DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

REPORT OF THE
DIVISION OF FORAGE PLANTS

PREPARED BY

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FOR THE YEAR 1921

Sunflower Breeding Block.

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REPORT OF THE DIVISION OF FORAGE PLANTS

INTRODUCTION

Following the resignation, in October last, of the Dominion Agrostologist, Dr. M. O. Malte, the work planned and incepted by him for the year was carried on by his assistant, who has prepared the following report covering details of the experimental work performed during the year.

The main work of this division consisted of the testing of varieties of forage crops and the selection and isolation of breeding material in connection with the improvement of grasses, clover, alfalfa, field roots and sunflowers. Variety tests were conducted with field roots, ensilage crops, annual hay crops, grasses and clovers. Selections and isolations were made from breeding material planted in 1920 and a considerable number of plots of individual plants set out from seed of plants isolated in 1920.

SEASON

Practically no damage was done to any grasses or clovers during the winter of 1920-21 and owing to a very favourable spring, 1920 seeding made excellent growth until the dry weather during the latter part of June and July. Good weather during April and May made it possible to get seeding done in good time—field roots, our earliest sown crop, being in May 4. A period during the latter part of June and in July, of about six weeks of extremely hot, dry weather adversely affected root crops, field root seed and 1921 plantings of grasses and clovers. During August and September, the weather was favourable for root crops which gave average yields. During midsummer the planting of individual plants had to be discontinued, but all that work planned was put in in time to make sufficient growth to withstand the winter.

ENSILAGE CROPS

VARIETY TESTS WITH INDIAN CORN

Fiften varieties of Indian corn were tested in triplicate one-hundredth-acre plots, one set being sown on land previously in timothy sod the other sets on land which had been in individual timothy plants. All land was manured at the rate of 15 tons per acre.

Seeding was done May 18 in rows 3 feet apart, the plants, when up, were thinned to 6 inches apart in the row. All varieties were harvested August 31 and weighed immediately after cutting. The average yields of the triplicate plots are given in the following table:—

VARIETY TESTS OF CORN FOR ENSILAGE

Variety	Stage of maturity when cut	Yield per acre		Yield of unhusked cobs per acre	
		tons	lbs.	tons	lb.
Wisconsin No. 7 (Registered seed)	Dough	17	878		
Bailey	Dough	17	1,504		
Leaming	Dough	17	268		
Esperanza X Alvord's	Kernels forming in a few	15	1,851		
North Western Dent	Ripe	15	1,368	4	990
Compton's Early	Dough	15	1,353		
Case & Sons	Dough	13	1,866		
Longfellow	Dough	13	1,501		
White Cap Yellow Dent	Dough to ripe	12	1,906		
Wisconsin No. 7 (Commercial)	Dough to ripe	12	1,906		
North Dakota	Early dough	12	408		
McConnell's Flint	Ripe	11	1,200	3	1,636
Twitchell's Pride	Ripe	10	10	3	1,392
Canada Yellow	Ripe	9	608	3	1,153
Quebec No. 28	Ripe	8	1,980	3	438
	Average	13	1,517	3	1,521

VARIETY TESTS WITH SUNFLOWERS

Five "varieties" of sunflowers were tested in one-twentieth-acre plots. Land selected for these plots had been in flax in 1920, was fall ploughed and in the spring, after an application of 15 tons manure per acre was again ploughed and prepared for seeding.

Seeding was done May 19, in rows 3 feet apart, and the plants were thinned to 6 inches apart in the row. Harvesting of varieties was done five days after the majority of flowers were open to the centre of the head. Date of cutting and yield of varieties tested was as follows:—

SUNFLOWERS—TEST OF VARIETIES

Variety	Date cut	Yield per acre		Remarks
		tons	lbs.	
Mammoth Russian—Short plump seed (Commercial).	Sept. 13	23	1,853	Single stalk, tall, late. Some seed formed before majority of plants in bloom.
Seed supplied by G. H. Hutton	Aug. 30	17	1,700	Fairly uniform, fine, single stalk variety.
Fresian (Rosthern district)	" 15	12	840	Fine stalk and leaves, majority single stalk. Flowering uniform.
Early Ottawa—from Cereal Division.	" 25	11	1,980	Fairly uniform in type; large heads.
Mammoth Russian—long narrow seed believed to have been grown in Chili (Commercial).	Sept. 13	10	46	Single stalk, grew about ½ height of plot from plump seed; great lack of uniformity both in size of plants and time of blossoming.
Average		15	483	

The Mammoth Russian sunflower (short, plump seed) were cut and weighed up at 11 a.m. and again weighed at 3 p.m., being left in sheaves on the field during this interval. The loss in weight during this 4-hour period was 7.3 per cent. There was also selected a variety in the breeding block of the same general type as Mammoth Russian—with single stalk and head, growing to a height of about 12 feet—and a number of plants cut and weighed up at intervals for three days. The shrinkage due to loss of moisture was as follows:—

SUNFLOWERS—SHRINKAGE AFTER CUTTING

From 10 a.m. Aug. 26 to 7 p.m. same date	12.5%
" to 10 a.m. Aug. 27	17.4%
" to 7 p.m. Aug. 27	26.4%
" to 10 a.m. Aug. 28	29.2%
" to 10 a.m. Aug. 29	37.3%
" to 10 a.m. Aug. 30	45.1%

SUNFLOWER BREEDING

Realizing the importance of sunflowers as an ensilage crop, particularly in districts where corn cannot be profitably grown, a large collection of material to serve as foundation stock was collected by the Dominion Agrostologist during the summer of 1920. This material, comprising some 100 seed samples from individual sunflowers, was planted at Ottawa in 1921 and used for the purpose of crossing and isolating. From the crosses a fair set of seed was obtained and from isolated plants from 0 to 50 good seeds were obtained from each.

A number of the original seed samples produced very uniform plants and an additional number of plants will be grown in 1922 from lots showing fair uniformity of desirable characters.

Unfortunately, due to lack of working or storage-room accommodation much valuable material was lost during the winter of 1921-22 and it is hoped that before drying and storage room is needed for 1922 crop adequate accommodation will be available for breeding material of sunflowers and other forage crops.

