops Australian and New Zealand wools are blended according to their suitability, and not according to their origin, and wool of different seasons' clip is similarly dealt with. The wool control and operations in the United Kingdom have been rendered much more difficult than in pre-war times by diminished transport and storage facilities and by depleted staffs.

It is thus impossible in the circumstances of to-day to ascertain the profit realized on the New Zealand clip for each separate year. Although no such provision was made in the original bargain, the Imperial Government has decided that the profit-sharing arrangements should be extended so as to include the results of the processes of top-making and carbonizing, it being the desire of the Imperial Government to deal with such questions in a broad and equitable manner. It will be understood, however, from the processes of blending above referred to that the division of the results of the operations between New Zealand and Australia will be to some extent a question of estimate, in proportion to the total values of Australian and New Zealand wool used in the two operations. There is no doubt, however, that the calculation will be made in a manner satisfactory to all parties.

The position regarding surplus profits may be summarized as follows: About 20 per cent. of the New Zealand clip is issued for civilian purposes, and half the profits made on such sales will be returned to New Zealand growers. The accounts now being completed include the greater portion of the 1916–17 clip, and the amount for distribution should be available early in 1919 for a *pro rata* distribution on a basis to be arranged. Further distributions will be made available on subsequent clips during the following years. Woolgrowers will, of course, understand that the amount for distribution is unlikely to be individually large, but no indication of the amount is yet possible.

MAXIMUM PRICE OF CORN-SACKS.

An Order in Council under the Regulation of Trade and Commerce Act, gazetted on 24th January, fixed the maximum price of corn-sacks throughout New Zealand as follows: The maximum price, when sold to farmers or other users on the usual trade terms, for delivery ex ship or ex store at the Port of Lyttelton or at the Port of Wellington is to be 1s. 7d. each for 48 in. sacks and 1s. 6d. each for any smaller size. When sold for delivery otherwise the maximum price to be the same with such addition only as represents the additional cost of delivery to the seller. When sold otherwise than on the usual trade terms the maximum price to be a price equivalent, as regards the seller, to the prices aforesaid. For the purposes of the Order stores at Christchurch or Addington are deemed to be stores situated within the Port of Lyttelton.

Shipping between Australia and South Africa.—Reporting under date 10th January, the New Zealand Trade Commissioner, Melbourne, stated that an improvement in this service had taken place, and by the end of March two steamers monthly would be running. At date of advice the "Austral Book" was loading 6,000 tons of merchandise, and was to be followed by the "Manica" with 6,500 tons in February, the "Swazi" with 6,500 tons early in March, and the "South Africa" with 2,700 tons at the end of that month. This development will, of course, benefit New Zealand transhipments as well as Australian cargo.

CONTROL OF BLACKLEG: AMENDED AREAS.

AMENDED regulations under the Stock Act, for the control of blackleg in cattle, altering the boundaries of the several infected areas, were gazetted on 9th January, 1919, and came into force on that date. The areas are now defined as follows:—

INFECTED AREAS "A."

No. 1 Area.—The counties of Franklin, Waikato, Waipa, Piako, and Matamata as at present constituted; that portion of Raglan County as at present constituted situated north of the southern boundary of Te Akau A6 and A3, and generally of the northern boundary of the Parish of Whangape to the Waikato River; that further portion of Raglan County as at present constituted lying westward of the Waipa River from a point commencing at the northern boundary of the Parish of Karamu where it meets the Waipa River to the watershed, thence along that watershed in a southward direction to the boundary of the Parish of Pirongia, following the western and southern boundaries of that parish to the Waipa River near Pirongia; that portion of West Taupo County as at present constituted north of the Puniu River, the Owairaka Stream, its watershed, and the Waiteti Stream to the Waikato River; and those portions of Ohinemuri and Thames Counties as at present constituted on the western side of the main-range watershed to the Waiwhakauranga Stream, following same to the Firth of Thames.

