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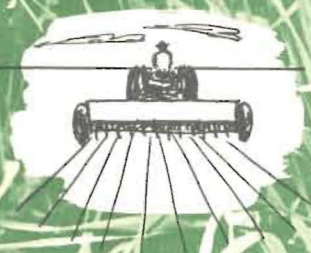
PROGRESS REPORT No. 2

HAY INVESTIGATIONS

1954



HAY RESEARCH COMMITTEE
ONTARIO AGRICULTURAL COLLEGE
GUELPH, CANADA

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* - Final report of project.

Report Of The Hay Research Executive Committee

Two changes were made in the membership of the Executive Committee in 1954. Professor R. G. Knox retired and his place was assumed by G. E. Raithby and J. W. Garland replaced M. A. MacGregor as secretary of the committee. The Executive Committee includes:

Dr. J. D. MacLachlan - President, O. A. C.
G. N. Ruhnke - Director of Research
W. E. Tossell - Field Husbandry Department, Committee Chairman
- Chairman, Production Sub-Committee
C. G. E. Downing - Agricultural Engineering Department
- Chairman, Preservation Sub-Committee
G. E. Raithby - Animal Husbandry Department
- Chairman, Utilization Sub-Committee
H. D. Branion - Nutrition Department
- Chairman, Quality Assessment Sub-Committee
D. R. Campbell - Agricultural Economics Department
N. R. Richards - Soils Department
J. W. Garland - Agricultural Engineering Department, Secretary

The activities of the Executive Committee in 1954 were aimed mainly at the consolidation of the hay research. The first annual report (1953) was prepared and distributed to members of the committee in November, 1954. It was hoped that such reports would serve two purposes. First, a report would bring together and provide a permanent record of all the information collected in hay investigations at the O. A. C. Second, it would provide a convenient means through which research workers could keep up to date with the research in all phases of hay at the O. A. C.

A general meeting of the hay research committee was held on February 19, 1955. At this meeting the sub-committee chairmen presented brief reports on the activities of the four sub-committees in 1954. These sub-committee reports are included in the annual report.

Report Of The Sub-Committees

1. Production:

Seedling establishment is a major crop production problem in certain areas in Ontario. A number of studies have been initiated on various aspects of this problem. Application of nitrogen and phosphorus aided the establishment of alfalfa and brome grass. Studies on methods of seeding indicated that methods involving packing were superior on both medium and heavy soil in 1954. Antibiotic seed treatments using Aureomycin, Terramycin and Penicillin increased seedling vigor markedly in alfalfa and moderately in red clover in greenhouse studies but had no effect in field trials and these studies were discontinued. Seed treatment with fungicides gave variable results. Rate of seeding in alfalfa grown alone and in combination with brome grass or timothy had no effect on hay yields but did affect hay

quality in that higher plant populations resulted in finer hay.

A number of projects are under way to study the response of the hay crop to applied fertilizer materials, barnyard manure, lime and minor elements. The studies on commercial fertilizer and lime are being expanded to form major projects in the Soils Department. In these expanded studies response data will be collected on the hay crop as well as on other crops over a range of soils in different localities. In 1954 the yield of red clover hay was not increased by the application of five minor elements. Preliminary yields from the rotation studies suggest an interaction between rotations and fertility management.

An experiment was completed in which eight methods of primary tillage had no effect on hay yields. Further projects will be initiated on primary tillage but will not necessarily be related specifically to hay production.

A strain evaluation program in forage legumes and grasses provided the first comparisons in 1954. Several strains were superior to the common lots. A series of species and mixture evaluation and formulation trials was established at Guelph.

2. Preservation:

The cutting, drying, storage and removal from storage all fall under the general heading of preservation. Research work has been done on the drying problem.

In basic drying studies, the efficiency of use of heat depends on hay thickness, air temperature and air velocity. This type of fundamental research is continuing.

Mow air distribution tests using cold air drying units have shown that system design and loading of the mow are most important. In deep mows with chopped hay a modified flue system has given good results. This work is now complete.

Work has been started on a continuous type drier which uses supplemental heat in the drying process.

