PROGRESS REPORT

FORAGE CROP INVESTIGATIONS

1960

BREEDING AND STRAIN TESTING

Field Husbandry Department
Ontario Agricultural College
Guelph

FORAGE PROGRESS REPORT 1960

This report contains data on O.A.C. trials. It is not complete in that only the data summarized by May 1, 1961, are included. However, it does contain most of the data. The report is prepared for use of the members of the Field Husbandry Department and for those associated with the forage program.

A federal-provincial program is in operation in variety and mixture testing and in orchardgrass breeding. This report does not cover the data collected by other stations in this co-ordinated program. The complete set of data from all stations is available.

CONTENTS

(Year refers to year trial was seeded, and number in brackets is experiment number)

REPORT OF 1960 ALFALFA DATA FOR ONTARIO

Co-ordinator: J.G. Provencher,
C.E.F., Ottawa, Ont.

Reports on alfalfa trials have been submitted by co-operators of six locations, namely Ridgetown, Guelph, Mindemoya, Kemptville, Ottawa and Kapuskasing. These reports have been summarized and are presented in the attached mimeographed section.

The testing centers, Ottawa and Kamptville, reported a 1956 seeding trial where yield data have been recorded for four years, 1957-60.

No 1957 seeding trial is reported.

Results of 1958 seeding trials are reported for three locations, namely Ridgetown, Ottawa and Kapuskasing.

Results of 1959 seeding trials are reported for three locations also, namely O.A.C., Mindemoya and Kapuskasing.

As a summary of the results mentioned in the report, the five outstanding varieties of each trial for each location are listed below:

A. 4-year trials (1957-60) - 1956 seeding
Ottawa - Alfa, DuPuits, M-50, Narragansett, and M-53.
Kemptville - Vernal, M-53, M-50, Alfa and DuPuits.
Mean (for similar varieties): M-50, M-53, DuPuits, Vernal and Alfa.

B. 2-year trials (1959-60) - 1958 seeding
Ridgetown - Alfa, DuPuits, Cardinal, Narragansett and Rhizoma.
Ottawa - Chartrainvilliers, Alfa, Socheville, DuPuits and Vernal.
Kapuskasing - Alfa, Chartrainvilliers, Vernal, Rhizoma and Narragansett.
Mean (for similar varieties) - Alfa, DuPuits, Vernal, Rhizoma and Narragansett.

C. 1-year trial (1960) - 1959 seeding
O.A.C. - N.Y. Syn.A, Alfa, DuPuits, A-600, Tourneur 505.
Mindemoya - DuPuits, Alfa, Vernal, Ladak and Rhizoma.
Kapuskasing - Narragansett, Alfa, Chartrainvilliers, Vernal and Rhizoma.

A study of the reported data indicates that the French type varieties are the leading varieties in yield at most locations. However, Vernal is also among the outstanding varieties and considering its other qualities, such as its fine stem and its winterhardiness, it should remain as the standard and the top recommended variety. The varieties Rhizoma, DuPuits and Alfa should also remain on our list of recommendations.

The variety Ranger should be deleted from our list of recommendations if the seed supply of the other varieties is good.

I would also suggest the following changes in Publication 296:

Page 7., paragraph 2. Deletion of following in lines 5 to 7: "For best results DuPuits or Alfa should be used for plantings which are expected to produce for one or two years. Production for longer terms is uncertain."

Page 7., paragraph 2, lines 17 to 19. Deletion of following: "They are recommended for use only on 'alfalfa' soils for stands up to two years in duration."

Results obtained at Ottawa and Kemptville during the 1957-60 period prove they can give good production for long terms. They also appear to be as winterhardy as other recommended varieties.

No other change is recommended.

ALFALFA STRAIN TRIAL, 11E, SEEDED IN 1959

1960 Yields in pounds D.M. per acre

	Cut 1		Cut 2	
	Yield	Rank	Yield	Rank
DuPuits	4150	10	2150	2
Alfa	4350	4	2050	6
Cardinal	4100	12	2070	3
Tourneur 505	4000	16	2210	1
F.D. 100	4000	15	2060	5
Vernal	4250	7	1880	20
Rhizoma	4100	13	1930	12
Narragansett	4100	14	1900	16
Buffalo	3250	30	1900	16
Grimm	3450	29	1820	23
Ranger	3500	27	1940	10
Atlantic	3750	24	2020	7
Williamsburg	3650	26	2010	8
Tuna	3800	22	2070	3
Ladak	3800	23	1530	26
Rambler	4150	9	1320	28
Teton	4450	2	1280	29
Viking B.T.	3500	28	1220	30
New York, Syn. A	4650	1	2010	8
Cayuga	3900	20	1910	15
Sask. 1	4100	11	1750	24
Sask. 2	4250	8	1900	16
Sask. 3	3950	18	1850	21
Beaver	4250	6	1850	21
Sask. 5	3950	17	1730	25
A 216	3850	21	1900	16
A 224	4400	3	1510	27
A 248	3700	25	1930	12
A 253	3900	19	1920	14
A 600	4300	5	1940	10
Mean	4000		1850	
L.S.D. 5%	530		220	
C.V.	9%		8%	

ONTARIO FORAGE SCREENING TRIALS

At the present time there is an increasing amount of plant breeding in forage grasses and legumes being done by private breeding firms in North America. As a result new strains are being produced and the number will probably increase rapidly. Experiment stations are now being asked to evaluate these strains with a view toward obtaining data to support a request for licensing and to determine if the strain(s) should be added to the recommended list for Ontario (Circular 296).

In addition to being requested to evaluate the strains bred privately in North America, Ontario experiment stations are being asked by members of the Canadian Seed Trade, acting as agents of private plant breeding firms in Europe, to evaluate a number of European strains for Ontario. Private breeding firms must be considered as valuable potential sources of new varieties. Materials produced by these firms should be assessed by the Ontario experiment stations which are searching for superior varieties to have available for Ontario farmers. It is essential that a testing policy be established at this time, when private breeding is at an early stage of development to: (1) provide adequate assessment of new strains bred by private breeders, and (2) provide assurance that efficient use is being made of the resources devoted to strain evaluation by the experiment stations.

The Forage Crop Sub-Committee of the Ontario Field Crop Recommendation Committee is composed of all crop testing agencies in Ontario and is responsible for the determination of the official Ontario grass and legume variety recommendations published annually in Circular 296, Field Crop Recommendations for Ontario. At a planning conference on March 10-11, 1959, it was agreed that a co-ordinated Federal-Provincial system of strain testing should be established to screen strains submitted by private breeding agencies.

The proposed testing procedure is as follows -

1. Entries accepted. Strains which meet the following requirements will be eligible to be entered in the trial.

   a. Supporting data indicating the superior feature(s) of the strain compared with varieties of known performance (preferably varieties currently grown in OOntario) must be made available to the Forage Crop Sub-Committee. These data must be indicative of performance in Ontario, i.e. collected in areas such as the North-Eastern, North Central, or mid-Western states.

      Where available, information such as total yield of dry matter for the season, seasonal distribution of production, relative maturity, leafiness and disease reaction should be forwarded.

   b. Requests to have a strain entered in the test for the current year must be received by the Secretary of the Committee by February 1 of that year. This is essential to allow adequate time for planning the trials. The Secretary is Dr. J.E. Winch, Field Husbandry Department, O.A.C., Guelph.

   c. Strains will be tested only if the committee is satisfied as to the existence of a suitable breeders' seed maintenance program which will retain the genotype of the variety.

2. Organization of the Trials. Each trial will be seeded at 4 locations. Seedings will be staggered so that seedings will be made at any one station only in alternate years, according to the following scheme.

Station	1960	1961	1962
Guelph Kemptville	Seed Variety Group A*	No seeding	Seed Variety Group B plus Variety Group C*
Ottawa Ridgetown	No seeding	Seed Variety Group A plus Variety Group B*	No seeding

*A includes strains received by February 1, 1960; B strains received February 1, 1960, to February 1, 1961; C strains received February 1, 1961, to February 1, 1962.

The requests to enter new varieties received by the Committee Secretary will be forwarded to the co-ordinator for the particular species. The co-ordinators for 1960-1961 are:

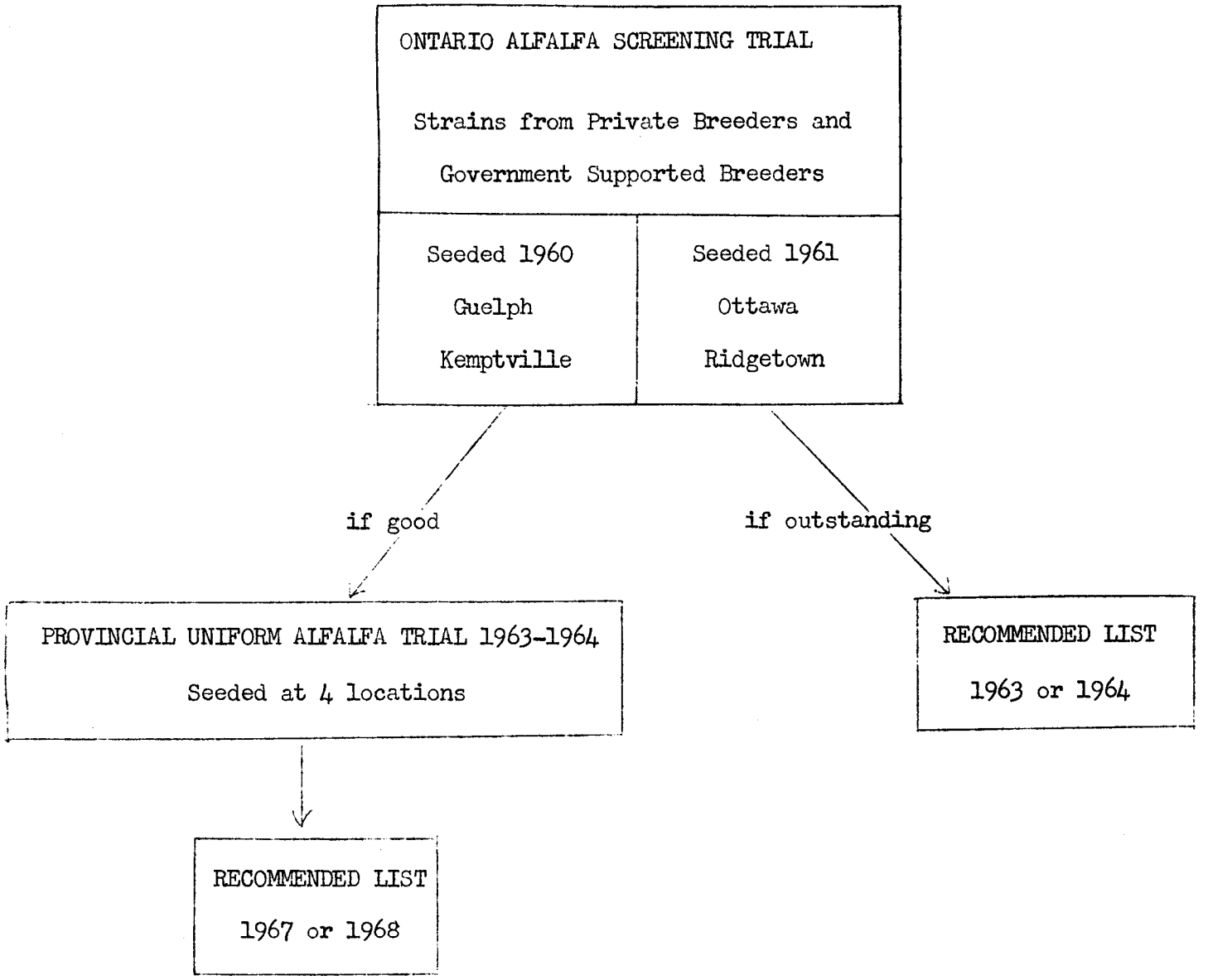
Alfalfa - G. Provencher, Genetics and Plant Breeding Research Inst., C.E.F.
Trefoil - B.E. Twamley, Field Husbandry Dept., O.A.C.
Red clover - H.A. McLennan, Genetics and Plant Breeding Research Inst., C.E.F.
Orchardgrass - W.C. Childers, " " " " " " "
Timothy - B.R. Christie, Field Husbandry Dept., O.A.C.
Brome - E.E. Gamble, " " " "

The detailed organization of the test will be outlined by the co-ordinator. Four replications is the minimum number. Individual stations may wish to increase the number. Plot size will be established for each series when the series is organized. As in number of replications, a minimum plot size will be established and this may be increased to suit the planting requirements or preferences of each station.