No. 2 Area.—All that area in the Taranaki and Wellington Land Districts bounded towards the north generally by the Mokau River from the sea to the north-western corner of the Mokau-Mohakatino No. 1G Block; thence by the western and south-western boundaries of that block and the north-eastern boundary of Mokau-Mohakatino No. 1J Block to Tawhitiraupeka Trig. Station; thence by Blocks IV and VIII, Waro Survey District, to the Tongaporutu–Mangaroa Road; thence by that road to the westernmost corner of Section No. 22, Block V, Ohura Survey District; thence by the eastern watershed of the Tangarakau Stream, over Mahoewaruwaru, Tatu, and Peneta Trig. Stations to the Ohura Road; thence by the said Ohura Road to the Heao Stream; thence by that stream to the northern boundary of the Whangamomona County; thence by the leading spur eastwards to the western watershed of the Ohura River; thence by the watershed to the Wanganui River at Onetea; thence by the right bank of the said Wanganui River to the point where it meets the south-eastern boundary-line of the Taranaki Land District; thence towards the south by a right line to the intersection of the Patea River with the south-eastern boundary-line of the Hawera County; thence towards the south-east by the said south-eastern boundary-line of the Hawera County to the sea; and thence towards the south-west, west, and north-west by the sea to the Mokau River aforesaid.

INFECTED AREAS "B."

No. 1 Area.—The counties of Waitomo and Manukau as at present constituted, and West Taupo County exclusive of the southern portion lying south of a right line from Trig. 1390 (Pareora) to the mouth of the Waihora Stream at Lake Taupo, and also exclusive of the northern portion included in infected Area "A."

No. 2 Area.—All that area in the Taranaki Land District bounded towards the north-west generally by the south-eastern boundary of the Hawera County from the mouth of the Manawapou River to where the confiscation-line intersects the Patea River; thence towards the east generally by the said Patea River to the ocean; and thence towards the south-west by the ocean to the place of commencement.

NOTE.—An article on "Blackleg and its Control," together with a summary of the Blackleg Regulations, was published in the *Journal* for August, 1916.

IMPORTATION OF FERTILIZERS: QUARTER ENDED 31ST DECEMBER, 1918.

Kind.	Country of Departure.	Auckland.		New Plymouth.		Wanganui.		Wellington.		Napier.		Lyttelton.		Dunedin.		Invercargill.		Totals.	
		Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Gypsum	United Kingdom	..	..	..	..	..	..	2	23	1	13	..	2	..	..	..	..	3	38
Nitrate of soda.. ..	Australia ..	4	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	66
Blood-and-bone ..	Australia ..	20	304	..	..	..	..	..	..	..	..	..	..	..	..	44	649	64	953
Bonedust	Australia ..	819	9,352	..	..	..	..	50	605	..	..	..	..	..	..	..	..	869	9,957
Guano and rock phosphate	Australia ..	..	..	150	495	..	..	..	..	..	..	974	3,028	..	..	..	..	1,124	3,523
	New Caledonia..	1,006	2,710	..	..	..	..	60	165	..	..	..	..	..	..	..	..	1,066	2,875
	Makatea Island	4,621	7,764	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4,621	7,764
	Total ..	5,627	10,474	150	495	..	..	60	165	..	..	974	3,028	..	..	..	..	6,811	14,162
Superphosphate ..	Australia ..	2,330	14,126	..	..	677	3,444	1,902	11,295	..	..	1,242	6,540	*Less 22	* Less 58	180	1,024	6,309	36,371
Sulphate of iron ..	United Kingdom	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1
	Australia ..	..	..	..	..	..	..	..	..	..	..	20	278	..	..	..	..	20	278
	Total ..	..	..	..	..	..	..	..	..	..	..	20	279	..	..	..	..	20	279
Other manures .. .	Australia ..	50	403	..	..	..	..	50	399	..	..	..	..	100	793	..	..	200	1,595
	Total ..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	14,280	63,421

* *Vide* September quarter return.