Sampling of hay to determine field losses has presented a problem, some progress was made in 1954 and will be repeated in 1955.

3. Utilization:

An experiment comparing the feeding value of barn cured, field cured-baled, field cured-loose, and field cured-chopped hay for dairy cattle was repeated in 1954. The four types of hay did not significantly affect milk production although small differences in consumption and milk production were found.

4. Quality Assessment:

Colour photography of hays, of various legumes and grass mixtures

cured by different methods, was attempted to prepare coloured charts which, together with average chemical analyses and carotene assays, could be used by the feeder as an indication of the feeding value of his particular hay. The results were not satisfactory. It was found that the photographing of hay in mows was of little value. The general project appears feasible, but samples of hay will have to be selected, or possibly "artifically" prepared.

The Effect Of The Operation Of Tillage Machinery On Soil And Crop Yields

Downing, C.G.E., Byers, G.L., Webber, L.R. (Ag. Eng. and Soils)

R.P.O. Number: Ag. Eng. 5 Year Initiated: 1949

Objectives: 1. To compare the effect on soil structure of various tillage implements.
2. To compare crop yields when these primary tillage implements are used.
3. To study the efficiency of operation and economics of using these machines either singly or in combination.

Procedure: This project was initiated in 1949 on both a loam and a clay soil. Soil building and soil depleting rotations were laid out using three replications of treatments in the longer rotations, two replications in the short rotations. Tillage treatments are as shown in Tables 1, 2, 3, 4. All tillage treatments were completed in the fall. Spring operations consisted of a limited amount of seedbed preparation with the disc harrow. The same for all treatments.

Size of Plot 20' x 86'
Sampling Method: - Two samples per plot = 30" x 20'

Results and Discussion: This project is now complete and results shown are the means of all yield data.

TABLE 1:- EFFECT OF TILLAGE TREATMENT ON YIELD OF HAY ON A LOAM SOIL WITH A FOUR YEAR ROTATION TONS/AC. 14% MOISTURE

Treatment	4 Yr. Rotation (poor)	4 Yr. Rotation (good)
Rotary Tillage:	2.34	1.26
Moldboard Plow:	1.99	1.22
One-Way Disc:	2.10	1.54
4 yr. Rotation (poor)	Hay, Corn, Corn, Oats	
4 yr. Rotation (good)	Hay, Wheat, Corn, Oats	

Statistical analysis showed no significance between treatments on either rotations. This was consistently the result during the four years of the rotation. However, the hay yields from the poor rotation were better

than those from the good rotation. It would appear that the two years of corn in the rotation was beneficial in preparing a more suitable seedbed for seedling germination. For all other crops the (good) rotation produced the higher yields.

TABLE 2:- EFFECT OF TILLAGE TREATMENT ON YIELD OF HAY ON A LOAM SOIL WITH A FIVE YEAR ROTATION TONS/AC. 14% MOISTURE

Treatment	1st Yr. Hay	2nd Yr. Hay	3rd Yr. Hay	Mean
Moldboard Plow	1.74	1.74	1.48	1.65
One-Way disc & disc plow	1.83	1.75	1.31	1.63
One-Way disc & Moldboard plow	1.66	1.64	1.37	1.56
T.N.T. Plow	1.49	1.73	1.40	1.54
Disc Plow	1.71	1.40	1.35	1.49
One-Way Disc	1.49	1.68	1.54	1.56
Rototiller	2.24	1.56	1.42	1.74
Cultivator	2.24	1.51	1.47	1.80
Mean	1.84	1.62	1.42	

Five Year Rotation - Corn, Oats, Hay, Hay, Hay

Statistical analysis showed no significance between treatments. However, plowing methods are more consistent in their yields and from observations made, the stand on these plots appeared to be of a better quality. Weed control on the rototiller and cultivator plots presented a problem.