The data to be collected will be decided individually for each trial. Dry matter yields will be collected at at least 2 of the 4 locations and at the other 2 stations strains will be rated for vigor relative to standard varieties. Other descriptive data will be collected.

The yield data will be collected from a specific management regime. The plots will be extended in length beyond that required for the yield trial so that 1 or 2 other managements can be applied and ratings taken for such items as survival, seed yield, compatability in mixture, and for distribution of growth throughout the season. The choice of items will be made for each new series at the time the series is organized. Data will be collected in 3 crop years for the perennial species and in 2 crop years for red clover from each of the trials at the 4 locations.

When the data are summarized a basis will be available for (1) the Forage Crop Sub-Committee to determine which strains are sufficiently good to warrant the submission of a request for licensing, and (2) decide which strains should be entered in the Provincial Uniform Strain Trials for final assessment. Strains which are also satisfactory in this latter trial would be considered for inclusion on the recommended list for Ontario.


ONTARIO ALFALFA SCREENING TRIAL
Strains from Private Breeders and
Government Supported Breeders
Seeded 1960
Guelph
Kemptville
Seeded 1961
Ottawa
Ridgetown
if good
if outstanding
PROVINCIAL UNIFORM ALFALFA TRIAL 1963-1964
Seeded at 4 locations
RECOMMENDED LIST
1963 or 1964
RECOMMENDED LIST
1967 or 1968

PROVINCIAL ALFALFA SCREENING TRIAL, 1960

A strain trial was seeded on the east end of 11E. The following varieties or strains were included:

DuPuits	Northrup-King, NK-501
Vernal	Northrup-King, NK-502
Narragansett	Northrup-King, NK-503
Wilt-resistant Narragansett	Northrup-King, NK-504
High seed-set Narragansett	New York, Synthetic A
Flemish wilt-resistant	Cayuga
Orchies	

Establishment was good. During August growth ceased and the leaves withered because of drought. No new growth occurred until early October and thus the plants entered the winter season with little opportunity to build up food reserves in the roots.

In the strain trial seeded in 1959 winter injury was negligible. The first and second cuts taken on June 20 and July 29 respectively were satisfactory but the prolonged drought in August and September sent the plants into a dormant state and no further cuts were possible.

ALFALFA SEED LOTS, 1960

Twelve seed lots of "Ontario Variegated" grown in Haldimand county were seeded. This material, collected by Haldimand county seedsmen, is supposed to represent alfalfa grown in the area for many generations.

Another strain, Alfalfa E, from R. Smith, Toronto, and Vernal and DuPuits were included. This is an observation trial seeded in broadcast plots in duplicate on B-1.

O. A. C. (Zone 3)

Report of Farm Plantings of Several Alfalfa Varieties Planted for Comparison on Soils of Fair to Variable Drainage (1958 Seeding)

"The report is in two parts: the first part is a report based on information received from the farmer co-operators and represents evaluation which should be useful as a basis for recommendations. The second part is a report based on evaluations by O.A.C. staff who visited the plots in 1960. In the section under 'stand of varieties' the 1 means simply that that variety had a stand equal to the best in the series at that location. 2 represents second best, etc." (W.S. Young, Extension Agronomist)

Farm plantings of a series made up of one acre each of alfalfa varieties, a mixture of trefoil and alfalfa and a plot of Viking trefoil were made in 21 locations, 1958.

DuPuits, Alfa, Grimm, Ranger, Rhizoma, Narragansett, Vernal, Vernal alfalfa and Viking trefil, and Viking trefoil were seeded on individual plots mixed with 6 lbs. of Climax timothy per acre.

During 1958-9 the plot series in Wentworth, Muskoka and Cochrane S. were badly winterkilled. During 1959-60 the series at New Liskeard and Lincoln county were killed.

Farmer Evaluation

In 1960 the farmer co-operators were asked to complete a report on the seedings. A summary follows.

Ten useful completed questionnaires were received.

1. Stand of alfalfa

1960 Alfalfa Stand (1958 Farm Plantings)

	Number of co-operators reporting						
	DuPuits	Alfa	Grimm	Ranger	Rhizoma	Naragansett	Vernal
over 50% stand	7	5	5	5	6	4	6
25% to 49% stand	2	3	4	4	3	2	2
up to 25% stand	0	1	1	1	1	2	0
not reporting	1	1	0	0	0	2	2

This indicates that: a number have already (in second harvest year) less than a 50% stand of alfalfa.

: Grimm and Ranger are lower in stand at more locations than other varieties.

2. Alfalfa survival in fair to poor drained areas.

   a) According to three co-operators Rhizoma survived better than others in fair to poor drainage. Two co-operators said Vernal survived best and one said Narragansett survived best.

   b) Two co-operators each indicated that Alfa, Ranger, Narragansett and Rhizoma survived poorer than other varieties in the series when drainage was fair to poor. DuPuits was reported to survive poorest in one location.

3. Variety preference for fair to poor drainage. The following indicates the variety which co-operators would purchase (price excluded). Some listed more than one variety.

No preference of variety	2
Vernal preference	4
Rhizoma	2
Alfa or DuPuits	2
Viking trefoil	1
Viking trefoil-Vernal alfalfa mixture	1
No Answer	1

4. Viking trefoil.

   a) Survival in mixture with alfalfa

   Five co-operators indicate that the trefoil has increased in this mixture:

   Vernal alfalfa 4 + Viking 3 + Climax 6

   They also indicate that the Viking is not making much production at present.

   One co-operator says that Viking is standing up to the competition from alfalfa. Three co-operators say Viking is not standing up to alfalfa competition.

   b) Survival in simple mixture — Viking 5 + Climax 5

   Five of the eight co-operators who made observations say that Viking does survive better than the best alfalfa in the series on land which has fair to poor drainage.

O.A.C. Staff Evaluation During the Summer of 1960

Thirteen locations of the alfalfa series were visited by one person. Of these six showed no practical variety differential in field stand of alfalfa. Stands in Bruce, Ontario, and Welland were good over entire plot area. In Durham, Lambton and Grenville there were areas which had winterkilled and other areas which had a good stand. In Lincoln the alfalfa stand was poor in part because of killing after intensive, severe cutting management of alfalfa for dehydrating plant.

In the North Simcoe, Lennox, Dundas, Wellington counties some variety differences in stand do show.

Stand of Varieties (second harvest year)

Comparisons Within Locations Only

County	N. Simcoe	Lennox	Dundas	Wellington
General Thickness of Stand	Good	Good	Fair	Fair
DuPuits	2	1	1	2
Alfa	2	1	1	2
Grimm	4	3	2	3
Ranger	3	2	2	2
Rhizoma	1	2	1	1
Narragansett	1	2	1	1
Vernal	1	1	1	1

Plots in Muskoka, Cochrane S., Temiskaming have no alfalfa left in 1960.

Birdsfoot Trefoil (Viking)

Cochrane and Temiskaming trefoil plots are poor in stand and only fair to poor in vigor. Muskoka plot is killed out where pastured and has fair to poor stand on part of plot which was harvested for hay.

In Bruce, Lambton, Lincoln, Welland, N. Simcoe, and Wellington, trefoil plot is fair in stand and has good growth.

In Lennox, Grenville, Dundas the stand is fair to poor as is the growth on the trefoil plots.

RED CLOVER STRAINS, 1960

Two strain trials were established on the east end of 11E. The entries were as follows:

Single-cut type	Double-cut type
Altaswede	Common
Silo	Lasalle,west
Hermes	Lasalle, east
Resistenta	Lasalle, foundation
Landskrona	Dollard, foundation
Merkur	Dollard, certified
Ultuna	Lakeland
Rea	Chesapeake
Ulva	Dutch
Alsike	Birdsfoot trefoil

Establishment was good. Weeds were controlled by clipping. Growth ceased in August and was not resumed until October.

PROVINCIAL STRAIN TRIALS, 1960

A new series of uniform trials was established at the following locations:

	Hay Test	Seed Test	Varieties
Zone 1 - Ridgetown	X		Ottawa (Foundation)
Zone 3 - Guelph	X		Ottawa (Bishops)
Mindemoya	X	X	Dollard (Foundation)
Zone 4 - Foxborough	X	X	Dollard (Calif.Cert.)
Zone 5 - Ottawa	X	X	Lasalle (East.Cert.)
Zone 7 - Noelville	X	X	Lasalle (West.Cert.)
Fort William	X	X	Chesapeake
Fort Francis	X	X	Lakeland
Zone 8 - Kapuskasing	X	X	

SUMMARY: YIELD REACTION OF EMPIRE AND VIKING BIRDSFOOT TREFOIL TO EXCESS WATER

A. Effect of Spring Flooding

Brampton, 1956

	1957		1958
	Flooded	Not flooded	Flooded
Viking + Climax	5394	6044	2474
Empire + Climax	5795	5170	2924

Guelph, 1957

	1958		1959	
	Flooded	Not flooded	Flooded	Not flooded
Viking + Climax	5339	6365	5053*	7952
Empire + Climax	5540	4951	6587	4285

Viking was harvested four times and Empire three times each year at Guelph. Brampton soil - heavy texture; Guelph - medium texture.

* 70-75% timothy. Estimated kill in Viking was 60%.

B. Effect of Imperfect Drainage

Brampton, 1958

	1959	1960
Roskilde	4674 (full bloom)	2806 (half bloom)
Empire	5747 (full bloom)	3301 (full bloom)

Guelph, 1957

	Imperfect Drainage - Kaine	Good Drainage - O.A.C.
Viking + Climax	2647	5534
Empire + Climax	3590	4659
Viking alone	4680	8670
Empire alone	4220	7320

BIRDSFOOT TREFOIL BREEDING

1. European Selection Nursery

A new nursery of about 1400 plants was established on the east end of 6E. It consisted of the progeny of about 60 parents selected for their seed size, their seedling vigor or their forage yield. In the main the number of individuals in each of the 60 families was about 23.

Open-pollination seed was harvested from all plants in August and threshed and cleaned in the fall. A 100-seed sample from all plants was weighed and no further consideration was given to any plant whose seed weight was below 0.16 grams. All others, numbering about 600 good seed-weight plants, were checked by progeny test for seedling vigor in the greenhouse.

2. Empire Selection Nursery

A nursery of about 900 plants was established in the mid-section of 6E. It consisted of 20 offspring of each of about 45 parents selected for seed size or seedling vigor. This group was handled in the same manner as the European strains but the critical seed weight was 0.1225. About 500 lines were tested for seedling vigor in the greenhouse.

3. Heritability Selection Nursery

This nursery established in 1959 consisted of 20 progeny plants from each of 72 parents selected to represent the complete range of seed weight. It was treated as in 1 above and about 500 individuals of good seed-weight grade were tested in the greenhouse for seedling vigor.

Some data derived from the seed weighings of material from the three nurseries noted above are summarized in the following table.

Seed Weight Information
Weight of 100 seeds in grams x 10^4

	European	Heritability	Empire
Population Range	1000-2300	900-2250	900-1725
Population Mean	1550	1450	1250
Range in Progeny Means	1300-1850	1200-1725	1180-1380

4. Holding Nursery

About 500 selected plants were transplanted from the older selection nurseries on 7, 8 and 9E to the centre section of 6E. These plants were the ones selected for progeny testing in 1960 or for other studies. The Empire selections were placed in rows 102-106, high yielding lines from 9E in rows 135-137, correlation study material in rows 138-140, and European clones being progeny tested were placed in rows 141-154. Some flood-resistant plants from 7E were placed in tier 22 and others from Brampton near the west end of the range.