ANNUAL HAY CROPS

MILLETS

Millets all require soil in good condition and an abundant supply of plant food and, as they can be sown considerably later than most crops and still produce, under favourable conditions, a good stand, their chief value is as a catch crop. Variety tests were conducted at the Central Experimental Farm from 1899-1904, the results indicating that results from millets are rather uncertain. In some years the green yield per acre had been as high as 18 tons whilst in other years the best yielding variety has given less than 9 tons green per acre. In order to gain additional data with regard to millets, a number of varieties were tested in 1921 in duplicate one-twentieth-acre plots, one set of plots being sown on muck land, and the duplicate on clay which had been in flax in 1920. The area was fall ploughed and after an application of 15 tons manure per acre was spring ploughed and prepared for seeding. Seeding was done June 8 at a rate of 30 pounds per acre. Yields of varieties tested are given in the table following:—

VARIETY TESTS OF MILLETS

Variety	Date cut	Yield per acre on muck				Yield per acre on clay				Average yield per acre				
		Green		Dry		Green		Dry		Green		Dry		
		tons	lbs.	tons	lbs.	tons	lbs.	tons	lbs.	tons	lbs.	tons	lbs.	
Japanese	Aug. 23	13	880	4	1,740	18	240	5	1,860	15	1,560	5	800	Hay of good quality.
Golden	" 23	12	840	4	1,780	14	1,520	4	1,820	13	1,180	4	1,800	Hay of good quality.
Pearl Millet (Foxtail.)	" 17	11	960	3	1,140	12	620	3	1,900	11	1,790	3	1,520	Very fine and leafy
Hungarian	" 5	7	1,820	2	1,440	11	1,660	3	860	9	1,740	3	150	Hay very coarse and of poor quality.
Common	" 5	8	1,160	2	1,580	8	1,780	3	40	8	1,470	2	1,810	Hay of fair quality
Hog	" 5	8	620	2	1,740	8	1,840	2	800	8	1,230	2	1,270	Hay coarse and of poor quality.
Siberian	" 5	8	1,660	3	40	9	1,260	3	100	9	460	3	70	Hay of good quality.
Average	.....	10	277	3	1,065	12	131	3	1,625	11	203	3	1,345	

SUDAN GRASS

Sudan grass was tested in 1920 and again in 1921 in comparison with seven varieties of millet. Sown on the same land as the millets and at the same rate it did not make favourable growth on the muck and clay land. On muck and clay, Sudan grass made comparatively slow growth and weeds practically crowded it out of the plots. Millets on the same land made very rapid growth and checked any weeds present.

In addition to the one-twentieth-acre plots of millets and Sudan grass sown on muck and clay a set of plots were sown on exceptionally rich land where abundant moisture was present. On this land Sudan grass compared favourably with Common and Siberian millet but it would appear, from two years' results, that Sudan grass cannot be depended upon as a late sown or catch crop unless conditions are very favourable.

FIELD ROOTS

VARIETY TESTS WITH MANGELS

Thirty varieties of mangels and feeding sugar beets from different seedsmen were tested in duplicate one-hundredth-acre plots on land which had been pig runs in 1920. Seeding was done on ridges 27 inches apart on May 4, the plants being thinned to 8 inches apart. All plots were harvested September 13th and 14th, the tops and roots from each plot being weighed up separately. Representative roots of each lot were forwarded to the Division of Chemistry for analysis. The following table, in order of yield of dry matter per acre, gives the results of varieties tested in 1921.

Variety	Source	Average Yield per Acre		Percentage of Sugar in Juice	Per cent Dry Matter	Yield per Acre Dry Matter	Remarks
		Roots	Tops				
		Tons Lbs.	Tons Lbs.			Tons Lbs.	
Prize Mammoth Long Red.	Kenneth McDonald.	26 420	4 967	5·75	13·00	3 815	Long red or uniformly objectionable type. Roots misshapen, prongy and very hard to harvest clean. Flesh white with deep red marbling.
Yellow Intermediate...	C.E.F., Ottawa...	30 1,635	3 524	3·36	10·35	3 379	Ottawa selections. Fairly uniform in shape and colour. A few long roots. Flesh white. Easy to harvest clean.
Yellow Intermediate...	C.E.F., Ottawa...	29 78	2 1,673	4·06	10·57	3 138	
Danish Sludstrup.....	Kenneth McDonald.	31 1,149	2 421	3·53	9·57	3 43	Fifteen per cent Sludstrups in shape and colour. Eighty per cent appear to be light lemon yellow, Yellow Intermediates. Five per cent of roots are dark red in colour. Flesh white. Easy to harvest.
Giant Yellow Intermediate.	Wm. Ewing.....	28 325	3 1,148	4·87	10·57	2 1,953	Yellow Intermediate to Giant Yellow Intermediate with light lemon yellow skin. Nine per cent Half Sugar Mangels. Yellow and Orange Globes and Long Red present. Flesh white, yellow, and white with red traces showing. A very difficult lot to harvest clean.
Selected Long Red Mammoth.	Wm. Ewing.....	28 1,632	3 1,467	4·16	10·26	2 1,913	Long red with dark red skin. A fairly good type of this variety. Colour of flesh from white to deep red. Hard to harvest clean.
Rose Giant.....	Scandinavian and R.Wiboltt,Ltd., Denmark.	26 1,994	2 1,593	4·54	10·75	2 1,804	Half Sugar Rose with light to medium pink skin. Fairly uniform. Flesh white. Very easy to harvest clean.
Sludstrup.....	Scandinavian and R.Wiboltt, Ltd., Denmark.	29 211	3 1,123	4·35	9·90	2 1,762	Fairly uniform lot, tends to be long and light coloured. Eleven per cent very light lemon skin. Flesh white. Due to presence of prongy roots it is rather difficult to harvest clean.
Danish Sludstrup.....	Wm. Ewing.....	32 1,421	2 1,453	2·84	8·61	2 1,632	Not uniform but appears to be more Yellow Intermediate type than Sludstrup. Seventy-five per cent of roots light lemon yellow skin. Flesh white. Prongy roots makes it difficult to harvest clean.
Giant White Green Top	Scandinavian and R.Wiboltt,Ltd., Denmark.	26 1,524	2 1,811	4·06	10·31	2 1,518	Half Sugar White of fairly uniform type. Eleven per cent show pink in crown. Six per cent appear to be sugar beets. Flesh white. Easy to harvest.
Yellow Ovoid Giant...	Scandinavian and R.Wiboltt,Ltd., Denmark.	30 1,754	3 237	3·86	8·75	2 1,403	Yellow Intermediate to Giant Yellow Intermediate in type. Colour of skin lemon to light orange yellow. Flesh white. Grows fairly deep in the ground and due to the presence of many small roots is rather hard to harvest clean.
Mammoth Long Red..	Steele Briggs.....	22 1,543	3 601	5·05	11·67	2 1,314	Long Red. Twenty-one per cent appear to be Half Sugar Rose. Flesh white with very pronounced red marbling. Rough, rooty, and difficult to harvest clean.