TABLE 3:- EFFECT OF TILLAGE TREATMENT ON YIELD OF HAY ON A CLAY SOIL WITH A FOUR YEAR ROTATION TONS/AC. 14% MOISTURE

Treatment	
Moldboard Plow	1.88
Disc Plow	1.26
Rototiller	1.38
One-Way Disc	1.46

4 Yr. Rotation (Poor) Corn, Corn, Oats, Hay

TABLE 4:- EFFECT OF TILLAGE TREATMENT ON YIELD OF HAY ON A CLAY SOIL WITH A SIX YEAR ROTATION TONS/AC. 14% MOISTURE

Treatment	Hay Following Wheat	Hay Following Oats	Hay Following Hay	Mean
Rotovator	1.78	2.0	1.29	1.69
One-Way Disc & Moldboard Plow	1.75	1.60	1.37	1.57
Rototiller	1.69	1.77	1.45	1.63
Moldboard Plow	1.71	1.62	1.31	1.54
One-Way Disc	1.85	1.87	1.61	1.71
Disc Plow .	1.52	1.74	1.36	1.54
Mean	1.71	1.77	1.40	

6 Yr. Rotation Wheat, Hay, Corn, Oats, Hay, Hay

Statistical analysis of the six year rotation data indicated no significant difference between the tillage treatments. However, yields from both the hay following wheat and oat crops were significantly higher than the second year of hay yield.

Generally speaking, results from the experiments conducted on both soil types gave similar results. Yields where hay followed oats being higher than the hay yields following other crops. A general decline in yield is also indicated where hay follows hay. The primary tillage practice does not appear to materially effect the yield on either soil type. Mulch tillage practices produced (by weight) the higher yields.

Summary: This report traces the effect of some primary tillage practices on hay yields from 1950 to 1954. Data presented show little evidence of a primary tillage practice superior to the conventional moldboard plow. However, results indicate that we may be working our soil more than is necessary.

Effect Of Deep Tillage Machinery On Crop Yields On Haldimand Clay Soil

Byers, G.L. (Agricultural Engineering)

R.P.O. Number: Ag. Eng. 18 Year Initiated: 1952

Objectives: 1. To compare the effect on crop yields of two deep tillage implements.
2. To study the economics of using these implements.

Procedure: Field tests were commenced in 1952, using a randomized split-plot design with four replications. Three tillage treatments namely:

(a) Moldboard Plow, (b) Subsoiler, 26" deep, every 26" on the surface, followed by the moldboard plow, (c) Deep Tillage cultivator, operated to a depth of 10", were combined with three levels of fertility as follows:

1. High level - Lime - 4 tons/acre
   Superphosphate: 550 lbs./acre
   3-18-9 - 150 lbs./acre
   Ammonium Nitrate: 150 lbs./acre Spring Application
2. Low level: 3-18-9 - 150 lbs./acre
3. No Fertilizer:

A five year rotation of wheat, hay, hay, corn and oats was selected. Tillage plot size = 150' x 175' - sub-divided to provide for the three levels of fertility - 50' x 175'.

Plots were seeded down with grasses following the fall wheat planting using a Cultipacker Seeder: Legumes were broadcast in the Spring of 1953.

Results and Discussion: Hay yields were harvested during the first week of July 1954 by baling the entire plot yield and weighing. These results are shown in Table 1.

TABLE 1:- EFFECT OF TILLAGE TREATMENT ON YIELDS OF HAY TONS/AC. AT 14% MOISTURE

Fertility Level	Tillage Treatment			Mean
	A	B	C	
1	1.24	1.25	.94	1.14
2	.90	1.00	.89	.93
3	.71	.95	.99	.88
Mean	.95	1.06	.94	

No Significant Difference between tillage treatments.

L. S. D. for fertility levels 1% .213 5% .153

Statistical analysis showed no significance between tillage treatments. However, results from the fertility levels showed the high fertility treatment to produce yields highly significant over the plots which received no fertilizer and significantly better than those which received the low rate of fertilizer.

Although the result differences from the tillage treatment are not significant, yields on the sub-soiled plots were generally higher, being only slightly lower than the yields from the Deep Tillage Cultivator on the no fertility plots. This same general trend was established with the wheat crop harvested in 1953. It is interesting to note that, in so far as yield by weight is concerned, fertility levels seemed to have no effect on the hay on the Deep Tillage Cultivator plots. However, it was noted during the

growing season, that the high fertility plots had a much higher percentage of timothy than the other plots. Legumes predominated on the low and no fertility plots. This was generally true on all plots under all tillage treatments. It appeared that the heavier stand of wheat the previous year on the high fertility plots depressed the stand of legumes.