5. Heritability Study

An estimate of heritability for seed size was made using the data collected as shown in 3 above. This estimate was 0.41. The inference is that large-seeded parents have a good chance of producing among their progeny some large-seeded offspring.

In some strains there was a decided switch in ranking between the two years, 1959 and 1960. On an average the seed weights in 1960 were 16% higher than in 1959 but in some families the increase was 30% and in others 7%. The result of such differential increase was that the strains which ranked first and second in 1959, the seedling year, ranked tenth and eighteenth, respectively, out of 36 in the second year. On the other hand, two strains that were in the bottom half of the group in the seedling year - and which then presumably would have been discarded - were in second and fifth place in the following year.

This plant x age of plant interaction raises some interesting questions and implications. The first is that some doubt must be cast on the validity of discarding plants as breeding material on the basis of seedling year seed weights. The second is that this shift in ranking for seed size between seedling year and first crop year may be related to a similar shift observed in forage yields between the two years.

6. Yield Trials of Selected Lines*

About 400 lines were selected for yield trials in the field in 1960. The basis of selection was seed size, seedling vigor in the greenhouse or in the field. The lines were sown in 11-foot plots, 2¼ feet apart with 300 seeds per row and replicated four times. These were graded for seedling and aftermath vigor and were harvested in July and again at the end of August, except for the Empire lines which were harvested only once. These trials are being retained for further study in 1961. It is envisaged that these data will make possible a final selection of clones to be included in a group of synthetics to be formulated in the late summer of 1961.

Some of the Empire lines appeared very promising. It is not certain, however, that some of the Empire clones were not pollinated by European plants in nearby rows to some extent. A re-test seems advisable using seed produced under more rigidly controlled pollination conditions.

* For further information on these lines see the 1959 Progress Report, Forage Crops Investigations, page 18.

CORRELATION STUDIES IN BIRDSFOOT TREFOIL

In 1959 two identical 64-strain trials were established, one on 11E and the other on the less well drained soil of 8C. Both were harvested twice in 1959 and again in 1960. Apart from the information gained the experiment was most useful as a pilot study. A modified form of the experiment was established in 1960 using improved techniques in field and greenhouse. In this second study eight seed-weight groups each cntaining eight entries were used. The high seed-weight group was approximately twice as heavy as the lowest seed-weight group and the other six ranged at fairly regular intervals between these.

Three seedings were made, one in the greenhouse, the others on 10E and 8C. Outside, 300 seeds were sown per 11-foot plot and four replicates were used. The greenhouse plots, seeded in flats, were graded several times and then harvested at about six weeks of age. The field plots were graded and harvested twice.

The data collected from the two experiments were subjected, in part, to two types of statistical treatment:

(a) Correlations. Coefficients of correlation were found for both experiments in an attempt to discover whether a relationship exists between seed weight, greenhouse grade, greenhouse forage yield, seedling year cuts, yields at different sites, etc.

(b) Analysis of Variance. Based on the eight seed weight groups an analysis was made of seedling yields in three sites, the greenhouse, 10E and 8C for the 1960 version only.

The results of these, both (a) and (b), are shown in the accompanying tables.

Comments

The correlation values for the experiment seeded in 1960 were higher than those for the 1959 seeding presumably because of improved machinery and techniques. Both sets provide evidence that for the entire range of seed weights, i.e. an unselected population, seedling vigor in the field as measured by cut 1 yields may be predicted with some degree of success by reference to seed weight, greenhouse grade or greenhouse forage weight.

The values relating seed weight to forage grade and yields in the greenhouse being high, it is open to question whether greenhouse data offer much valuable screening information beyond that provided by seed weight alone. The implication is that this part of the screening program might well be eliminated. Further study is needed to clarify this question.

At one site cut 1 yields were significantly correlated with cut 2 yields but this was not true at the second site. To what extent this anomaly was due to management practice and to what extent to environment is not known. It was encouraging to note that seedling vigor, i.e. cut 1 yields, were significantly related at the two sites. This suggests that from the standpoint of seedling yields exclusively one testing site only may be feasible.

Not unexpectedly, it was shown that screening for vigorous lines in the upper seed weight groups was not nearly so rewarding as for the entire population and that if the heaviest 5-10% of the population had been retained several lines

that performed well in the fields would have been discarded. The implication here is that only an improvement in the technique of greenhouse grading can bring about an improvement in this phase of the screening program. This phase of the breeding and research program is receiving further study.

The analysis of variance of the seed-weight groups confirm the general conclusion noted above. It also makes possible more detailed as well as additional conclusions regarding the progeny performance of the several groups. Some of these are noted below.

Between Groups

The upper four were superior to the lower four.
The upper two were usually superior to the next two.
The upper group was not superior to the second group.
The third group was superior to the fourth at the 10% level.

Within Groups

Significant differences among the 8 components of each weight group was common and especially so in the greenhouse and on 8C. This means that relatively good and relatively poor material may be found in any weight group. It must be recorded, however, that good material became scarcer as the seed weight decreased.

Interactions

Reference to the analysis table reveals highly significant interaction between groups and sites. However, that significance was found to be caused by differences in degree rather than in kind, i.e. switches in ranking were rare. This indicates, as does the correlation value, that superiority in one area is likely to be repeated in another and that, for practical purposes, testing in one area may be sufficient.

Conclusions

Screening of the breeding population on the basis of seed weight appears to be a valid method for detecting lines with good seedling vigor in the field.

As the range of seed size becomes smaller the efficiency of selection decreases.

It is not certain that the use of the greenhouse for further screening of high seed weight selections is effective using present techniques.

Recommendations Arising from Correlation Study

1. The expected frequency distribution of seed weight groups in a random population is:

   $$(1 + 1)^7 = 1 + 7 + 21 + 35 + 35 + 21 + 7 + 1 = 128$$

   If only the top two groups are retained for field testing the percentage is (8/128) x 100 = 6.25% and if the top three the percentage is 22.7%. Thus for every 100 progenies that can be field tested the nursery size should be 1600 under the first condition and 440 under the second.

2. Research should be directed towards developing an improved greenhouse technique for screening lines of good seed weight. A study in the greenhouse of lines of known field performance might be illuminating.

CORRELATION VALUES IN THE 1959 SEEDING

	Seed weight	G.H. grade	G.H. yield	11E grade	11E cut 1	11E total	8C grade	8C cut 1
Greenhouse grade	.54							
Greenhouse yield	.49	.59						
11E grade	.30	.50	.24					
11E, cut 1	.29	.32	.04	.36				
11E, cut 1 + 2	.36	.51	.38	.40	.87			
8C grade	.46	.66	.31	.77	.38	.40		
8C, cut 1	.38	.46	.37	.29	.31	.43	.51	
8C, cut 1 + 2	.39	.46	.37	.34	.32	.43	.47	.89

CORRELATION VALUES IN THE 1960 SEEDING

	Seed weight	G.H. grade	G.H. yield	10E cut 1	10E cut 2	8C cut 1
Seed weight		.07		.19		.32
Greenhouse grade	.80	Groups 1-8		.27		.24
Greenhouse yield	.64 .95			Groups 1-3		
10E, cut 1	.64 .93	.60	.61 .90			
10E, cut 2	.42 .85		.48 .83	.65 .89		
8C, cut 1	.72 .95	.66	.68 .89	.77 .95	.88	
8C, cut 2	-.18		-.18	00	-.37	-.10

	Significant Values 5%	1%
Groups 1-3, population of 16	.48	.60
Groups 1-8, population of 64, upper figures	.25	.32
Groups 1-8, population of 8, lower figures	.71	.83

TABLE OF SIGNIFICANT DIFFERENCES OR INTERACTIONS

Cut 1 of the Seedling Year, 1960

	Differences				Interactions	
	G.H.	1OE	8C	Total	G.H. vs. Fields	1OE vs. 8C
Between groups						
1 2 3 4 vs. 5 6 7 8	++	++	++	++	++	++
1 2 vs. 3 4	++		++	++	++	
5 6 vs. 7 8		++	++	++		
1 vs. 2						
3 vs. 4		+		+		
5 vs. 6			++	+		
7 vs. 8			++	++		
Within groups						
1	++		+	++	++	
2	++		+	++	++	
3	++		++	++	++	
4	+	++		++	+	
5	++		++	++	++	
6	+	+	+	+	++	
7					+	
8	+			++	+	

EXPERIMENT 211 - TIMOTHY STRAIN TRIAL, 1958

Total Yield - lbs./acre

Cut 2, 1960

	With Vernal[1]		Alone[2]		
Variety	Medium	Late	Medium	Late	Mean
Common	3400(11)[3]	3490(9)[3]	1370	1560	2260
S-51	3570(2)	3610(0)	1180	1370	2200
Climax	3410(8)	3680(6)	1190	1400	2200
Drummond	3740(4)	3680(2)	900	840	2000
Essex	3510(0)	3710(2)	700	880	1920
S-48	3270(0)	3480(0)	500	530	1660
Mean	3480	3610	980	1100	2040
L.S.D. 5%	300		240		130
1%	390		320		180

C.V. (for varieties) = 10.3%

1 Cut August 12, 1960

2 Cut September 1, 1960

3 Estimated % timothy in brackets

Because of extreme lodging, the forage on these plots was cut on June 28 with the rotary chopper and discarded.

EXPERIMENT 213 - PRELIMINARY TIMOTHY STRAIN TEST, 1958

Cut 1

Variety	Yield (lbs./acre) 1959[1]	1960[2]	Mean	Composition - 1960 % vegetative[3]	% leaf
T-41	4990	6010	5500	28	25
Climax	5130	5430	5280	39	29
O-233	4930	5470	5200	36	25
T-48	5080	5180	5130	34	29
S-48	3470	4960	4220	91	30
L.S.D. 5%	360	NS	430	31	3
1%	490		580	42	4
C.V.	6.4	11.7	8.5		

1 Cut June 18, 1959

2 Cut June 27, 1960

3 All shoots without visible heads were classed as vegetative. The varieties T-41 and T-48 are being tested further.

EXPERIMENT 604 - TIMOTHY VARIETY OBSERVATION NURSERY, 1959

Variety		Spring Vigor* April 28/60	Height at Bloom
			inches
Early	Barenza Hay	3.5	37
	Favor	2.5	34
	Kampe II	2	34
	Scottish	4	35
	Vanadis	2.5	37
Medium	Climax	3	38
	Drummond	3	36
	Medon	2.5	37
	Melle Hay	2	--
	Omnia	2.5	--
Late	Barbantia Pasture	4	--
	Barenza Pasture	3.5	--
	C.B.	3.5	--
	Heidemiz	3.5	--
	King	4	--
	Melle Pasture	4	--
	S48	3	33
	S51	3.5	--

* 1 (good) to 5 (poor)

SUMMARY: TIMOTHY VARIETIES GROWN WITH TREFOIL 1956, 1957

TIMOTHY + VIKING TREFOIL, 1957 - GUELPH

Yield in lbs./acre - Rotation Pasture

Variety	1958	1959	1960	Mean
		Total Yield		
Common	5530	7950	7950	7140
Climax	5530	7910	7680	7040
S-48	5900	7800	7820	7170
		Legume Component		
Common	3180	5230	5510	4640
Climax	3260	5180	5200	4550
S-48	3180	4850	5670	4560
		Grass Component		
Common	2360	2720	2440	2500
Climax	2270	2730	2430	2480
S-48	2720	2940	2150	2610

TIMOTHY + VIKING TREFOIL, 1956 - GUELPH

Yield in lbs./acre - Hay + Aftermath Pasture

Variety	1957	1958	1959	Mean
		Total Yield		
Climax	7130	7740	7790	7550
S-48	6540	7530	8200	7430
		Legume Component		
Climax	2360	4260	5080	3900
S-48	2740	4790	6190	4570
		Grass Component		
Climax	4770	3480	2710	3650
S-48	3800	2740	2010	2850