MANGELS AND FEEDING SUGAR BEETS—*Concluded*

Variety	Source	Average Yield per Acre				Percentage of Sugar in Juice	Per cent Dry Matter	Yield per Acre Dry Matter		Remarks
		Roots		Tops						
		Tons	Lbs.	Tons	Lbs.			Tons	Lbs.	
Royal Giant Sugar Beet	Steele Briggs.....	27	356	2	732	4·16	9·77	2	1,301	Fairly uniform in shape but not in colour, which runs from white to deep red. All roots show pink in crown. Tendency to be rough at shoulder. Flesh white. Very easy to harvest.
Improved Danish Sugar Beet.	Kenneth McDonald.	26	123	2	1,381	4·56	10·04	2	1,233	Majority Half Sugar Rose type with pink showing only in the skin at ground line or in the crown. Flesh white with faint traces of pink in a small percentage. Rather difficult to harvest clean.
Selected Giant Rose Intermediate Sugar Beet.	Wm. Ewing.....	26	394	2	805	4·34	9·96	2	1,218	Fairly uniform type of Half Sugar Rose with light pink skin. Flesh white. Very east to harvest clean.
Giant Half Sugar.....	Kenneth McDonald.	24	1,620	2	1,385	4·16	10·51	2	1,215	A uniform Half Sugar Rose with light to medium pink skin. Flesh white. Traces of pink in a small percentage. Fairly easy to harvest clean.
Giant Yellow Intermediate.	Kenneth McDonald.	26	1,393	2	837	4·25	9·71	2	1,184	Appears to be Yellow Intermediate in general type. Twenty five per cent Long Yellow. No uniformity. Flesh white. Hard to harvest.
Giant White Half Sugar Mangel.	Wm. Ewing.....	29	294	2	1,339	3·24	8·81	2	1,135	Fairly uniform lot of Half Sugar mangels. Six per cent show pink in crown. Flesh white and white and green. Fairly easy to harvest.
Improved Giant Sugar Beet.	Wm. Rennie.....	24	357	4	403	3·85	10·44	2	1,048	Fifty per cent Half Sugar Rose with light pink skin. Fifty per cent Green Top White showing pink in crown. Flesh white. Easy to harvest.
Eckendorffer Red.....	Kenneth McDonald.	29	1,673	1	1,826	2·13	8·44	2	1,036	Eckendorffer Red of uniform shape and colour. Flesh white with traces of pink in a small percentage. Very easy to harvest.
Giant Yellow Globe...	Wm. Ewing.....	26	1,148	1	1,647	4·06	9·32	2	953	Rough and lacks uniformity. Colour light yellow. Twenty per cent orange yellow. Flesh white and green and white. Very easy to harvest.
Perfection Mammoth Long Red.	Wm. Rennie.....	24	551	2	1,354	4·16	10·18	2	942	Long Red with dark red skin. Twenty per cent with white flesh. Eighty per cent white with red marbling. A rough, rooty lot very difficult to harvest clean.
White Sugar.....	Steele Briggs.....	31	1,953	2	383	1·74	7·71	2	930	White Green Top. Sixty-one per cent show pink in crown. The shape is good and fairly uniform, a tendency being to roughness at the shoulder. Flesh white with a few showing traces of pink. Very easy to harvest.
Giant White Sugar.....	Wm. Rennie.....	25	493	1	1,585	3·74	9·47	2	781	Twenty-two per cent with light pink skin, forty-two per cent show pink in crown, balance white green tops. Flesh white. Rough but very easy to harvest.

Jumbo Sugar Beet.....	Wm. Rennie.....	26	545	2	1,066	3·55	8·70	2	571	Half Sugar Mangel. Forty-one per cent Green Top White showing pink in crown. Five per cent red roots, eighteen per cent yellow. The Half Sugar White type present are exceptionally uniform in shape are very smooth and easy to harvest. Flesh white.
Giant Yellow Half Long Intermediate.	Wm. Rennie.....	24	1,508	2	1,617	3·33	9·16	2	534	All types from globes to Long Yellow. Predominating colour light lemon yellow. Flesh white. Fairly easy to harvest.
Giant Half Sugar.....	Steele Briggs.....	22	1,838	2	709	3·46	9·43	2	323	Good uniform type of Half Sugar White. Four per cent Long Reds, two per cent appear to be sugar beets. Flesh white. Very easy to harvest clean.
Yellow Globe.....	Kenneth McDonald.	27	1,429	1	1,188	2·77	7·55	2	185	Lemon Yellow Globe. Three per cent White Globe. Eleven per cent Yellow Tankard. Flesh white. Grew practically on top of the ground, which made harvesting extremely easy.
Selected Yellow Globe.	Steele Briggs.....	24	1,323	1	1,032	2·44	7·86	1	1,876	Forty per cent Yellow Tankard. Flesh white. Very easy to harvest.
Golden Tankard.....	Kenneth McDonald.	21	404	1	1,387	3·77	9·11	1	1,863	No uniformity to any shape or colour, although Sludstrup and Yellow Intermediate types predominate. Globes, Long Red, Eckendorffer Red and Sugar Mangels present. Flesh white, Yellow and White with red marbling. Fairly easy to harvest.
Average.....	.....	27	236	2	1,389	3·80	9·68	2	1,233	

VARIETY TESTS WITH FIELD CARROTS

Thirteen varieties of field carrots were tested in duplicate one-hundredth-acre plots on land which had been in pig runs in 1920. The varieties were sown on ridges 27 inches apart, on May 4, the plants being thinned to 4 inches apart. All were harvested October 14th and 15th, and the following yields obtained.