Summary: The data presented show evidence of subsoiling being beneficial on a heavy clay soil. However, further data are necessary to determine if such a practice is economical. Deep Tillage with a cultivator which leaves most of the crop residue on the surface has not as yet given satisfactory results, yields from this method of tillage being consistently lower than yields from the other tillage practices. However, other factors such as seed and fertilizer placement in the mulch will have to be evaluated before conclusions can be drawn.

Study Of The Interrelationship Of Fertility Levels And Cropping Systems On Soil Properties And Crop Yields

Ketcheson, J. W. (Soils)

R. P. O. Number: S. F. 74 Year Initiated: 1952

Objectives: To study the influence on soil productivity of various proportions of soil building to soil depleting crops under two different management practices.

Procedure: This project was started in 1952 and is to be continued for twelve years (1964). The five cropping systems to be compared are:

1. Six-year rotation with four years grass-legume sod.
2. Four-year rotation with two years grass-legume sod.
3. Six-year rotation with two years grass-legume sod.
4. Three-year rotation with one year grass-legume sod.
5. Continuous corn.

Each system will be used at two levels of management: (a) Minimum fertility level using residues only, and (b) Adequate fertility level according to soil tests, using commercial fertilizers in addition to residues.

This project is located on the S. A. E. Farm, Guelph. The design is fashioned after a rotation plan proposed by Dr. C. H. Goulden, Central Experimental Farm, Ottawa. Corn and hay are to be used as indicator crops. Plots are arranged to bring such crops from the various rotations adjacent in one block. The number of replications of the various systems varies from two for a six year rotation to twelve for continuous corn. Each crop of each system occurs each year.

Results and Discussion: Three years results for this study indicate that the corn and hay crops are responding to the higher fertility treatments on all rotations. In addition there is an indication that certain cropping systems decrease the yield of corn and hay to a greater extent than do others.

Moreover, the percentage decrease is greater under low fertility than under high fertility. These results suggest that some rotations have higher nutrient requirements than others. The yields are indicated in the accompanying table. Observations on the growth of the corn in the continuous corn system suggests that the main limitation to its growth is inadequate nitrogen.

TABLE 1:- YIELDS CORN AND HAY UNDER TWO MANAGEMENT PRACTICES - BUS. GRAIN PER ACRE OR TONS PER ACRE (15 percent moisture)

	High Fertility	Low Fertility
Corn following corn (continuous)	56.55	28.66
Corn following oats or hay	58.37	37.64
Percent reduction for continuous corn	3.12%	23.85%
Average Yield	57.46	33.15
Hay following hay (rotation)	2.48	1.96
Hay following oats following corn	1.80	0.94
Percent reduction for hay - oats - corn	27.41%	52.04%
Average Yield	2.14	1.45

Fertility Of Major Soil Types As Indicated By Response Of Crops To Applied Fertilizer Material

Sheard, R. W. (Soils)

R. P. O. Number: S. F. 22 Year Initiated: 1952

Objective: To determine fertility requirements of major Ontario soil types for various crops.

Procedure: Treatments are laid down on privately-owned farms in cooperation with the operator of the farm. Treatments are planned and applied by the Soils Department. Seeding and care of the crop was by the farmer as conditions require. The plot size was 10 feet by 20 feet. In 1954, phosphorus and potassium treatments were applied in the spring to red clover in a 3 x 3 factorial design with four replications. The phosphorus was applied as superphosphate (20%) at the rate of 0, 200 and 800 lbs. per acre. The potassium was applied as muriate of potash (60%) at 0, 100, and 400 lbs. per acre.

Results and Discussion: In this instance phosphorus gave a significant increase in the yield of hay on Otonabee loam but not on Darlington loam. Potassium did not increase the yield of red clover on either soil. The yields are given in Table 1.