TIMOTHY + EMPIRE BIRDSFOOT TREFOIL, 1956 - GUELPH

Yield in lbs./acre - Rotational Pasture

Variety	1957	1958	1959	Mean
		Total Yield		
Common	4660	6990	7750	6470
Climax	4140	7020	7900	6360
S-48	4480	7080	6830	6130
		Legume Component		
Common	2810	4280	5540	4210
Climax	2360	4460	5640	4160
S-48	2570	4540	5890	4330
		Grass Component		
Common	1850	2710	2220	2260
Climax	1780	2560	2260	2200
S-48	1910	2540	1440	1960

TIMOTHY + EMPIRE BIRDSFOOT TREFOIL, 1956 - GUELPH

Yield in lbs./acre - Hay + Aftermath Pasture

Variety	1957	1958	1959	Mean
		Total Yield		
Climax	6630	6320	7450	6800
Essex	6220	6040	7350	6540
S-48	5730	6250	7090	6350
		Legume Component		
Climax	2400	4120	3740	3420
Essex	2460	3440	4730	3540
S-48	2370	3580	4540	3500
		Grass Component		
Climax	4240	2200	3710	3380
Essex	3760	2600	2620	2990
S-48	3360	2660	2540	2860

EXPERIMENT 602 - PROVINCIAL ORCHARDGRASS TEST, 1959

Seeded at Guelph, Ridgetown & Ottawa. Guelph data only in this report

Treatment - Pasture

Variety	Spring* Vigor	Yields - 1960** May 16	June 8	July 6	Aug. 10	Oct. 14	Total
Trifolium 1613	3.8	2050	2050	1070	2640	740	8550
Danish	2.8	2660	1770	990	2450	610	8480
Frode	3.0	2270	2100	980	2470	660	8480
Latar	1.8	2940	1790	900	2330	500	8460
Pennlate	3.2	2370	1880	960	2570	570	8350
Ottawa 200	3.0	2360	2210	950	2340	380	8230
Hercules	2.5	2250	1900	1000	2540	550	8230
S-143	4.5	1490	2150	1200	2530	850	8220
Tardus II	3.0	2380	1940	890	2290	650	8150
L.S.D. 5%		380	260	140	230	150	NS
1%		500	350	190	310	200	NS
C.V.		14%	11%	13%	8%	21%	6%

* Taken April 28, 1960. 1 = most vigorous, 5 = least vigorous. Frode given 3 in every rep.

** Less than 10% alfalfa in all plots.

Treatment - Silage

Variety	Yields - 1960* June 8	July 6	Aug. 10	Oct. 14	Total
Stirling	4960	1060	2670	730	9420
Tardus II	4810	1070	2700	680	9260
Danish	5040	1030	2560	600	9230
Latar	4810	1020	2700	460	8990
Frode	4610	1070	2540	680	8890
Trifolium 1631	4430	840	2750	720	8750
Hercules	4270	1130	2740	580	8720
Ottawa 200	4250	1000	2790	510	8550
S-143	3560	820	2570	720	7670
L.S.D. 5%	570	130	NS	120	790
1%	760	170	NS	150	1060
C.V.	11%	11%	11%	16%	8%

* Less than 10% alfalfa in all plots

EXPERIMENT 602- PROVINCIAL ORCHARDGRASS TEST, 1959

Treatment - Hay

Variety	Yields - 1960*				
	June 16	July 6	Aug.10	Oct. 14	Total
Stirling	5820	830	2700	870	10200
Danish	5610	740	2880	670	9900
Latar	5600	700	2820	530	9650
Frode	5230	750	2870	790	9640
Tardus II	5520	620	2540	690	9370
Hercules	5180	750	2640	630	9200
Trifolium 1631	5060	580	2860	680	9180
Ottawa 200	4860	740	2650	610	8860
S-143	4120	490	2540	860	8000
L.S.D. 5%	830	150	NS	190	930
1%	1110	200	NS	250	1240
C.V.	14%	19%	9%	23%	8%

* Less than 10% alfalfa in all plots

EXPERIMENT 602 - COMPOSITION OF ORCHARDGRASS FORAGE - 1960

Variety	Silage - June 8			Hay - June 16			Average		
	Vegetative shoots[1] %	Reproductive shoots % leaf[2]	Total % leaf	Vegetative shoots[1] %	Reproductive shoots % leaf[2]	Total % leaf	Vegetative shoots[1] %	Reproductive shoots % leaf[2]	Total % leaf
S-143	82	30	87	75	19	80	78	24	84
Ottawa 200	56	27	68	53	18	62	54	23	65
Trifolium 1631	56	24	66	52	15	59	54	19	63
Latar	55	30	68	44	21	56	49	26	62
Frode	54	23	65	39	16	49	47	20	57
Hercules	50	21	61	40	15	50	45	18	55
Tardus II	49	21	60	40	15	49	44	18	54
Danish	37	21	54	34	14	43	35	18	49
Sterling	29	19	43	28	13	37	28	16	40
L.S.D. 5%	11	3	11	9	2	8	7	2	4
1%	15	4	14	12	2	10	10	2	6
C.V.	19	10	14	18	9	12	18	11	8
Mean squares for: Silage vs. Hay							NS	**	NS
Varieties x managements							NS	NS	NS

1 All shoots without visible heads were classed as vegetative

2 % leaf on shoots with visible heads

% PROTEIN IN ORCHARDGRASS SILAGE

Variety	Vegetative Shoots	Leaves	Stems
S-143	15.7	19.7	8.3
Ottawa 200	15.5	20.5	7.8
Trifolium 1631	15.0	20.7	9.6
Latar	16.4	20.6	8.4
Frode	15.0	19.4	8.4
Hercules	15.2	19.4	8.7
Tardus II	14.8	20.1	8.6
Danish	15.4	21.3	9.3
Sterling	15.6	20.5	10.0
L.S.D. 5%	NS	1.6	1.0
1%	NS	2.2	1.4
C.V.	7.8	7.9	9.1

EXPERIMENT 603 - ORCHARDGRASS VARIETY OBSERVATION NURSERY, 1959

Variety		Spring Vigor* April 28/60	Aftermath Vigor* Jun.2/60	Aftermath Vigor* Jul.6/60	Height at Bloom	Pasture types
					inches	
Very Early	Sterling	3	3	3	45	
Early	Avon	2	3.5	3	45	
	Danish	2.5	3.5	3	45	
	Kentucky Syn.	2	3	2.5	46	
	Oron	2	3	3.5	46	
	Penn. Early	2.5	4	3	48	
	Potomac	2	3	3	50	
	Wisc. 52	3	3	3.5	46	
Medium	Akaroa	3	3	2	42	X
	Barbantia	4	3	4	40	X
	Coxa	3	3.5	2.5	48	
	Dorise	2.5	2.5	3.5	45	X
	Eagle Hill	3	2	3	48	
	Esquire I	3	4	3.5	45	X
	Esquire II	3	3.5	3.5	42	X
	Frode	2	2.5	3	46	
	Glasnevin	3	3.5	2.5	42	X
	Grasslands	4	4	4	44	X
	Hammenhogs	2	3.5	2.5	47	
	Hercules	2.5	2.5	4	46	
	Japanese	4	3	3	42	X
	Mommersteeg's	3	2	4	44	X
	Penn. Medium	3	3	2	46	
	Polycross (Hespeler)	3.5	3.5	3.5	46	
	Roskilde	2.5	3.5	3	46	
	S-26	3.5	2.5	4	42	X
	S-37	3	3.5	3.5	47	X
	Tardus II	2.5	3	4	46	
	Trifolium 1631	2.5	2.5	3.5	46	X
	Trifolium All	2.5	4	3	50	
	Trifolium (Extra Early)	2.5	3	3	46	
	Utah Syn. II	2.5	2	4	47	
Late	Aurora	2.5	1	3.5	--	
	Barenza	4	3.5	3	--	X
	Latar	2.5	2	4.5	--	
	Ottawa 200	3	3.5	3.5	46	X
	S-143	4	4	5	--	X

* Rating: 1 (good) to 5 (poor)

SUMMARY OF PERFORMANCE OF TARDUS II ORCHARDGRASS
(Recommended for Licensing 1960)

ORCHARDGRASS STRAIN TRIAL, 1953

Variety	Fall Vigor* 15/10/53	Fall Vigor* 12/11/54	Spring* Vigor 30/4/54	Leafiness** 1954	Panicle*** volume 1954	Bloom date 1954	Bloom date 1955	Relative° worth June/54	% Crude Protein 1955
Oron	1.5	2.0	3.0	9.0	8.0	Jun.16	Jun. 8	X	5.2
Frode	2.0	2.0	4.7	2.0	4.8	Jun.20	Jun.14	1.0	7.2
Tardus II	1.8	1.8	3.5	3.5	5.0	Jun.19	Jun.13	1.5	6.8

* 1 (good) to 5 (poor)
** 1 (good) to 10 (Poor)
*** 1 (low) to 10 (high)
° 1 (good) to 3 (fair); X = unsatisfactory

Yields - Tons per Acre

Variety	1954 Hay	1954 Aftermath	1954 Total	1955 Hay	1955 Aftermath	1955 Total
Oron	2.74	0.42	3.13	2.57	0.47	3.04
Frode	2.79	0.61	3.45	3.53	0.67	4.20
Tardus II	2.76	0.45	3.20	3.24	0.54	3.78
L.S.D. 5%	0.34	0.10	0.38			

ORCHARDGRASS STRAIN TRIAL, 1955

Yields - Tons per Acre

Variety	Hay	Aftermath	Total
Oron	1.8	1.2	3.0
Frode	1.6	1.0	2.6
Tardus II	1.4	0.9	2.3

ORCHARDGRASS VARIETY ROWS, 1959

Variety	Spring* Vigor 28/4/60	Pasture Aftermath I 2/6/60*	Pasture Aftermath II 5/7/60*	Bloom date	Height at bloom
Oron	2	3	4	June 13	47"
Frode	2	2	3	June 19	46"
S-143	4	5	5	June 23	--
Tardus II	2	3	3	June 19	46"

* All ratings - 1 (good) to 5 (poor)

PROVINCIAL ORCHARDGRASS TEST, 1959

Pasture - 1960 (lbs./acre)

Variety	Spring* Vigor	May 16	June 8	July 6	Aug. 10	Oct. 14	Total
Frode	3.0	2270	2100	980	2470	660	8480
S-143	4.5	1490	2150	1200	2530	850	8220
Tardus II	3.0	2380	1940	890	2290	650	8150
L.S.D.5%		380	260	140	230	150	NS
1%		500	350	190	310	200	

* 1 (good) to 5 (poor)

Silage - 1960

Variety	June 8	July 6	Aug. 10	Oct. 14	Total	% veg.	% leaf
Frode	4610	1070	2540	680	8890	54	23
S-143	3560	820	2570	720	7670	82	30
Tardus II	4810	1070	2700	680	9260	49	21
L.S.D. 5%	570	130	NS	120	790	11	3
1%	760	170	NS	150	1060	15	4

Hay - 1960

Variety	June 16	July 6	August 10	October 14	Total
Frode	5230	750	2870	790	9640
S-143	4120	490	2540	860	8000
Tardus II	5520	620	2540	690	9370
L.S.D. 5%	830	150	NS	190	930
1%	1110	200	NS	250	1240

UNIFORM PROVINCIAL BROME VARIETY TRIALS (1957)

This series of trials are now complete and a summary of the data obtained is presented in Tables 1-3.

The Provincial Brome Variety Trial, consisting of five varieties, Saratoga, Lincoln, Lyon, Manchar, and Canadian, was established under pure stands at six locations in four climatic zones in 1957 and at Ottawa in 1958. Two years' data have been reported from all trials except Appleton. Dayton, Verner, Fort William and Kapuskasing have reported data for the third crop year. Only the Ottawa location reported aftermath yields as well as hay yields.