FIELD CARROTS—TEST OF VARIETIES

Variety	Source	Average yield per acre	Per cent dry matter	Yield per acre dry matter	Remarks
		tons lbs.		tons lbs.	
Improved Intermediate White.	Wm. Ewing.....	31 650	11·62	3 1,279	Green top white, a few bronze tops, fairly uniform. Flesh white.
Improved White Vosges.	K. McDonald...	32 150	11·25	3 1,216	White, green and bronze tops. Shape uniform. Flesh white.
White Mammoth Intermediate.	Wm. Rennie....	34 1,800	8·29	2 1,786	White green top intermediate with white flesh. Lacks uniformity, impossible to harvest without digging.
Improved White Belgian.	K. McDonald...	32 550	8·82	2 1,693	White green and bronze tops. Flesh white or yellow. Rooty and impossible to harvest without digging.
Improved Short White.	K. McDonald..	26 1,200	10·59	2 1,633	White green top. Short to intermediate type. Flesh white.
Danver's Half Long..	K. McDonald..	23	12·09	2 1,561	Orange green top. Short and with many roots. Flesh orange.
Danish Champion.....	Ottawa.....	24 1,600	11·06	2 1,485	Yellow green top with a few bronze tops. Type uniform. Yellow flesh.
White Belgian.....	Scandinavian and R. Wiboltt.	24 1,900	9·74	2 860	White green top with white flesh, 10 per cent bronze tops with yellow flesh. Lacks uniformity. Impossible to harvest without digging.
Improved Short White	Steele Briggs...	25 1,050	8·56	2 369	White green top. Intermediate type. Lacking in uniformity. Flesh white
Yellow Belgian.....	Wm. Ewing.....	21 350	9·96	2 218	Light orange green top. Flesh orange yellow. Type long and very thin. Impossible to harvest without digging, and even then practically all roots were broken.
Danish Champion....	K. McDonald..	22 1,000	8·95	2 27	Yellow green top. Flesh yellow. Uniform and very easily harvested.
Large White Belgian.	Steele Briggs...	24 750	7·95	1 1,875	White bronze top. Flesh light yellow. Long narrow type impossible to harvest without digging.
Danish Yellow Champion.	Scandinavian and R. Wiboltt.	23 50	8·37	1 1,854	Yellow green top with yellow flesh; an exceptionally smooth uniform lot. Very easy to harvest.
Average.....	.....	26 1,311	9.78	2 1,219	

VARIETY TESTS WITH SWEDE TURNIPS

Twenty-six varieties of swede turnips were sown in duplicate one-hundredth-acre plots at the same time and on the same class of land as was used for other root variety tests. Seeding was done on ridges 27 inches apart and the plants thinned to

9 inches apart in the row. All varieties made exceptionally heavy growth of tops and the roots formed were not of good size. This was perhaps due, not so much to fault of varieties as to unfavourable conditions affecting their growth.

Results, which cannot however, be taken as representative of varieties tested, are recorded in the following table.

SWEDE TURNIPS—TEST OF VARIETIES

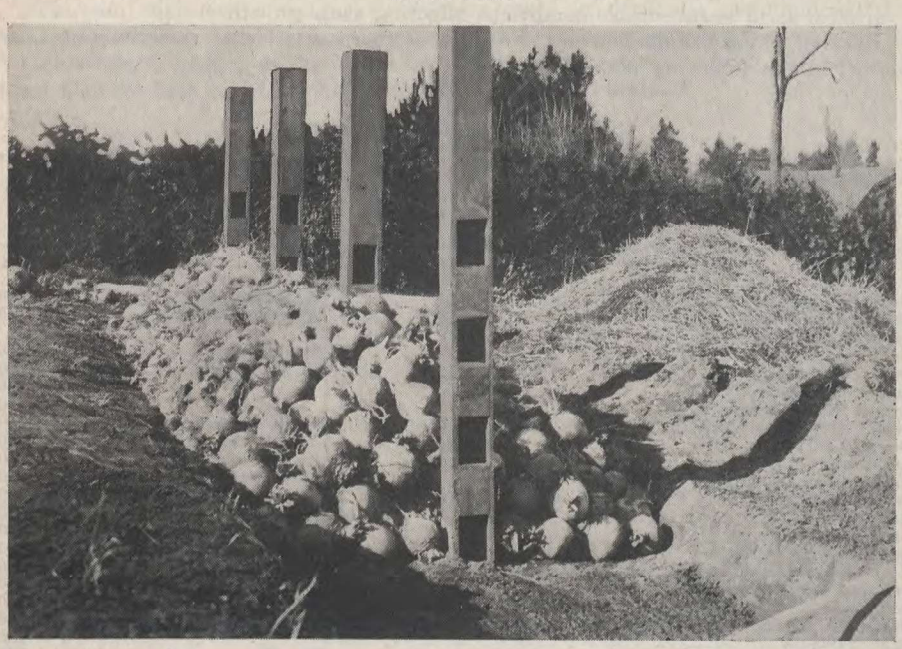
Variety	Source	Average yield per acre	
		tons	lbs.
Skirving's Improved Purple Top	K. McDonald & Sons	16	1,500
Derby Bronze Top	Wm. Rennie	12	650
Improved Elephant	"	12	
Canadian Gem	Steele Briggs	11	950
Invicta Swede	K. McDonald and Sons	10	1,800
Hartley's Bronze Top	"	10	1,000
Selected Prize Elephant	"	10	150
Jumbo	Steele Briggs	9	1,600
Kangaroo	Wm. Rennie	9	700
Kangaroo	K. McDonald & Sons	9	550
Kangaroo	Steele Briggs	9	100
Carter's Improved Hardy	K. McDonald & Sons	8	1,800
Prize Purple Top	Wm. Rennie	8	1,560
Prize Purple Top	Wm. Rennie	8	1,400
Monarch	Nappan, N.S.	8	150
Sutton's Champion	Fredericton, N.B.	6	1,600
Champion Purple Top	K. McDonald & Sons	6	1,150
Good Luck	Steele Briggs	6	1,050
Perfecta	K. McDonald & Sons	6	650
Magnum Bonum	"	6	250
Elephant or Monarch	Wm. Ewing	5	750
Hall's Westbury	"	5	400
Shepherd's	Scandinavian & Weibolt Ltd.	4	100
Hall's Westbury	K. McDonald & Sons	3	1,400
Bangholm	Scandinavian-Weibolt	2	1,700
Ditmars Swede		1	1,850
Average		8	262

VARIETY TESTS WITH SUGAR BEETS

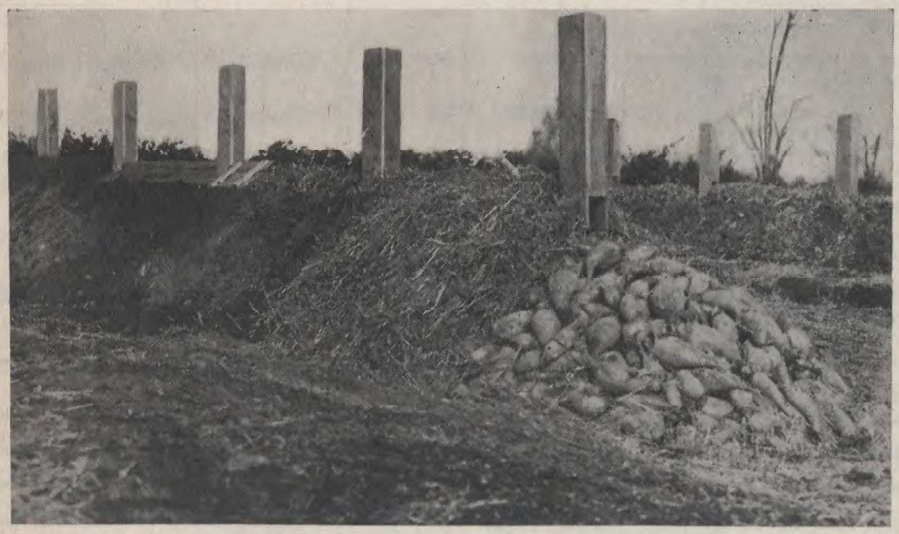
Four varieties of sugar beets were tested in duplicate one-hundredth-acre plots. Seeding was done at same time and on the same class of land as used for the mangel tests. Results in yield per acre are shown in following table:—