TABLE 1:- AVERAGE YIELDS RED CLOVER IN TONS PER ACRE AT THREE LEVELS OF PHOSPHORUS AND POTASSIUM FERTILIZATION

Soil	Phosphorus Lbs. Super/ac.			Potassium Lbs. Muriate/ac.		
	0	200	800	0	100	400
	Yield	Increase	Increase	Yield	Increase	Increase
Otonabee Loam	1.88	+0.20	+0.35*	2.02	+0.06	+0.09
Darlington Loam	2.67	-0.05	-0.22*	2.54	+0.07	+0.04

* Significant at 5% level

Summary: This project is to continue with an N. P. K. factorial in which grass-legume hay will be seeded with oats at six locations. First and second year hay yields will be taken in 1956 and 1957 respectively.

Phosphorus And Potassium Response Of Burford Loam

Ketcheson, J. W. (Soils)

R. P. O. Number: S. F. 54 Year Initiated: 1951

Objectives: To determine the response obtainable with adequate levels of phosphorus and potassium in the presence of other nutrients on the growth in a rotation of crops including grass-legume hay.

Procedure: Complete N-P-K treatments are applied adjacent to either N P (for K response) or N K (for P response) in a "paired - plot" arrangement. Plots are .025 acres in size and the treatments are replicated four times. The soil is mapped as Burford loam and is located on the S. A. E. Farm at Guelph.

Results and Discussion: Grass - legume hay has responded each year to the complete treatment as compared to the N P plots, indicating a potassium response. The response to phosphorus is somewhat less. This behaviour corresponds to the soil nutrient levels as determined by rapid soil tests which indicate relatively high amounts of phosphorus and medium to low potassium. The yields for 1954 are given in Table 1.

TABLE 1:- YIELD GRASS - LEGUME HAY 1954 - AREA 5 - S. A. E. GUELPH

	Tons per Acre				
	Rep I	Rep II	Rep III	Rep IV	Average
Complete Trt	1.73	1.50	1.76	1.41	1.60
P omitted (adjacent plot)	1.50	1.11	1.76	1.59	1.49
Increased for P	.23	.39	0	.18	.11
Complete Trt	1.46	1.33	2.01	1.50	1.57
K omitted (adjacent plot)	1.24	1.22	1.30	1.13	1.22
Increase for K	.22	.11	.71	.37	.35

Use Of Various Phosphate Materials As Soil Treatments

Ketcheson, J. W. (Soils)

R. P. O. Number: S. F. 61 Year Initiated: 1951

Objective: To evaluate the use of various phosphorus supplying materials in a soil fertility programme.

Procedure: Rock phosphate from two sources (Florida and Africa) have been applied at rates of 1000 and 2000 lbs. per acre for a 3 year rotation of wheat and 2 years hay. The plots are approximately .05 acres each and each crop of each rotation appears each year. Superphosphate 20% is being used in comparison with the above materials at a maximum rate of 600 lbs. for the 3 year rotation, and is also being used as a starter treatment in combination with the rock phosphate. The treatments are used in a randomized block with two replications for each stage of the rotation. The soil is a Burford loam, near neutral in reaction, located on the S. A. E. Farm, Guelph.

Similar treatments have been applied to Haldimand clay at the Nie Farm south of Cayuga. However, three rates of rock phosphate and two rates of superphosphate have been used in addition to a no phosphorus treatment. All soil treatments have been applied both with and without a starter treatment of superphosphate with the seed at planting time. The plots are .002 acres in size and the treatments are used in a randomized split plot with starter treatment and no starter treatment as main treatments, and various kinds and rates of phosphate material as sub treatments. There are three replications for each phase of wheat, hay, corn rotation.

Results and Discussion: While hay yields were not taken in 1954, phosphorus treatments had not previously increased yield of dry matter at Guelph, and had not increased the phosphorus content of the red clover hay at Cayuga. It is planned to determine yield and phosphorus uptake for the treatments on these soils over a period of several years.

Lime Requirements On Lockport Clay Loam

Willis, A. L. (Soils)

R. P. O. Number: S. C. 34 Year Initiated: 1952

Objectives: The objective of this project is to study lime requirements of Lockport clay loam (pH 5.2) as reflected in crop growth, effect on pH and base saturation of the soil.