Table 1 includes the hay yields from the first and second crop years at the various locations conducting the trials. Additionally, a two-year average and the provincial average are included. Table 2 contains the results of the third crop year yield, and the three-year average for the locations reporting these data. The aftermath yields reported by Ottawa and some additional data reported by Guelph are included in Table 3.

The data summarized in Tables 1 and 2 indicate that under a pure stand establishment Saratoga is superior to the other varieties. This superiority although small relative to Lincoln is relatively consistent for all locations. Lyon, Canadian and Manchar appear to be sufficiently lower in yield to prohibit their recommendation for general use. However, Manchar had relatively good aftermath recovery and perhaps should be included in any future brome trials to test this feature further.

TABLE 1. FIRST AND SECOND CROP YEAR AND TWO-YEAR AVERAGE HAY YIELDS FOR THE PROVINCIAL BROME VARIETY TRIALS, 1958 AND 1959*

Zone	4	5	5	7	7	7	8	
Location	Guelph	Ottawa	Appleton	Dayton	Verner	Fort William	Kapuskasing	Prov. Average
First Crop Year	July 2	Jun.25	Jun.10	Jul.29	Jul.25		Jul.21	
Saratoga	2799	3905	3840	3924	4390	4742	1926	3647
Lincoln	3164	3789	3740	3765	4398	4818	2151	3689
Lyon	2736	3488	3040	3794	4252	4549	2095	3422
Manchar	2863	3662	2940	3598	4195	4612	1498	3338
Canadian	1634	2842	3720	3502	3827	4203	2051	3111
Mean	2640	3537	3456	3714	4212	4585	1944	3441
L.S.D. .05	420	611	NS	NS	345	NS	NS	
Second Crop Year	Jun.15	Jun.22		Jul. 9	Jul.15	Jul.10	Jul.13	
Saratoga	7087	6585		4659	6669	5941	5526	6078
Lincoln	7061	6060		4194	6160	5451	4189	5519
Lyon	6878	5643		3631	5752	5706	3978	5265
Manchar	6205	5523		4778	6074	5560	5342	5580
Canadian	5659	5248		4403	5549	5454	5072	5231
Mean	6289	5812		4333	6041	5622	4821	5486
L.S.D. .05	518	699		NS	562	NS	NS	
Two-year Average								
Saratoga	4943	5245		4292	5530	5342	3726	4863
Lincoln	5113	4925		3980	5279	5135	3170	4604
Lyon	4807	4566		3713	5002	5128	3037	4344
Manchar	4534	4593		4188	5135	5033	3420	4459
Canadian	3647	4045		3953	4688	4829	3562	4171
Mean	4465	4675		4024	5127	5104	3383	4464

* first crop year was in 1958 at all locations except Ottawa (1959)

TABLE 2. THIRD CROP YEAR HAY YIELDS AND THREE-YEAR AVERAGE HAY YIELDS FOR THE UNIFORM PROVINCIAL BROME TRIALS.

	Dayton	Verner	Fort William	Kapuskasing	Average
Third crop year	Jul. 7	Jul.15	Jul. 6		
Saratoga	4828	4933	2939	2800	3875
Lincoln	5242	5240	2973	2316	3943
Lyon	5133	5134	3423	2535	4056
Manchar	4817	4816	3319	2692	3911
Canadian	4351	4683	3042	2419	3624
Mean	4874	4961	3139	2552	3881
L.S.D. .05	NS	NS	NS	NS	
Three-year average					
Saratoga	4470	5331	4541	3417	4440
Lincoln	4595	5266	4414	2885	4290
Lyon	4186	5046	4559	2869	4165
Manchar	4203	5028	4497	3177	4226
Canadian	4085	4683	4233	3181	4046
Mean	4308	5071	4449	3106	4234

TABLE 3. AFTERMATH YIELDS, OTTAWA; AND SOME QUALITY DATA, GUELPH, 1959.

	Aftermath			Spring Vigor* (Ottawa, Guelph)	Guelph, 1959			
	1959 Sep. 9	1960 Sep.27	Average		After-math	Leaf disease*	Crude protein %	Leaf %
Saratoga	1873	1132	1503	1	1	2	8.7	44.4
Lincoln	1393	682	1038	3	3	3	8.7	42.2
Lyon	1545	697	1121	3	4	3	8.4	43.6
Manchar	1809	1125	1467	3	4	4	8.8	36.1
Canadian	1536	698	1117	5	5	5	9.8	47.6
Mean	1631	867	1249					
L.S.D. .05	316	318						

YIELD (POUNDS D.M. PER ACRE) OF BROME + VERNAL AT KEMPTVILLE.

	Hay				Aftermath		
	1957 Jun.25	1958 Jun.18	1959 Jun.19	1960 May 26	1958 Sep.10	1959 Sep.25	1960 Oct. 6
Saratoga	5054	5848	5774	2212	1519	991	862
Achenbach	5003	6374	5481	2296	1500	821	955
Lyon	4980	6130	5337	2200	1497	1017	695
Canadian	4394	4494	4099	1616	870	619	555

TEST 210 - BROME POLYCROSS PROGENY TEST (1958)

The polycross progenies of nine high seed weight clones of brome are included in this test in order to evaluate their yielding potential in pure stand seedings. Approximately 50 pounds of elemental nitrogen was applied in the early spring of 1959; 100 lbs. of N in the spring of 1960 plus an additional 50 lbs. of N which was applied six weeks after harvesting the first cut. The second cut was harvested four weeks after this date. The second application of nitrogen was made in 1960 since there had been no aftermath recovery after harvesting the first cut.

None of the polycross progenies are as high in yield as Saratoga but some appear superior to Lincoln. All appear to be superior in yield potential than Canadian Common but not significantly so in many cases.

Some differences apparently exist among progenies with regard to leafiness. Three of the progenies show a higher mean percent of leafiness.

In 1961, this test will be harvested to obtain seed yield and seed quality data.

TEST 210 - BROME POLYCROSS PROGENY TEST (1958)

Summary of 1960 Results

Entries	G. Number	Yield D.M. in lbs./acre			Pounds D.M. per acre of		Percent** of	
		Cut 1.	Cut 2*	Total	Leaf	Stem	Leaf St	Stem
S-55-50	1361	6112	2572	8684	2448	4467	35.2	64.8
S-55-56	1362	5698	2307	8005	2745	3746	42.3	57.7
S-55-64	1363	5938	1529	7467	2418	3521	41.1	58.9
S-55-82	1364	5112	1528	6640	1884	3734	34.1	65.8
S-55-92	1365	5841	2477	8318	2618	3275	43.7	56.3
S-55-93	1366	5360	2276	7636	1895	3648	34.3	65.7
S-55-99	1367	5781	1773	7554	2694	3050	47.3	52.7
S-55-106	1368	6065	2016	8081	2463	4104	37.6	62.4
S-55-109	1369	6138	2358	8496	2190	3986	35.5	64.5
Can.Common	1002	5604	1980	7584	2115	3781	36.1	63.9
Saratoga	1325	6043	2902	8945	2537	3915	39.1	60.9
Lincoln	1452	5572	2163	7735	2492	3719	39.8	60.2
L.S.D. .05		NS	NS		NS	NS		
C.V.		12.0	31.6		19.8	15.8		

* Reps. 1-3 only.

** Percent Crude Protein and Crude Fibre not completed on this material.

Two-year Average Hay Cut, Test 210

	1959	1960	Average
S-55-50	6087	6112	6100
S-55-56	6203	5698	5950
S-55-64	5566	5938	5752
S-55-82	5916	5112	5514
S-55-92	5835	5841	5838
S-55-93	6129	5360	5745
S-55-99	5812	5781	5797
S-55-106	6490	6065	6278
S-55-109	5482	6138	5810
Can.Common	5248	5604	5426
Saratoga	6728	6043	6386
Lincoln	6368	5572	5970
L.S.D. .05	538	NS	
C.V.	7.8	12.0	

TEST 216: A COMPARISON OF VIGOR FROM THE SEEDLING TO THE MATURE PLANT STAGE IN BROMEGRASS AND ITS RELATIONSHIP TO SEED WEIGHT (1959).

Purpose: (1) To determine the effect of seed weight on seedling vigor and vigor of the plants at later stages of development.

(2) To compare vigor at the seedling and mature plant growth stage.

(3) To compare greenhouse and field ratings for seedling vigor.

(4) To obtain information on growth curves in bromegrass.

(5) To obtain additional information on the interrelationships of several agronomic attributes.

(6) Additional information on various phases of bromegrass development.

Location: Section E, Range 12.

Seeded: May, 1959

Seeding rate: 100 seeds per 4 foot row.

Design: Split-plot with sub-plots in a simple lattice design.

Entries: Main plots include harvest at one month, two month , four month and mature (one year) growth stages.

Sub plots include 100 clones grouped into 11 seed weight classes with 9 clones per class having the same seed weight. One extremely low seed weight clone was added to give the 100 clones.

Results: None of the data collected has been summarized at this time.

TEST 219: A COMPARISON OF VIGOR FROM THE SEEDLING TO THE MATURE PLANT STAGE IN BROMEGRASS AND ITS RELATIONSHIP TO SEED WEIGHT (1960).

Purpose: This test is essentially a repetition of Test 216 and the purposes remain the same as for the previous test.

Location: Section E, Range 12.

Seeded: May 5 and 6, 1960.

Plot size: 4-foot rows, rows 3 feet apart.

Seeding rate: 100 seeds per row (using 1958 seed).

Design: Same as for test 216.

Entries: In this test only 25 clones were included as sub-plot entries. These clones consist of 5 different seed weight groups with 5 clones per seed weight group having essentially the same seed weight.

TEST 218: BROME SYNTHETIC TEST (1960)

The purpose of this test is the evaluation of yield and other agronomic attributes of nine introduced synthetics of bromegrass in comparison with the presently recommended varieties.

Location: Section B, Range 1.

Seeded: May 4, 1960.

Seeding rate: 10 lbs. per acre (Pure stand).

Entries:

S-5054 (Syn.2)	Saskatoon
S-4088 (Syn.3)	Saskatoon
S-4535 (Syn.2)	Saskatoon
S-4092 (Syn.2)	Saskatoon
Syn. C	Ottawa
Syn. B	Ottawa
B 81	Wisconsin
B 63	Wisconsin
B 55	Wisconsin
Can. Common	
Lincoln	
Saratoga	

TEST 220: SURVEY OF ANNUAL BROMUS SPECIES (1960)

This test was planted to observe the potentiality of several annual Bromus species in terms of adaptation and usefulness as a species per se or of future breeding material.

Location: Section B, Range 1.

Seeded: May 5, 1960.

Plot size: 8-foot row, 3 feet between rows.

Seeding rate: Approximately 2-3 lbs. per acre.

Entries: 23 annual or winter annual species with some species represented by more thanone seed introduction giving a total of 27 entries.

The seed for these species was obtained from the U.S.D.A., Plant Introduction Station, Ames, Iowa.

Observations recorded in 1960 are summarized in the accompanying table. Observations obtained on some of the species indicate that they warrant additional investigation. B. catharticus, particularly, appeared outstanding. This species is commonly known as rescue grass.

Seeded: May 5, 1960.

TEST 220: SURVEY OF ANNUAL BROMUS SPECIES - SUMMARY OF 1960 RESULTS.