SUGAR BEETS—TEST OF VARIETIES

Variety	Source	Yield per acre		Remarks
		tons	lbs.	
Chatham	Dominion Sugar Co.	25	1,900	10 per cent of roots showed red blood.
Waterloo	Dominion Sugar Co.	22	1,100	10 per cent of roots showed red blood.
Klein Wanzleben	Rimpau (Germany)	20	1,300	30 per cent of roots showed red blood.
British Columbia	Dominion Sugar Co.	20	150	10 per cent of roots showed red blood.



Partly filled, showing depth of trench, method of piling roots and ventilators in position.



First covering of straw and earth being put on. V-shaped boards connecting ventilators are removed before final covering is put on.

FIELD ROOT BREEDING

It was realized, some years ago, from results and observations obtained in connection with field root variety tests, that a great need existed for the improvement of varieties of field roots available on the Canadian market. The Division of Forage Plants at Ottawa and several of the Branch Farms and Stations undertook to improve, by selection, some of the more suitable field root varieties and produce stock seed of those varieties.

At Ottawa, improvement was undertaken with Yellow Intermediate mangel, Purple Top swede turnip and Danish Champion field carrot and results so far indicate conclusively that it is possible, by selection, to produce more uniform and higher yielding strains of these varieties than are at present obtainable from Canadian seed

Second (final) covering of straw and earth being put on. This covering is not put on until first covering of earth is well frozen. Bags on ventilators for control of temperature.

merchants. Thus, at Ottawa, although starting with a rather inferior type of Yellow Intermediate mangel which lacked uniformity and was comparatively low in dry matter content, there has been developed a selection of this variety which, last season, gave excellent yields and a very uniform crop. A strain of Danish Champion field carrot has been developed superior in type, uniformity, yield and dry matter content to the original stock and considerable improvement has been obtained with the swede turnip variety worked with.

Mangels

One-quarter acre of stecklings (bulk selection) were set out for seed production. These were planted by hand on May 4 in rows 3 feet apart with 2½ feet between plants in the row. A perfect stand was obtained and, until blossoming, indications were for an exceptionally heavy yield of seed. Weather conditions while plants were in bloom were very unfavourable and a large percentage of blossoms did not form seed, with the result that the seed yield was only at the rate of 750 pounds per acre. In addition to the quarter-acre of bulk selection, three small plots were set out, in isolated locations, of specially selected stecklings, for the production of seed for steckling raising in 1922.

One-quarter acre was devoted to the raising of stecklings (bulk selection) for seed raising 1922. The crop from this area was of excellent quality and uniformity and was stored in pits during the winter.

In 1920, following the usual practice, a number of exceptionally good roots were selected when the pits were opened. These roots were tested in brine of increasing strength until 30 roots were obtained which sank in a 5½ per cent salt solution. Of each of these roots the Chemical Division took a sample which was used for determination of dry matter content. Of the 30 roots the 10 with the highest dry matter content were set out for seed growing from isolated plants. Roots isolated in cheese cloth cages did not, however, set seed satisfactorily but 3 roots grown without cages but where there was practically no chance of cross-fertilization produced sufficient seed to plant for stecklings in 1921. When roots of these 3 families were harvested, representative roots of each were sent for analysis to the Chemistry Division and the following results obtained:—

MANGELS—ANALYSIS

Family	Sugar in juice	Per cent dry matter
Mc	7·73	13·20
Da	7·54	13·10
La	7·05	12·60

Roots of these three families were marked for identification and stored with the bulk of the stecklings in pits during the winter.

Swede Turnips

One-eighth acre of Purple Top stecklings were set out for seed production but the seed crop, owing to unfavourable weather conditions and attacks by insects, was practically a failure. Seed was, however, obtained from a few selected roots for steckling raising in 1922.

One-quarter acre of stecklings was grown for seed raising in 1922.

Field Carrots

One-quarter acre of Danish Champion stecklings were set out for seed production. Unfavourable weather conditions during blossoming adversely affected the set of seed, the yield obtained being only at the rate of 350 pounds per acre.

One-quarter acre of stecklings were grown and pitted for seed raising in 1922.

GRASSES, CLOVERS AND ALFALFA

TIMOTHY

In order to test the productiveness and uniformity of timothy breeding material plots were sown in 1920 with an Ottawa bulk selection and, for comparison, with varieties from the United States and Sweden. In addition to plots of each variety, there were set out 150 individual plants for the purpose of comparing the uniformity and type of the varieties being tested.

When harvested the following yields were obtained:—

TIMOTHY—YIELDS FROM SELECTIONS

—	Yield (dry) per acre	
	tons	lbs.
Ottawa Bulk Selection	2	213
Primus (Sweden)	1	1,825
3937 (Ohio, U.S.A.)	1	1,800
Gloria (Sweden)	1	1,505

3937 was four days earlier than others tested but lacked, comparatively, in leaf growth and uniformity. Primus and Gloria were comparatively short but tillered well and produced a heavy leaf growth. Ottawa bulk selection not only gave a very favourable yield but, as a variety, was much more uniform than other lots tested.

Testing Hulled vs. Unhulled Timothy Seed

Fom various causes, many samples of timothy show a large percentage of hulled seed, which may be either due to type character, to unfavourable weather during harvesting or to allowing the seed plants to stand too long before cutting. In order to test, under field conditions, the productiveness of hulled and unhulled seed stored for increasing periods, plots were sown in 1917, 18, 19, and 20 with unhulled and hulled seed harvested in 1916. During the first years of the test very little difference was noted between the crops produced from hulled and unhulled seed. The following figures indicate, however, that hulled seed loses, when stored, its productive value much more quickly than does the unhulled seed.