Procedure: This project was started in 1952 to continue for possibly three years (1955). Increments of dolomitic limestone were applied in the Spring of 1952 to small scale plots on a privately owned farm in Halton County. The treatments were replicated four times. Oats seeded to alfalfa and fertilizer were sown in the Spring of 1952.

Results and Discussion: While this project was inactive in 1954 in so far as acquiring yield data, effects of limestone treatments on soil reaction were obtained. The information collected was summarized in the Progress Report of Hay Investigations, 1953, page 9. The work is to be reorganized as a major project in the Department and hay yields will constitute part of the data to be collected.

Livestock Manure As A Soil Treatment

Ketcheson, J. W. (Soils)

R. P. O. Number: S. F. 73 Year Initiated: 1952

Objectives: To study the effect on soil productivity of various systems of applying livestock manure.

Procedure: A basic treatment of ten tons of manure is being applied either in a single application to one of the crops in a four year rotation of corn, oats, two years hay, or as split applications to combinations of two crops in the rotation. Treatments also vary as to the time of year applied. An untreated plot and a commercial fertilizer treated plot are also included.

The treatments are made on .04 acre plots in a randomized block design with three replications. Each phase of the rotation appears each year. Measurements consist at present of total yield of dry matter by the crops.

Results and Discussion: The yields secured in 1954 suggest that, with both corn and second year hay, the larger yield responses are obtained with treatments supplying manure immediately ahead of the crop. No evaluation of the combined effect of the response for the rotation will be made until the treatments have been in operation for a longer period.

Minor Element Studies

Willis, A. L. (Soils)

R. P. O. Number: S. C. 72 Year Initiated: 1953

Objectives: To study the minor element requirements of soils for growth of legume crops.

Procedure: Five minor elements (Mn, Zn, Cu, Mo, B) were added to 0.014 acre plots in a randomized block design with 2 replicates of each treatment. The plots were located on the S. A. E. farm, and were seeded to red clover hay in 1953. The five elements mentioned were applied at the following rates:

Copper	- 10	and	20	pounds	per acre
Manganese	- 40	"	80	"	"
Zinc	- 10	"	20	"	"
Boron	- 40	"	80	"	"
Molybdenum	- 1	"	2	"	"

In addition there were other plots receiving all five of the elements as well as plots receiving all but one element. In the latter case one of the five elements was omitted in turn.

Results and Discussion: Hay yields were taken on June 16, when the area was harvested. The yields, on the basis of 15 per cent moisture, are given in Table 1.

TABLE 1:- YIELD OF RED CLOVER HAY ON PLOTS TREATED WITH MINOR ELEMENTS

Treatment	Average Yield of 2 Replicates
All elements combined (at lower rate)	3331 pounds/ac.
-Mn (all elements except Mn)	3822 " "
Zn only at rate 1	3585 " "
Zn only at rate 2	3835 " "
Check	3375 " "
-B (all elements except B)	3862 " "
Cu only at rate 1	3490 " "
Cu only at rate 2	3315 " "
-Mo (all elements except Mo)	3367 " "
Mn only at rate 1	3420 " "
Mn only at rate 2	3417 " "
-Zn (all elements except Zn)	3165 " "
B only at rate 1	3297 " "
B only at rate 2	3490 " "
-Cu (all elements except Cu)	3692 " "
Mo only at rate 1	3387 " "
Mo only at rate 2	3610 " "

Summary: No significant increase is indicated for any treatment. Another area on the farm has been seeded to red clover with the hope of continuing the experiment in 1955.

Study Of Plant Root Feeding Zones And Their Modification Through Placement Of Applied Nutrients

Ketcheson, J. W. (Soils)

R. P. O. Number: S. F. 86 Year Initiated: 1953

Objectives: 1. To determine the extent of root feeding zones as they may vary between soils and with period of growth.
2. To determine the extent to which root feeding zones may require modification through nutrient additions to benefit the growth of plants.
3. To improve recommendations for soil management and fertilizer application.