Species	P.I. Number	G. Number	Country of Origin	Yield Cut 1 Aug. 18	Yield Cut 2 Sep. 27	Yield Total	% D.M. Cut 1	% D.M. Cut 2	Vigor[1] Initial June 13	Vigor[1] Mature Aug.29	Vigor[1] Recovery** Aug.29	Height (ins.) Jul.11	Heading date	Leafiness[3] Aug.29	Disease[4] Aug.29
B. auleticus	162779	G-1841	Argentina	6293	3420	9713	30.4	25.5	6	2	3	22.0	Jul.10	2	1
B.japonicus	171541	G-1843	Turkey	2780	1582	4362	20.0	19.5	7	8	6	8.4	Aug.29[2]	1	2
B.catharticus	189612	G-1818	S. Africa	7339	2547	9886	33.8	23.1	4	1	3	23.8	Jul.11	2	2
B.rubens	197571	G-1849	Italy	3292	794	4086	23.7	31.8	8	6	8	13.2	Aug.25	1	3
B. catharticus	202359	G-1821	Argentina	6252	2599	8851	33.6	27.2	5	3	4	24.0	Aug.7	2	2
B.cappadicius	202532	G-1839	Belgium	5707	1788	7495	23.9	27.8	4	1	1	20.6	Jul.11[2]	3	1
B.macrostachys	203452	G-1847	Turkey	2632	324	2956	30.1	37.8	8	8	10	10.2	Aug.29[2]	1	3
B.tectorum	204413	G-1845	Turkey	----	----	----	----	----	6	8	8	13.5	W.A.	3	4
B.pseudodanthoniae	204424	G-1828	Turkey	2840	462	3302	23.4	28.7	7	9	9	11.5	Aug.30[2]	2	3
B.anatolicus	204862	G-1846	Turkey	2138	----	2138	30.5	----	7	8	10	11.8	W.A.	2	4
B.commutatus	205284	G-1848	Turkey	2064	----	2064	66.9	----	1	9*	10	20.0	Jun.25	5	-
B.squarrosus	206415	G-1844	Turkey	2008	200	2208	33.8	32.0	8	9	10	8.6	Aug.30[2]	1	3
B.arvensis	206551	G-1812	Greece	3939	794	4733	23.4	23.4	8	6	6	12.5	W.A.	2	4
B.pseudodanthoniae	211006	G-1829	Afghanistan	5483	2207	7690	27.4	22.8	5	10*	8	15.5	Jun.17	3	2
B.valdivianus	211856	G-1837	Chile	3699	2742	6441	18.4	19.7	8+	5	1	11.1	W.A.	2	1
B.catharticus	217593	G-1819	India	7833	3182	11015	35.2	21.4	6	4	2	17.7	Jul.11	2	4
B.catharticus	219801	G-1820	Chile	6328	2681	9009	27.2	23.0	6	4	2	26.0	Jul.6	1	4
B.stamineus	219804	G-1838	Chile	4006	2744	6750	17.7	18.9	8	4	1	11.2	W.A.	1	3
B.madritensis	220089	G-1834	Afghanistan	1167	----	1167	53.6	----	9	10*	9	14.5	Jun.13	5	-
B.oxyodon	220378	G-1836	Afghanistan	3392	----	3392	50.1	----	8	7*	10	20.5	Jun.31	3	1
B.scoparius	220514	G-1835	Afghanistan	----	----	----	----	----	7	10	8	12.8	Jul.11	2	4
B.danthoniae	226453	G-1833	Iran	4640	----	4640	56.2	----	6	9*	10	21.8	Jun.22	3	4
B.sterilis	227661	G-1832	Iran	2129	604	2733	25.5	31.3	9	7	10	8.9	Aug.25	2	4
B.brachystachys	229527	G-1831	Iran	5663	----	5663	43.1	----	8	4*	10	33.5	Jul.5	2	2
B.carinatus	232201	G-1813	U.S.A.	3792	2551	6343	21.8	21.3	6	5	2	13.0	Aug.29[2]	2	1
B.carinatus	236754	G-1814	Canada	3254	2196	5450	24.3	22.0	6	5	3	13.6	Aug.29[2]	1	2
B.marginatus	236765	G-1811	Canada	3802	1227	5029	24.7	35.5	6	4	4	17.8	Aug.29[2]	1	3
B.inermis	Saratoga	G-1912	U.S.A.	2941	1872	4813	28.4	24.2	6	2	8	15.4	------	3	1
C.V.				24.4	64.7	21.3									
L.S.D. .05				2120	NS	2477									

[1] 1 = good, 10 = poor; * mature; + largely ryegrass

1-12"; 10-0"; **cut Aug.18

[2] few culms present

[3] W.A. - winter annual; 1-good, 5-poor

[4] 1-none, 5-100%

TEST 221: SURVEY OF PERENNIAL BROMUS SPECIES (1960)

This test was planted to observe the potentiality of several perennial Bromus species and several introductions of B. inermis with regard to adaptation and usefulness in breeding or production programs.

Location: Section B, Range 1.

Seeded: May 5, 1960.

Plot size: 8-foot row, 3 feet between rows.

Seeding rate: Approximately 2-3 lbs. per acre.

Entries: 13 species in addition to 20 introductions of B. inermis.

During 1960 only observations on seedling vigor were recorded. These will be summarized with the 1961 data in the 1961 report. In general none of the Brome species equalled the seeding year vigor of B. inermis with the exception of B. sitchensis. B. sitchensis had outstanding vigor in the seeding year but it has a very rough leaf.

Two Russian and one Yugoslavian introductions of B. inermis showed very good seeding year vigor.

SEED WEIGHT SELECTION PROGRAM IN BROME

In 1957, a source nursery of 4500 plants was established from polycross seed of 9 high seed weight clones. In 1958 and again in 1959 seed was harvested from approximately 350 randomly selected plants. Seed weights were determined for each of these selected plants in both years.

On the basis of the average seed weight in 1958 and 1959, 19 of these plants were selected for three slightly different reasons to recombine in order to initiate a second cycle of selection for seed weight. Propagules of these plants were grown and increased in the greenhouse during the winter of 1960-61. They will be transplanted in four different, isolated, recombination nurseries in 1961. Some of the selected plants are found in more than one of the nurseries.

The proposed nurseries and the selections included in them follow.

I. RECOMBINATION OF NINE SELECTIONS HAVING THE HIGHEST SEED WEIGHT REGARDLESS OF THEIR PARENTAGE. (THIS NURSERY WILL BE DUPLICATED AT TWO LOCATIONS FOR ADDITIONAL STUDIES OF THE EFFECT OF ENVIRONMENT ON SELECTION.)

Selection (from Range D-1)	Maternal Clone selection	Two-year Average Seed weight gms./100 seeds
149-19	S-51-50	.4956
152-6	S-51-56	.4952
133-2	S-51-50	.4848
126-7	S-51-50	.4840
21-1	S-51-92	.4839
20-9	S-51-109	.4721
36-16	S-51-64	.4711
145-9	S-51-109	.4708
187-13	S-51-92	.4625

II. RECOMBINATION OF NINE BEST PLANTS AGRONOMICALLY-SPEAKING, EACH PLANT TRACING BACK TO ONE OF THE ORIGINAL MATERNAL CLONES. SEED WEIGHT WAS THE SECONDARY FACTOR IN SELECTION.

Selection (from Range D-1)	Maternal Clone selection	Two-year Average Seed weight gms./100 seeds
126-12	S-51-50	.3784
139-16	-56	.3862
154-5	-64	.4338
47-2	-82	.3834
21-1	-92	.4839
151-2	-93	.3539
162-5	-99	.4482
56-1	-106	.3278
128-16	-109	.3847

III. RECOMBINATION OF THE NINE HIGHEST SEED WEIGHT PLANT SELECTIONS, EACH SELECTION TRACING BACK TO ONE OF THE ORIGINAL MATERNAL CLONES.

Selection (from Range D-1)	Maternal Clone selection	Two-year Average Seed weight gms./100 seeds
149-19	S-51-50	.4956
152-6	-56	.4952
36-16	-64	.4711
47-2	-82	.3834
21-1	-92	.4839
88-14	-93	.3730
162-5	-99	.4482
26-17	-106	.3997
20-9	-109	.4721

COMPARATIVE SEED QUALITY IN BROMEGRASS

During the winter of 1959-60 a number of letters were sent to several American and Canadian institutions requesting data, if available, on the comparative seed quality of bromegrass. One of the reasons for requesting this data was to obtain some information on the effect of location of seed production on seed quality. In the past Canadian common brome seed produced in Western Canada has generally had good seed weight with relatively less inert material included. On the other hand seed of some of the southern-type brome varieties produced mainly in the American mid-west has been low in quality, having a low seed weight and a high proportion of inert material.

If the superiority in quality of Canadian common brome seed could be attributed largely to production under a favourable environment, then it would be desirable to produce Ontario's bromegrass seed supply in Western Canada. This would also be beneficial to the Western Canada seed producer since the export market for Canadian Common brome seed has been rapidly dwindling in the last few years. If the Western Canada producer was producing seed of the southern-type brome varieties, the export market for bromegrass seed might be increased again.

Very little response was obtained from the request for information. Most stations neglected to answer the letter, and the others indicated that no information was available, with the exception of Dr. R. Kalton, formerly of Iowa State University. The limited data from Iowa indicated that Canadian Common was superior in seed weight to southern-type varieties when grown in Iowa but this superiority was considerably less than that obtained when the seed was produced in Western Canada. Seed yield of Canadian Common was approximately the same as southern-type varieties in Iowa but in Western Canada, Canadian Common gave a higher seed yield than the southern types.

Dr. R. Knowles, Saskatoon, had no data available, but, in answer to our request, sent to O.A.C. seed harvested from two tests which included both northern and southern-type varieties and synthetics.

An analysis of seed weight on these two tests was conducted and the means and mean squares for the two tests are presented in the following tables. The seed produced in 1959 was harvested from a replicated space-planted nursery, whereas the seed produced in 1960 was harvested from drilled plots with the rows spaced one foot apart.

Summary of Seed Weight Analysis on Saskatoon Material

1) Manchar had the highest seed weight in both tests.

2) Saratoga, a southern type variety, had the same seed weight as Canadian Common.

3) Lincoln has a relatively low seed weight in both tests.

4) Differences occur among both northern and southern strains with regard to seed weight suggesting that some selection should be made for seed weight in a breeding program.

5) No data is yet available to directly compare the effect of environment on seed quality.

Processing of Brome Seed

In addition to seed weight analysis of brome varieties some consideration was given, during the winter of 1960-61, to the possibility of a more complete processing of brome seed in order to increase the seed weight and also eliminate the inert material. Some processing work was carried out co-operatively with Mr. W.D. Taylor of the Field Crops Branch using a buffer to free the inert material from the seed. The seed used in these trials was generously made available by two commercial firms.

A report of this work written by Mr. Taylor follows.

Bromegrass Buffing Trials

In November an attempt was made to improve the weight per bushel of a lot of bromegrass seed. Samples were set up of lots buffed at different speeds and rates of feeding. Samples from these lots were set out for germination but the germination of the whole lot was so low that useful data were not available. A second attempt to check the physical reaction from buffing was set up on February 15. A small model Forano buffer was used at a speed of 1100 r.p.m. This was the slowest possible r.p.m. with our equipment. It was found necessary to cover the screen in the bottom of the buffer with smooth tin to eliminate excessive buffing action and undue hulling. The seed had to be hand fed to the elevator and a chokeup at the buffer discharge caused by an abrupt 90° change in the seed flow direction, were difficulties experienced. The rate of flow affected the buffing action and when the chokeup, due to the slowness of the seed to get out of the machine occurred, the seed was damaged and badly hulled by the extra buffing action.

Although germination tests to show seed damage were not possible, the following results were obtained.

Original weight per bushel - 15 lbs.
After buffing at 1100 r.p.m. 21 lbs. per bushel. Refuse was removed with a small blower.
Increase in weight per bushel - 6 lbs. (from 15 to 21).
Loss in weight per bushel - 1¼ lbs. dust and hulls.
The seed shows some damage (20% hulled) but not able to check due to low germination.
The petrie dishes set out for germination became infected with mould and this may have had an adverse effect on the germ due to susceptibility from seed damage.

Conclusions -

(I) Special equipment or attachments are required for elevating brome.

(II) The bottom screen of the buffer must be covered to prevent seed loss and excessive breakage.

(III) The discharge on the small Forano buffer is not satisfactory for bromegrass.

(IV) The rate of feeding is very important.

(V) Buffing to remove 1-1¼ lbs. of material gave a 6 lb. increase in bushel weight.