YIELD OF HAY PER ACRE FROM HULLED AND UNHULLED SEED HARVESTED 1916

—	Unhulled		Hulled	
	tons	lbs.	tons	lbs.
Sown 1919 cut 1920	2	840	1	1,375
Sown 1920 cut 1921	2	1,354	2	53

Breeding

Thirty-six plots of individual plants were set out with seed of plants isolated in 1920. Each plot is in two sections one half being planted with 6 inches between plants each way, the balance being with 1 foot between plants each way. These plots will be used to obtain comparative yields of Ottawa selections of timothy.

Two hundred and ten pounds of timothy seed was obtained from non-isolated plants in the timothy-breeding block.

Western Rye Grass

One hundred and thirty varieties of Western rye grass were set out in plots of individual plants in 1920. During the summer of 1921, these varieties were harvested for hay and seed yield. When in bloom from 75 to 100 plants of each variety were cut for hay and yields compared on a basis of yield per 100 individual plants. The same plants of each variety cut for hay were again cut before frost for obtaining comparative yield of second growth. As the varieties became fit to harvest for seed,

125 to 200 individual plants were cut, cured and stored for threshing during the winter. Seed from these plants was used, when threshed, for comparing the seed yield of different varieties and for supplying seed to branch Farms, particularly in the Western provinces, for comparative test in different districts. Of each variety,

Western Rye Grass—Plots of individual plants.

4 plants were dug out, 2 to file away as records, 1 to replant in a plot in order to have always representative plants growing in the field, and 1 to harvest seed from for seeding in 1922. After harvest, all 1920 seedings of Western rye were ploughed under in preparation of the land for further test in 1922.

The following table gives results of variety tests Western rye grass.

VARIETY TESTS OF WESTERN RYE GRASS

Number	Hay yield per 100 individual plants				Aftermath (2nd cut) yeild per 100 individual plants Green		Seed yield per 100 individual plants		Average weight 1,000 kernels
	Green		Dry						
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	grams
1	30	.....	11	.....	.....		.....		1·238
2	50	10·6	21	5·3	7	11·7	.....		1·137
3	60	.....	21	5·3	9	7·4	5	7·3	1·141
4	97	5·3	50	10·6	10	2·1	8	13·6	1·450
5	68	14·7	37	8·0	16	7·7	6	14·7	1·462
6	72	.....	36	10·6	8	.....	6	7·0	1·218
7	45	5·3	24	10·6	9	1·0	3	13·1	1·689
8	42	10·6	21	5·3	9	1·0	4	12·8	1·404
9	50	10·6	26	.....	9	7·4	5	13·9	1·399
10	60	.....	32	.....	3	11·7	7	11·0	1·432
11	78	10·6	39	5·3	12	14·0	8	7·8	1·235
12	83	1·8	39	14·0	20	8·3	5	11·2	2·390
13	73	10·9	39	0·5	11	9·2	2	2·4	2·606

VARIETY TESTS OF WESTERN RYE GRASS—*Continued*

Number	Hay yield per 100 individual plants				Aftermath (2nd cut) yield per 100 individual plants		Seed yield per 100 individual plants		Average weight 1,000 kernels
	Green		Dry		Green				
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	grams
14	58	10·6	24	10·6	13	5·3	4	2·2	1·520
15	100	.....	42	10·6	11	5·3	5	5·5	1·955
16	118	.....	59	.....	19	3·2	8	5·8	
17	72	.....	40	.....	12	.....	4	15·5	1·696
18	72	.....	52	.....	12	10·6	6	1·1	1·640
19	82	.....	37	5·3	11	7·4	7	0·8	1·656
20	94	.....	46	10·6	13	5·3	7	1·6	1·500
21	85	.....	35	.....	15	.....	5	6·9	1·319
22	50	.....	20	13·3	21	10·6	.....		
23	34	6·0	16	10·6	11	10·6	3	13·9	1·524
24	37	8·0	12	8·0	11	10·6	.....		
25	46	14·0	20	13·3	15	13·3	3	0·1	1·645
26	66	10·6	25	.....	9	2·6	3	3·8	1·878
27	41	10·6	16	10·6	20	13·3	3	0·5	1·591
28	58	5·3	20	13·3	15	.....	.....		1·873
29	50	.....	20	13·3	13	5·3	6	0·9	1·841
30	.....		.....		12	8·0	.....		
31	72	14·6	29	2·4	18	5·3	.....		
32	79	2·4	29	2·4	3	5·3	3	11·2	1·786
33	83	5·3	33	5·3	15	.....	5	8·0	1·973
34	87	8·0	33	5·3	53	5·3	6	0·9	1·717
35	89	9·3	33	5·3	16	10·6	6	4·0	1·773
36	68	12·0	25	.....	11	10·6	.....		2·011
37	52	1·3	16	10·6	14	2·6	5	7·8	2·015
38	58	5·3	25	.....	9	2·6	4	5·5	1·833
39	60	6·6	25	.....	8	5·3	9	1·1	1,747
40	.....		.....		.....		.....		.....
41	.....		.....		.....		2	5·2	2·265
42	.....		.....		.....		.....		1·867
43	.....		.....		.....		.....		.....
44	.....		.....		.....		.....		.....
45	.....		.....		.....		.....		.....
46	.....		.....		.....		.....		.....
47	.....		.....		.....		2	9·6	1·674
48	.....		.....		.....		1	0·1	1·564
49	.....		.....		.....		.....		.....
50	116	10·6	41	10·6	11	10·6	5	6·4	1·938
51	141	10·6	50	.....	23	5·3	8	1·7	
52	68	12·0	37	8·0	5	.....	2	12·4	2·2105
53	51	0·6	20	13·3	8	5·3	.....		1·871
54	72	14·6	25	.....	10	.....	9	14·3	1·818
55	108	8·0	37	8·0	17	8·0	.....		1·928
56	100	.....	33	5·3	20	.....	6	4·0	1·684
57	50	.....	12	8·0	18	5·3	.....		1·465
58	26	0·6	12	8·0	.....		.....		2·088
59	87	8·0	33	5·3	12	5·3	6	7·2	1·848
60	100	.....	37	8·0	18	5·3	3	13·7	1·529
61	91	10·6	33	5·3	10	.....	6	0·9	1·965
62	73	15·3	25	.....	16	10·6	6	12·1	1·618
63	90	10·0	33	5·3	9	2·6	8	8·3	1·673
64	104	2·6	41	10·6	20	.....	6	3·3	1·979
65	83	5·3	25	.....	12	8·0	7	13·0	1·655
66	58	5·3	25	.....	12	8·0	2	9·9	1·389
67	41	10·6	12	8·0	5	.....	2	5·1	2·063
68	29	2·6	8	5·3	4	2·6	2	1·3	1·162
69	75	.....	29	2·6	11	10·6	7	14·3	1·847
70	95	1·3	37	8·0	20	1·3	5	2·3	1·882
71	66	10·6	25	.....	7	8·0	7	3·3	1·502
72	.....		.....		.....		.....		1·153
73	91	10·6	33	5·3	15	.....	4	12·3	2·132
74	66	10·6	25	.....	12	8·0	4	8·5	1·854
75	25	.....	8	5·3	4	2·6	2	1·3	1·186
76	33	5·3	12	8·0	14	2·6	.....		1·542
77	66	10·6	25	.....	6	10·6	5	7·8	1·695
78	80	.....	41	5·3	16	8·5	8	1·5	1·482
79	52	10·6	24	.....	13	3·3	8	5·3	1·748
80	62	10·6	26	10·6	14	2·1	1	14·0	1·580
81	99	5·3	49	5·3	20	4·2	3	15·1	1·679