Procedure: It is proposed to characterize feeding zones through the introduction of tagged nutrients and ascertaining their uptake by the various plants concerned. The effect of nutrient addition and placement will be determined by placing various nutrients in various positions in this zone.

Results and Discussion: To date, one project has been carried out in which alfalfa at nine lbs. per acre and brome at six lbs. per acre were seeded in drills seven inches apart. Muriate of potash at 200 lbs. K_2O/acre was used as a soil treatment broadcast on the surface, drilled in bands 5 inches deep, or banded one inch from the seed. Nitrogen phosphorus and potassium were drilled with the seed in a factorial arrangement on each of the heavy potassium soil treatments. The seed treatments were based on 400 lbs. 5-5-10 per acre.

Plant counts were made in the row on June 30 and indicated an average stand of five plants per foot of drill. While there were no significant differences between these treatments, possibly due to initially high nutrient levels in the soil, there was an indication that the combination of nitrogen and phosphorus with the seed gave a better establishment. It was also significant that 200 lbs. K_2O/acre banded near the seed did not seriously hinder germination and establishment.

Likewise, hay yields the following year did not reflect treatment effects although the potassium content of the hay was increased where potassium was applied. These figures are given in Tables 1 and 2.

TABLE 1:- YIELD ALFALFA-BROME--FERTILIZER PLACEMENT
S.A.E. - GUELPH - CUT June 28, 1954

	Lbs. per Plot (8 rows wide, 15 ft. long) Rep I	Rep II	Average
C-200 lbs. K_2O soil trt			
plus N seed trt	11.9	10.3	11.1
P " "	11.2	9.7	10.4
K " "	10.9	11.9	11.4
NP " "	11.1	7.6	9.3
NK " "	10.1	8.6	9.4
PK " "	10.6	9.5	10.1
NPK " "	9.3	10.7	10.0
O " "	8.8	10.7	9.7
D no soil trt			
N seed trt	6.9	8.1	7.5
P " "	8.0	8.1	8.1
K " "	10.5	9.9	10.2
NP " "	8.1	8.7	8.4
NK " "	6.7	10.3	8.5
PK " "	6.3	10.0	8.1
NPK " "	7.5	7.2	7.3
O " "	6.3	6.5	6.4

TABLE 2:- PERCENT POTASSIUM IN BROME-ALFALFA TISSUE
FERTILIZER PLACEMENT - S.A.E. GUELPH

	Rep I	Rep II	Average
C 200 lbs. K_2O soil trt			
plus no seed trt	1.44	1.46	1.45
40 lbs. K_2O seed trt	2.31	1.42	1.86
D no soil trt			
no seed trt	0.72	0.97	0.84
40 lbs. K_2O seed trt	1.02	1.08	1.05

Summary: The present study has not been carried on long enough to draw definite conclusions. The results indicated for the treatments used suggests however, that the work should be continued in greater detail.

Studies On The Operation Of Machines Used In The Preparation Of A Seedbed And In The Seeding Of Grasses And Legumes

Byers, G. L. and Fulkerson, R. S. (Ag. Engineering and Field Husbandry)

R. P. O. Number: Ag. Eng. 22 Year Initiated: 1953

Objectives: To investigate the ability of certain machines to place small seeds and the effect of the type of seedbed on this placement.

Procedure: No change from procedure as outlined in Progress Report No. I (1953). Sampling of plots completed on June 24/54. Size of sample taken, 25' long, 30" wide.

Seedbed Preparation

All plots were fall plowed and the following seedbed preparation methods applied in the Spring.

A. Disc Harrow
B. Spring Tooth Harrow
C. Rotary Tillage

Methods of Seeding Used

1. Single Disc Grain Drill: Brome and orchard grasses mixed with Oats. Remainder broadcast from the grass seed box. Followed by smoothing harrows.
2. Seeds placed as in (1) but followed by cultipacker.
3. All seeds (other than Oats) placed with a cultipacker seeder.

Results and Discussion: Hay yields were harvested on June 24/54 and are shown in Table 1.