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

LIVE-STOCK IN NEW ZEALAND: 1917-18.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1917–18.	Number of Lambs tailed, 1917–18.	Sheep (including Lambs) as at 30th April, 1918.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
Auckland	96,543	63	947,764	247,177	32,328	1,868,141	816,253	1,844,666	79,905	1,905	2,832
Hawke's Bay	40,000	95	429,815	37,925	5,362	5,731,556	2,565,203	6,308,338	16,267	322	794
Taranaki	26,010	1	354,083	139,698	7,941	1,039,755	375,455	960,219	37,640	349	4,264
Wellington	52,854	23	556,576	117,434	13,418	5,392,250	2,535,927	5,724,165	39,136	978	357
Nelson	9,143	..	54,985	16,696	2,556	419,451	182,320	473,270	9,965	876	1,442
Marlborough	7,605	..	36,038	9,620	1,294	967,092	414,608	1,037,660	6,910	432	1,079
Westland	3,271	..	37,627	7,747	1,782	62,772	28,860	66,907	3,443	826	819
Canterbury	69,507	45	176,558	53,082	7,027	4,060,431	2,296,009	5,135,942	38,395	236	140
Otago	42,087	24	127,006	38,998	6,807	2,645,682	1,190,655	3,097,291	15,524	5	27
Southland	31,030	2	149,013	42,185	4,139	1,562,570	788,877	1,889,844	11,509	2	45
Totals for Dominion..	378,050	253	2,869,465	710,562	82,654	23,749,700	11,194,167	26,538,302	258.694	5,931	11,799

[From agricultural and pastoral statistics issued by Government Statistician, gazetted 12th December, 1918.]

ESTIMATED YIELDS OF WHEAT AND OAT CROPS.

THE following estimated average yields of wheat and oats for the current season (1918–19) have been compiled by the Government Statistician from reports furnished by the Fields Inspectors of the Department of Agriculture:—

	Bushels per Acre. Wheat.	Oats.		Bushels per Acre. Wheat.	Oats.
Auckland	23·00	30·43	Marlborough	26·56	43·27
Hawke's Bay	25·42	31·15	Canterbury	28·47	35·44
Taranaki	22·18	28·78	Otago	29·41	35·35
Wellington	22·99	30·82	Southland	25·35	33·41
Nelson	20·00	30·00			
Average (estimated) for Dominion, season 1918–19				28·32	34·90
Average (actual) for Dominion, season 1917–18				24·23	31·64

According to the foregoing estimates, taken in conjunction with the acreage grown, the total yield of wheat for the Dominion should be approximately 6,265,000 bushels, as against an actual yield of 6,807,536 bushels in 1918.

The percentage of the oat crop threshed in 1916–17 was 31·44, and in 1917–18 32·00. Assuming that a similar proportion is threshed this year, the total yield of grain should be 5,140,000 bushels. The oats threshed in the previous season yielded 4,942,759 bushels.

Owing to the wet and cold season experienced the harvest is exceptionally late, and realization of the estimates depends largely on forthcoming weather.

FORTHCOMING AGRICULTURAL SHOWS.

Rangitikei A. and P. Association: At Taihape, 26th February.
Egmont A. and P. Association: At Hawera, 26th and 27th February.
Ohura A., P., H., and I. Association: At Nihoniho, 27th February.
Franklin A. and P. Association: At Pukekohe, 28th February and 1st March.
Hawke's Bay A. and P. Society: At Hastings, 5th March.
Katikati A. and P. Association: At Katikati, 5th March.
Marton A. and P. Association: At Marton, 5th March.
Taranaki Agricultural Society: At New Plymouth, 5th and 6th March.
Hikurangi-Otonga Ridings A., P., and I. Association: At Hukerenui, 12th March.
Rotorua A. and P. Association: At Rotorua, 12th March.
Taumarunui A. and P. Association: At Taumarunui, 12th March.
Wanganui A. and P. Association: At Wanganui, 12th and 13th March.
Mangonui A. and P. Association: At Kaitaia, 14th March.
Ashburton A. and P. Association: At Ashburton, 20th March.
Matamata A. and P. Association: At Matamata, 20th March.
Strath Taieri A. and P. Society: At Middlemarch, 1st April.
Oxford A. and P. Association: At Oxford, 3rd April.
Methven A. and P. Association: At Methven, 3rd April.
Temuka and Geraldine A. and P. Association: At Winchester, 3rd April.
Malvern A. and P. Association: At Sheffield, 16th April.
Mackenzie County A. and P. Society: At Fairlie, 21st April.

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

Areas in Orchards, Gardens, Plantations, &c.—Particulars of areas in occupation and cultivat on in New Zealand under this class, according to the 1917–18 statistics, are as follows: Commercial orchards, bearing, 12,689 acres—not bearing, 13,865 acres; orchards for private use only, 7,898 acres; vineyards, 253 acres; market gardens, 2,551 acres; nurseries and seed-gardens, 441 acres; private gardens and grounds about residences, 53,689 acres; plantations, 65,534 acres.