VARIETY TESTS OF WESTERN RYE GRASS—*Concluded*

Number	Hay yield per 100 individual plants				Aftermath (2nd cut) yield per 100 individual plants Green		Seed yield per 100 individual plants		Average weight 1,000 kernels
	Green		Dry						
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	grams
82	62	.....	29	5·3	15	7·4	6	11·7	1·659
83	64	.....	30	.....	16	4·2	7	9·3	1·558
84	68	.....	33	5·3	18	10·6	8	2·5	1·767
85	65	2·6	25	5·3	14	2·1	7	14·8	1·436
86	53	5·3	25	5·3	16	.....	7	0·7	1·718
87	48	10·6	17	5·3	11	13·8	.....	.....	1·582
88	60	.....	24	.....	14	10·6	6	10·6	1·678
89	65	5·3	26	10·6	13	1·0	7	9·5	1·756
90	59	6·0	18	12·0	.....	.....	3	0·6	1·836
91	68	10·6	32	.....	21	7·4	5	10·1	1·785
92	72	10·6	29	5·3	13	5·3	5	14·5	1·447
93	57	5·3	26	10·6	14	10·6	9	12·3	1·784
94	28	.....	4	.....	5	9·6	1	5·6	1·547
95	32	.....	11	.....	10	6·4	6	3·4	1·282
96	37	8·0	13	5·3	10	12·8	3	3·2	1·202
97	.....	.....	.....	.....	.....	.....	3	12·8	1·480
98	86	10·6	42	10·6	20	2·1	9	14·3	1·690
99	52	.....	20	.....	17	5·3	3	6·1	1·550
100	45	5·3	17	5·3	13	3·2	3	0·1	1·329
101	52	.....	19	5·3	17	7·4	2	12·9	1·541
102	44	.....	12	.....	16	6·4	2	4·5	1·700
103	44	.....	20	.....	4	.....	1	6·5	1·651
104	.....	.....	.....	.....	.....	.....	5	12·1	1·494
105	.....	.....	.....	.....	.....	.....	3	7·2	1·732
106	.....	.....	.....	.....	.....	.....	2	10·2	1·177
107	.....	.....	.....	.....	.....	.....	1	4·2	1·286
108	76	.....	32	.....	16	10·6	5	.....	1·490
109	78	10·6	34	.....	9	1·0	7	1·8	1·862
110	37	8·0	13	5·3	4	2·1	2	8·5	1·145
111	52	.....	18	10·6	7	13·8	5	3·9	1·540
112	.....	.....	.....	.....	.....	.....	3	0·7	1·450
113	20		4	5·3	5	3·2	4	4·7	1·517
114	52	.....	18	10·6	11	7·4	5	8·8	1·667
115	.....	.....	.....	.....	.....	.....	3	4·6	1·125
116	40	.....	14	.....	6	14·9	5	4·2	1·280
117	14	.....	10	10·6	3	11·7	.....	.....	1·0325
118	66	10·6	40	.....	13	9·6	4	11·3	1·410
119	.....	.....	.....	.....	.....	.....	.....	.....	1·339
120	10	.....	3		.....			13·7	0·726
121	.....	.....	.....	.....	.....	.....	.....	.....	1·694
122	40	.....	13	.....	8	.....	.....	.....	1·694
123	28	10·6	10	5·3	4	10·6	1	0·6	1·485
124	40	.....	13	9·3	13	1·0	5	2·3	1·705
125	44	.....	14	10·6	6	6·4	2	10·8	1·327
126	50	10·6	13	10·6	8	6·4	1	1·5	1·37
127	51	5·3	20	.....	16	2·1	1	2·9	1·625
128	.....	.....	.....	.....	.....	.....	.....	.....	1·100
129	.....	.....	.....	.....	.....	.....	1	1·7	
130	.....	.....	.....	.....	.....	.....	1	4·0	1·055

Seventeen small additional lots of Western rye grass were set out in plots of individual plants. These 17 represent lots of which a good set of seed was not obtained until 1920 and some lots where there appeared to be considerable breaking up in type characters.

ORCHARD GRASS

From plots of individual plants set out in 1920, a number of plants were isolated and seed harvested. Test plots and individual plants were sown of a variety of orchard grass obtained from Sweden under the name Skandia. As a variety this lot lacked uniformity, but contained a number of exceptionally leafy types very suitable for pasture. A number of these types were isolated and seed will be planted in 1922 for further observation.

MEADOW FESCUE

Isolations were made from plots of individual plants sown in 1920. Seed harvested from these isolated plants will be used for further planting in 1922. In addition a number of plants were isolated from a Swedish selection which appeared to be particularly suited for pasture.

KENTUCKY BLUE GRASS

One plot of individual plants, sown in 1919, was harvested in bulk for seed production. This lot was one of six originally collected by the Dominion Agrostologist and showed up in the trial plots as a very uniform and desirable type. All other plants of Kentucky Blue were cut before flowering and this one lot allowed to flower and set seed.

A number of Kentucky Blue types were collected in 1919 and put out as small plots of individual plants in 1920. One of the types collected proved uniform and was isolated in bulk for seed production.

FIELD BROME GRASS

A plot of this grass was sown in 1920 and came through the winter well. Growth was very slow in starting in 1922 but, although late in maturing, a good stand was secured. Owing, however, to the fact that the straw was very weak and lodged, and to the fact that part of the plot had ripened seed before the balance had flowered, it was impossible to get any results from this plot. It would, however, appear that this grass is not suitable for this district.