(VI) A relation between complete and partial hulling and seed germination will have to be established.

TABLE 1: SEED WEIGHTS OF 16 STRAINS OF BROMEGRASS GROWN AT SASKATOON IN 1959

Symbol	Variety	Source	Seed weight (mgms./50 seeds)
11A	Northern Commercial	Unity 1956	186.1
43A	Northern Commercial	Unity 1955 S-4712	179.2
24A	Manchar	U.S.D.A.	195.2
12A	S-4088 Syn. 2	Blk. 6 Forestry Farm 1956	171.3
13A	S-4092 Syn. 2	Blk. 4 Seed Farm	168.8
14A	S-4475 Syn. 2	Anderson 1956	169.4
21A	S-4506 Syn. 2	Anderson 1956	176.2
22A	S-4506 Syn. 1	Anderson 1956	180.3
23A	S-4535 Syn. 1	Blk. 12 Sheep Farm	172.6
44A	S-4946	Bulk O.P. Seed non-creeping	188.4
31A	Saratoga	U.S.D.A.	179.2
32A	Minn. Syn. B	U.S.D.A.	189.8
33A	Lincoln	U.S.D.A.	163.4
34A	Lancaster	U.S.D.A.	153.6
41A	Fischer	U.S.D.A.	179.6
42A	Southland	U.S.D.A.	180.7
		Mean	177.1
		L.S.D. (.05)	13.1
		(.01)	17.4
		C.V. (%)	6.4

TABLE 2: ANALYSIS OF VARIANCE OF SEED WEIGHT FOR 16 BROME STRAINS GROWN AT SASKATOON, 1959.

	Degrees of Freedom	S.S.	M.S.
Replicates	5	1,039.36	207.87
Entries	15	9,931.53	662.10**
Northern vs. Southern type strains	1	428.70	428.70
Within Northern type strains	9	4,222.29	469.14**
N. Commercial + Manchar vs. S-strains	1	1,672.80	1,672.80**
N. Commercial vs. Manchar	1	626.67	626.67*
N. Commercial ('55) vs. Com. ('56)	1	142.83	142.83
S-4946 vs. other S-strains	1	1,198.22	1,198.22**
Syn. 2 S-strains vs. Syn. 1 S-strains	1	202.68	202.68
Remainder	4	379.11	94.78
Within Southern type strains	5	5,280.54	1,056.11**
Saratoga vs. Minn. Syn. B	1	340.27	340.27
Saratoga vs. Lincoln	1	747.34	747.34*
Saratoga vs. Lancaster	1	1,958.41	1,958.41**
Saratoga vs. Fischer	1	0.48	0.48
Saratoga vs. Southland	1	7.05	7.05
Error (Reps. x Entries)	75	9,778.02	130.37
Reps. x northern vs. southern type strains	5	987.26	197.45
Reps. x within northern type strains	45	6,162.75	136.95
Reps. x within southern type strains	25	2,628.01	105.12
Total	95	20,748.91	

* significant at 5% level

** significant at 1% level

TABLE 3: MEAN SEED WEIGHTS OF 16 STRAINS OF BROMEGRASS GROWN AT SASKATOON IN 1960

Strain	Source	Mean Seed Weight* (mgms.)
Commercial	Seed Fair, 1959, Composite Vera	138.8
S-4088 Syn. 3	Sutherland 3, 1958	129.0
S-4088 Resel. Syn. 2	Sutherland 3, 1958	126.7
S-4475 Syn. 3	Sheep Farm 9, 1958	132.5
S-4535 Syn. 2	Sutherland 1, 1958	125.4
S-5563 Syn. 1	Greenhouse 1958-59	140.3
S-5564 Composite	Sutherland 2, 1958	137.1
Commercial	Seed Fair, 1958, Composite Kinley	141.4
S-5030 Composite	Blk. 907 Clonal Nursery 1959	142.3
Lincoln	Nebraska 1959, S-5605	129.4
Manchar	Pullman 1959, S-5582	146.6
Saratoga		142.8
S-4088 Syn. 2	Resel. Blk. 6 F. farm 1958	126.4
Ottawa Syn. A, S-5588	Childers 1958 Ottawa	135.7
Ottawa Syn. B, S-5589	Childers 1958 Ottawa	130.6
Ottawa Syn. C, S-5590	Childers 1958 Ottawa	135.5

s.e. of treatment mean = 3.50

C.V. = 4.5%

* mean of two lots of 50 seeds each (in mgms.)

TABLE 4: MEAN SQUARES FOR SEED WEIGHT OF 16 BROME STRAINS GROWN AT SASKATOON IN 1960.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares
Replicates	5	64,097	12,819
Entries	15	399,477	26,632**
Northern named Var. vs. Southern named Var.	1	27,851	27,851**
Can. Com. lots vs. Manchar	1	16,943	16,943*
Saratoga vs. Lincoln	1	54,002	54,002**
Among S-strains	7	186,960	26,709**
Among Ottawa strains	2	10,253	$5,126^{NS}$
Can. Com. lots vs. S-strains	1	55,968	55,968**
Saratoga vs. S-strains	1	56,513	56,513**
Saratoga vs. Ottawa strains	1	35,201	35,201**
Can. Com. lots vs. Ottawa strains	1	27,553	27,553**
Error	75	275,517	3,674
Total	95	739,091	

TEST 217 (1960): STUDY OF THE COMPETITION BETWEEN BROMEGRASS AND ALFALFA VARIETIES IN THE SEEDING YEAR.

Location: Section B, Range 1.

Seeded: May 4, 1960.

Seeding rate: Alfalfa - 10 lbs./acre
Brome - 10 lbs./acre
Orchard - 8 lbs./acre
Timothy - 6 lbs./acre

Design: Split-plot with alfalfa varieties as main plots and grass varieties as sub plots.

Entries: Alfalfa - Vernal, DuPuits.
Brome - Saratoga, Lincoln, Can. Common.
Orchard - Frode.
Timothy - Climax.

Other information: No companion crop seeded.
Sprayed with 2,4-DB when two inches growth to control weeds, mainly white cockle.

Summary of Results:

1. DuPuits outyielded Vernal alfalfa in mixtures and also in legume component.

2. Grass yield was higher when grown with Vernal than with DuPuits but not significantly so for cut 1.

3. There were differences in yield among grass species both in mixtures and components but interactions of grass varieties and alfalfa varieties also occur.

   These differences and interactions are evident by a joint study of the tables of means and the tables of mean squares which follows.

TEST 217: SUMMARY OF YIELD AND PERCENT COMPOSITION OF YIELD IN THE SEEDING YEAR (SEEDED MAY 4, 1960) OF THE BROME-ALFALFA COMPETITION STUDY.

Entry	Yield (D.M./Acre)			Percent Composition				
				Legume		Grass		Weeds
	Cut 1 (Jul.14)	Cut 2 (Aug.30)	Total	Cut 1	Cut 2	Cut 1	Cut 2	Cut 1
	lbs.	lbs.	lbs.	%	%	%	%	%
Vernal +								
Can. Common	2349	3087	5436	53.0	85.6	42.7	14.4	4.3
Lincoln	2107	3262	5368	65.2	86.2	29.2	13.8	4.9
Saratoga	2400	3136	5536	45.9	75.8	51.1	24.2	3.3
Climax	2491	2897	5388	43.8	89.9	53.3	10.1	3.0
Frode	2083	3211	5294	55.0	65.7	41.3	34.3	3.8
Alone	2224	3152	5376	92.7	100.0	1.7	----	7.3
Mean	2276	3124	5400	59.3	83.9	43.5	19.4	4.4
DuPuits +								
Can. Common	2464	3291	5704	64.1	98.0	33.5	2.0	2.5
Lincoln	2418	3435	5849	69.4	98.6	26.9	1.4	3.7
Saratoga	2514	3217	5732	52.1	96.7	45.2	3.4	2.7
Climax	2666	3294	5960	54.3	98.4	43.6	1.6	2.1
Frode	2449	3654	6103	64.3	80.9	33.7	19.1	2.1
Alone	2263	3522	5784	94.3	100.0	1.3	0.1	5.7
Mean	2454	3402	5856	66.4	95.4	36.6	5.5	3.1
C.V.	10.7	9.1	9.8					

MEAN SQUARES FOR YIELD DIFFERENCES AMONG THE MIXTURES IN THE SEEDING YEAR OF THE BROME-ALFALFA COMPETITION STUDY (1960)

Source of Variation	Degrees of Freedom	Yield (lbs. D.M./acre)		
		Cut 1	Cut 2	Total
Between alfalfa var.	1	1,143,296**	2,826,792*	7,490,707**
Error (a)	11	114,177	522,702	393,309
Among grass var.	5	428,913**	404,325**	62,475
Grass var. vs. alone	1	423,357**	156,763	64,885
Brome var. vs. Climax + Frode	1	88,157	19,406	190,287
Climax vs. Frode	1	1,169,689**	1,359,460**	7,130
Can.Com. vs. Lincoln + Saratoga	1	7,454	87,025	43,542
Lincoln vs. Saratoga	1	455,910**	353,290*	6,533
Saratoga vs. Frode	1	437,963**	783,107**	49,794
Lincoln vs. Climax	1	1,198,904**	766,338**	48,197
Alfalfa var. x Grass var.	5	107,061	116,750	292,496
Alfalfa x Grasses vs. alone	1	70,434	60,904	16,522
x Bromes vs. Climax + Frode	1	41,206	513,281*	1,007,032*
x Climax vs. Frode	1	54,483	6,533	168,863
x Can.Com. vs. Linc. + Sara.	1	43,414	23,409	20,069
x Lincoln vs. Saratoga	1	58,115	25,300	249,985
x Saratoga vs. Frode	1	189,882	392,589*	1,128,533*
x Lincoln vs. Climax	1	55,352	149,522	22,925
Error (b)	110	63,659	87,318	200,065

SUMMARY OF THE YIELD OF THE LEGUME AND GRASS COMPONENTS IN THE SEEDING YEAR OF THE BROME-ALFALFA COMPETITION STUDY (1960)

	Legume			Grass			Weeds
Entry	Cut 1	Cut 2	Total	Cut 1	Cut 2	Total	Cut 1
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Vernal +							
Can. Common	1237	2646	3883	1013	441	1454	99
Lincoln	1370	2817	4187	618	486	1104	100
Saratoga	1099	2380	3479	1228	756	1984	79
Climax	1060	2603	3663	1357	294	1651	74
Frode	1121	2062	3183	884	1148	2032	79
Alone	2059	3152	5211	----	----	----	166*
Mean	1324	2610	3934	1020	625	1645	99
DuPuits +							
Can. Common	1544	3143	4687	812	147	959	58
Lincoln	1679	3384	5063	649	51	700	90
Saratoga	1307	3110	4417	1139	107	1246	68
Climax	1448	3239	4687	1162	54	1216	55
Frode	1564	2948	4512	832	706	1538	53
Alone	2133	3522	5655	----	----	----	129*
Mean	1613	3224	4837	919	213	1132	75
C.V.	12.0	11.3	9.2	24.0	62.7	28.1	47.2

* these values include grass found in legume alone plots

MEAN SQUARES FOR YIELD DIFFERENCES AMONG THE LEGUME COMPONENT IN THE SEEDING YEAR OF THE BROME-ALFALFA COMPETITION STUDY (1960)