MISCELLANEOUS WORK WITH GRASSES

Collections were made 1919 of types of Red Top, Awnless Brome and Red Fescue, and of each type a plot of individual plants were set out in 1920. Desirable types were selected from these plots and isolated in 1921. This material will be set out in 1922 as plots of individual plants for further selection.

CLOVERS AND ALFALFA

RED CLOVER

Six plots of red clover, representing different types and sources of production, were sown in comparative test plots in 1920. In addition to the plot of each variety there were set out a number of individuals for the purpose of obtaining comparative degree of winter hardiness of varieties tested, by counting in the fall and spring. All plots and all individual plants were sown or planted under similar conditions and grown on land sown to mangels in 1919, after an application of 15 tons manure per acre. No nurse crop was used. An excellent stand was obtained in 1920 and all varieties came through the winter well. Owing, however, to the presence of clover wilt, in the rows of individual plants no accurate count was possible for determining winter hardiness. In the plots of varieties no winter killing was apparent.

Six varieties were tested with the following results.

CLOVER VARIETIES—YIELD PER ACRE

Variety	Date cut	First cutting		Second Cutting		Total yield per acre
		Green	Dry	Green	Dry	
		tons lbs.	tons lbs.	tons lbs.	tons lbs.	tons lbs.
Altaswede	July 5	9 8	2 1,320			2 1,320
Oxdrift	June 21, Aug. 6	9 1,944	3 1,632	3 1,632	1 1,960	5 1,592
Ottawa	June 21, Aug. 6	11 500	2 1,688	6 160	2 680	5 368
Svälof Improved	July 8	10 88	3 1,812			3 1,812
Swedish Medium Late	July 8	10 376	3 92			3 92
Swedish Late	July 5	11 1,373	3 1,236			3 1,236

NOTE.—No correction made for edges of plots or pathways but all plots same size, shape, and with same length of edge on pathways.

Altaswede, supplied by the University of Alberta, was of the same type as Late Swedish. In comparison with this latter variety it lacked uniformity of type and appeared to contain some Common Red types. Some plants of this variety were in bloom and ready for cutting very early, but the majority matured at about the same time as Late Swedish.

Oxdrift.—Seed of this variety was obtained from the Kenora Cooperative Seed Growers' Association and has, in the past, given excellent results. It makes a little coarser in quality than common red, but gives good yields, recovers very quickly after cutting and has compared favourably here with other varieties in regard to winter hardiness.

Ottawa Perennial has been developed from Common Red and has shown strong tendency to perennialism. Seed used for this plot was harvested from a plot sown in 1916 and from which a hay and a seed crop have been taken in 1917-18-19.

Late Swedish, Swedish Medium Late and Svälof Improved were obtained from Svälof, Sweden. They are all of the same type as the Late Swedish which has shown in previous trials to be a type particularly well suited for districts where, normally, two cuts from Common Red cannot be depended upon. These three varieties, and the Altaswede, all gave hay of much finer quality than did Oxdrift or Ottawa. No appreciable difference could be noted between the three Svälof varieties, except that the Late Swedish was a little earlier than the other two and contained a considerable number of plants having 4, 5, 6 and 7 foliate leaves (6 and 7 imperfect).

Altaswede and varieties from Svälof gave a short aftermath of leaves only. Ottawa and Oxdrift gave two good cuttings and were up about 8 inches and again coming into bloom for the third time when cut down by frost.

BREEDING RED CLOVER

In 1920, to replace breeding material lost during the fall and spring of 1919-1920, some 800 individual plants of Ottawa Perennial (bulk selection) were grown in pots and later transferred to the field, where they were set out with 3 feet between plants each way. Unfortunately, it was necessary, owing to the presence of clover wilt, to remove over half of the plants in this block. Plants left were kept clipped back to prevent blossoming until other clover in the same field was cut in order to eliminate danger of cross pollination with any clover other than in this breeding block. When coming into bloom, all plants of undesirable type were removed from the breeding block. Seed harvested will be used for planting in 1922.

SEED RAISING

In 1920 an area of 4,000 square yards was sown in rows 30 inches apart with Ottawa Red Clover selection, for the purpose of obtaining sufficient seed for test in large plots. The seed used was harvested in 1919 from a plot sown in 1917 and from which hay and seed crops were taken in 1918 and 1919.

On this area a cutting was made for hay June 13, the yield being at a rate of 1 ton 1,570 pounds per acre. Seed was harvested from the second growth, the yield of seed being at the rate of 195 pounds per acre.

Hay and seed crops were taken from small plots of Ottawa Red Clover sown in 1920 and the plots left in order to obtain further seed crops in 1922.

ALFALFA

From a block of individual plants set out in 1920, a number of plants were isolated and seed obtained for further planting and selection. Owing to the fact that we have never had a good set of seed from plants isolated in cheese-cloth or cotton cages, the Division last year used isolation cages made of wire mosquito net. These proved very satisfactory, as they not only allowed the plant to blossom and set seed under natural conditions, but were very easy to open and close daily for the purpose of tripping the flowers. The frames of these cages are in five sections, four sides and a top, all made to a standard size, making it handy to assemble them in the field and when not in use easy to store away in flat sections.

A block of 300 plants was set out with a very heavy seed producing type isolated at Summerland, B.C., in 1920.

ANNUAL SWEET CLOVER

A number of annual sweet clover plants were set out for the purpose of seed multiplication. These plants grew to a height of about five feet and blossomed and set seed very unevenly. Whilst no weights for hay were taken from this plot, a comparison was made with Biennial White Sweet Clover plants sown at the same time and under similar conditions. Biennial White Sweet Clover grew only about half the height of the annual but whereas the annual growth was principally of stalk and stem with very little leaf, the biennial grew a comparatively fine, heavily-leafed crop. It would appear that where seeded early, and of course without a nurse crop, the biennial white is preferable, as an annual hay or pasture crop, to the annual sweet clover.

PASTURE MIXTURES

Thirty-five mixtures and combinations of alfalfa, red clover, alsike, white dutch, sweet clover, timothy, orchard grass, meadow fescue, red top and kentucky blue were sown in duplicate plots for the purpose of ascertaining most suitable and productive hay and pasture mixtures for this district.

WORK ON BRANCH FARMS

In addition to the work reported on above conducted on the Central Experimental Farm, the experimental work with forage plants on the Branch Farms was generally supervised, the work throughout the System thus being correlated and accurate and complete records kept.

MISCELLANEOUS

Besides the strictly experimental work of the division, a large amount of correspondence was conducted with Branch Farms and also with those inquiring as to forage plant problems. A considerable amount of judging at fairs was also done.