Source of Variation	Degrees of Freedom	Yield of Legume Component		
		Cut 1	Cut 2	Total
Between alfalfa var.	1	2,990,593*	13,581,682**	29,318,607**
Error (a)	11	53,629	393,485	490,489
Among grass var.	5	12,569,297**	1,965,926**	8,106,805**
Grass var. vs. alone	1	11,341,686**	5,069,909**	31,577,520**
Brome var. vs. Climax + Frode	1	159,400*	1,155,523**	2,173,273**
Climax vs. Frode	1	93,545	2,079,169**	1,290,680**
Can.Com. vs. Linc. + Sara.	1	11,183	12,731	50
Lincoln vs. Saratoga	1	1,240,668**	1,512,300**	5,492,503**
Saratoga vs. Frode	1	232,965**	693,121*	122,412
Lincoln vs. Climax	1	878,043**	384,850	2,425,502**
Alfalfa var. x grass var.	5	104,219**	195,747	501,251*
Alfalfa x Grass vs. alone	1	328,363**	429,733*	1,509,385**
x Brome var. vs. Climax + Frode	1	142,608*	190,775	663,269*
x Climax vs. Frode	1	9,436	186,751	280,143
x Can. Com. vs. Lincoln + Saratoga	1	9,425	91,607	42,264
x Lincoln vs. Saratoga	1	31,263	79,870	11,193
x Saratoga vs. Frode	1	167,088*	72,541	459,817
x Lincoln vs. Climax	1	18,174	14,352	64,827
Error (b)	110	30,961	108,424	160,904

MEAN SQUARES FOR YIELD DIFFERENCES AMONG THE GRASS COMPONENT AND THE WEED COMPONENT IN THE SEEDING YEAR OF THE BROME-ALFALFA COMPETITION STUDY (1960)

Source of Variation	Degrees of Freedom	Grass Component			Weed Component
		Cut 1	Cut 2	Total	Cut 1
Between alfalfa var.	1	306,637	5,089,024**	7,894,043**	20,496**
Error (a)	11	126,567	99,897	259,483	1,142
Among grass var.	4(5)	1,550,756**	2,138,427**	2,879,290**	23,652**
Grass var. vs. alone	1	---	---	---	103,584**
Brome var. vs. Climax + Frode	1	638,674**	1,385,309**	3,905,218**	8,563*
Climax vs. Frode	1	1,936,837**	6,801,096**	1,479,114**	20
Can.Com. vs. Lincoln + Saratoga	1	264	50,101	43,091	544
Lincoln vs. Saratoga	1	3,627,250**	317,200*	6,089,738**	5,547
Saratoga vs. Frode	1	1,271,404**	2,949,712**	347,991	728
Lincoln vs. Climax	1	4,703,138**	107,068	3,390,970**	11,224**
Alfalfa var. x Grass var.	4(5)	57,670	151,935	103,582	1,021
Alf. x Grasses vs. alone	1	---	---	---	1,150
x Bromes vs.Climax + Frode	1	9,739	100,442	47,629	12
x Climax vs. Frode	1	60,919	123,424	10,920	180
x Can.Com. vs. Linc. + Saratoga	1	117,363	247,340	23,948	3,762
x Lincoln vs. Sara.	1	42,662	136,533	331,835	0
x Sara. vs. Frode	1	4,107	127,617	177,512	728
x Lincoln vs. Climax	1	151,538	114,954	2,523	169
Error (b)	88(110)	54,310	69,104	152,575	1,684

MIXTURE DIVERSITY TRIAL 1960 (310)

Yield and composition in seedling year, 1960

Association	Lbs. D.M./acre Alfalfa + Grass			% alfalfa		% grass		
	Jul.14	Aug.30	Total	Jul.14	Aug.30	Jul.14	Aug.30	Difference
DuPuits + Lincoln	2282	3372	5654	86.7	96.3	13.4	3.7	9.7
+ Climax	2597	3365	5962	62.0	96.5	38.0	3.5	34.5
+ Frode	2375	3698	6073	69.7	81.5	30.3	18.5	11.8
Mean	2418	3478	5896	72.8	91.4	27.2	8.6	18.6
Vernal + Lincoln	2098	3367	5465	81.2	90.4	18.8	9.6	9.2
+ Climax	2354	3064	5418	51.8	89.2	48.2	10.8	37.4
+ Frode	2121	3428	5549	57.0	66.9	43.0	33.1	9.9
Mean	2191	3286	5477	63.3	82.2	36.7	17.8	18.9

Association	Lbs.D.M./acre - Alfalfa			Lbs. D.M./acre - Grass			
	Jul.14	Aug.30	Total	Jul.14[1]	Aug.30[2]	Total	Difference between 1 and 2
DuPuits + Lincoln	1978	3247	5225	304	125	429	179
+ Climax	1610	3247	4857	987	118	1105	869
+ Frode	1655	3014	4669	720	684	1404	36
Mean	1748	3169	4917	670	309	979	361
Vernal + Lincoln	1704	3044	4748	394	323	717	71
+ Climax	1219	2733	3952	1135	331	1466	804
+ Frode	1209	2293	3502	912	1135	2047	-223
Mean	1377	2690	4067	814	596	1410	218

TEST 222: EFFECT OF LOCATION ON GENOTYPE IN SEED PRODUCTION (1960)

This test is being conducted in co-operation with Dr. R. Knowles, Forage Research Station, Saskatoon, to investigate possible genotype changes due to seed increase of southern-type bromes in the western provinces.

Location: Section B, Range 1.

Seeded: May 4, 1960.

Seeding rate: 10 lbs./acre (Pure stand).

Entries:
1. Lincoln - Man.S-5839 (grown 1959)
2. Lincoln - Saskatoon (grown 1959)
3. Lincoln - S-4981 (original seed from Nebraska)
4. Fischer - Alysham, Saskatchewan (grown 1959)
5. Fischer - Iowa (original seed from Iowa)
6. Fischer - Zealandia (grown 1959).

SARATOGA BROMEGRASS EVALUATION

Extension Branch, Field Crops Branch, O.A.C. and Soil and Crop Improvement Association branches co-operating

In 1960 two series of plots were established as farm plantings in Ontario. The following report gives an indication of the progress on these plantings in the seeding year.

Early Hay or Silage Aftermath Pasture Demonstration

The farm plantings were made to show DuPuits alfalfa and Saratoga bromegrass performance under a wide range of farm conditions.

Two plots, two acres in size, were seeded at each location. DuPuits alfalfa at 10 lbs. in mixture with Saratoga brome at 10 lbs. in one plot and DuPuits 10 lbs. mixed with orchard 8 lbs. on the other plot.

Plans were made for co-operators in 32 locations - one per county in central and southwestern Ontario. Reports were not received from three. Two others did not seed plots in 1960. Following is a summary of reports made by the 27 co-operators involved. Some co-operators did not answer some questions hence the discrepancy between the number of reports received and the total of responses in the tables.

Seeding date	No. of co-operators
Last week of April	2
1st week of May	5
2nd week of May	5
4th week of May	1
First week of June	11

	Number of Co-operators				
Stand of Forages (Oct. 1960)	Excellent	Very Good	Good	Fair	Poor
DuPuits alfalfa	9	7	7	2	0
Saratoga bromegrass	1	2	10	9	3
Orchardgrass	1	4	11	6	3

	Number of Co-operators				
Vigor (Oct. 1960)	Excellent	Very Good	Good	Fair	Poor
DuPuits alfalfa	6	6	11	1	0
Saratoga bromegrass	1	2	9	9	2
Orchardgrass	1	3	11	8	0

From these tables we infer that farmers felt the stand and vigor of orchardgrass was better than that for Saratoga bromegrass. The differences in rating by the farmers, however, are not large, indicating that Saratoga has made nearly as good a start as orchardgrass in the seeding year. Both grasses are reported to have suffered from the dry August and September weather of this year. Several reports show a lowered vitality of both grasses since the dry weather began.

Of the 24 who used fertilizer on the plot area, 13 followed recommendations based on soil test. Fourteen manured the field during 1959 or before seeding 1960. Each co-operator fall plowed the field and one re-plowed in the spring. Six co-operators packed or rolled, while most harrowed to firm the soil before seeding. Of the 25 who reported using a companion crop, 20 used less than 2 bushels of grain as the seeding rate. None used other than the standard width between drills of grain (7").

Fourteen of 24 co-operators placed the plots on a field which had a grain crop on it in 1959. In 7 locations, the plots followed corn. Bromegrass was seeded with grain through the drill in 17 of the locations. Only 7 report seeding bromegrass at over 2" deep. Twelve covered the seed with a roller or packer, while 9 used harrows (chain or spike) and 2 used chains behind the drill to cover the grass seed. Of 19 who reported weeds in the field, only 6 reported use of spray for control. One reported mowing for weed control.

Bromegrass Competition and Aftermath Production

The object of this series of plantings was to compare Saratoga, Lincoln, Canadian bromegrass and Climax timothy when grown with Vernal alfalfa.

Plots seeded were:

Saratoga	10	Lincoln	10	Canadian	10	Climax	6
Vernal	10	Vernal	10	Vernal	10	Vernal	10

Plans were made for 13 co-operators - two in each of the districts in Ontario served by Field Crops Branch fieldmen. Reports are based on observations of seven locations by members of Field Husbandry or Field Crops Branch staff.

	Number of locations					
Stand of Species	Excellent	Very Good	Good	Fair	Poor	None
Alfalfa	1	2	2	1	1	0
Lincoln			3	1	2	1
Saratoga			3	1	2	1
Canadian			1	2	3	1
Climax			2	2	2	1

Stand of grasses has not been high. Stand of Saratoga and Lincoln appear equal and slightly better than Climax. Canadian bromegrass appears to have established most poorly of the grasses.

	Number of locations					
Vigor of Species	Excellent	Very Good	Good	Fair	Poor	None
Alfalfa	1	1	2	1	1	0
Lincoln			2	2	1	1
Saratoga			3	1	1	1
Canadian			1	2	2	1
Climax			2	1	1	1

Vigor of the grasses appears to follow the order of: Saratoga, Lincoln, Climax and Canadian though small differences were involved.

EXPERIMENT 608 - MEADOW FESCUE STRAINS, 1958

	Cut 1 - 1959				Cut 2 - 1960
			% Protein		
Variety	Yield	% leaf	Leaf	Stem	Yield
Climax (timothy)	5600	54	11.3	7.0	1540
Mimer	5310	35	11.0	8.4	820
Common	4180	44	12.5	9.8	600
S-53	4070	38	11.8	10.4	490
L.S.D. 5%	770	7	NS	NS	
1%	1100	10	NS	NS	
C.V.	10	11	6	8	

Cut 1, 1959 - June 18
Cut 2, 1960 - September 1

This experiment was terminated in 1960. Further testing of the variety Mimer will be carried out.

EXPERIMENT 605 - MEADOW FESCUE VARIETY OBSERVATION NURSERY, 1959

Variety		Spring Vigor* April 28/60	Height at bloom
			inches
Early	Ensign	5.0	
	Mefon	3.5	
	Mommersteeg's Hay Type	4.0	
	Mommersteeg's Pasture Type	2.5	33
	S-170 (Tall Fescue)	1.0	41
Late	Barenza Pasture	3.5	28
	Festo	3.5	
	Melle Pasture	3.0	35
	Mimer	2.5	34
	S-53	4.0	
	S-215	2.5	30
	Sceempter	3.0	36
	Trifolium II	2.5	34
	Trifolium 6622	3.0	33
	Prato (K.B.G.)	3.0	24

* Rating: 1 (good) to 5 (poor)

EXPERIMENT 606 - PERENNIAL RYEGRASS VARIETY OBSERVATION NURSERY, 1959

Variety		Vigor* April 29	Vigor* June 30
Early	Barenza Pasture	4.5	2.5
	Barenza Early Hay	3.5	3.0
	Mommersteeg Hay	2.0	3.0
	S-24	2.5	3.5
	Trifolium 790	4.0	3.0
	Trifolium 6135	4.0	3.0
	Viris	3.0	3.5
Medium	Barbantia Hay	4.0	3.0
	Barenza Late Hay	4.5	3.0
	Daublet	2.5	2.5
	Glasnevin Rosa	2.5	3.0
	Hunsable	2.0	3.0
	Melle Hay	3.0	4.0
	Mommersteeg Pasture	4.0	2.5
	Mommersteeg Permanent Pasture	2.5	3.0
	S.101	3.0	3.0
Late	B.2	3.0	2.0
	Heraf	4.0	3.0
	Pelo	2.5	2.5
	S.23	3.0	2.5

* Rating: 1 (good) to 5 (poor)