TABLE 1:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON YIELDS OF HAY IN TONS/AC. (AT 14% MOISTURE)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	2.72	2.72	2.82	2.75
Grain Drill & Cultipacker	2.45	2.47	2.79	2.57
Cultipacker Seeder	2.24	2.51	2.49	2.41
Mean	2.47	2.56	2.70	

L. S. D. For Method of Seeding 5% Level = .237
L. S. D. For Interaction 1% Level = .56 5% Level = .41

Statistical analysis showed no significant difference between the total yields from the three methods of seedbed preparation. However, further analysis showed the method of seeding No. 1 to produce yields significantly better than method 3. No significance appeared between methods 1 & 2 or 2 & 3.

Further analysis also showed a significant interaction occurring. Method of Seeding 1 produced a yield highly significant over method of seeding 3 on the seedbed preparation method A. This same method of seeding also produced the higher yields on the other methods of seedbed preparation significantly higher than method of seeding 3 on Seedbed preparation A, but not significantly higher than the other methods of seeding on the remaining methods of seedbed preparation.

With reference to previous studies of this nature on this farm A. Eng. 11 & 12, their results showed the disc harrow and the cultipacker to be the better methods. Results from this experiment show a somewhat different trend, namely, no significance between seedbed preparation methods and the cultipacker to give the poorest results on all methods of seedbed preparation.

Plant Counts 1954

As two plot areas are laid out for this experiment, both one year old hay yields and new seedlings establishment plant counts are obtained in the same year.

Tables 2, 3, 4, 5, 6, 7, 8, 9 show the results of the plant counts taken in the fall of 1954. Four one foot square samples were taken from each plot.

TABLE 2:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON RED CLOVER COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	2.0	2.9	2.1	2.3
Grain Drill & Cultipacker	2.1	2.8	3.2	2.7
Cultipacker Seeder	0.8	0.6	0.8	0.7
Mean	1.6	2.1	2.0	

L. S. D. For Methods: 5% - 1.0 1% - 1.3

No significance between methods of Seedbed Preparation. Methods 1 & 2 highly significant over method 3.

TABLE 3:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON ALFALFA COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	4.0	6.1	3.5	4.6
Grain Drill & Cultipacker	7.7	8.3	7.2	7.7
Cultipacker Seeder	6.1	4.9	4.4	5.1
Mean	5.9	6.5	5.0	

L.S.D. For Methods of Seeding 5% = 2.2 plants per sq. ft.

No significance between methods of Seedbed Preparation. Method of Seeding 2 significantly better than Methods of Seeding 1 & 3.

TABLE 4:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON TOTAL LEGUME COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	6.1	9.1	5.6	6.9
Grain Drill & Cultipacker	9.7	11.2	10.4	10.4
Cultipacker Seeder	6.9	5.6	5.2	5.9
Mean	7.6	8.6	7.0	

L.S.D. For Methods of Seeding: 5% = 2.8 1% = 3.9

No significance between methods of Seedbed Preparation. Method of Seeding 2 highly significant over Method of Seeding 3 and significantly better than Method of Seeding 1.

TABLE 5:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON TIMOTHY COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	1.4	1.5	2.0	1.6
Grain Drill & Cultipacker	2.2	1.9	2.7	2.3
Cultipacker Seeder	1.0	0.5	0.9	0.8
Mean	1.5	1.3	1.9	

L.S.D. For Methods of Seeding 5% = 0.6 1% = 0.9

No significance between methods of Seedbed Preparation. Method of

Seeding 2 highly significant over Method of Seeding 3 and significantly better than Method of Seeding 1. Method of Seeding 1 significantly better than Method of Seeding 3.

TABLE 6:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON ORCHARD GRASS COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	3.8	1.9	2.1	2.6
Grain Drill & Cultipacker	3.8	2.9	3.0	3.2
Cultipacker Seeder	2.0	1.5	2.2	1.9
Mean	3.2	2.1	2.4	

No significance between methods of Seedbed Preparation or between Methods of Seeding.

TABLE 7:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON BROME GRASS COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	2.4	1.4	2.2	2.0
Grain Drill & Cultipacker	1.7	2.0	1.8	1.8
Cultipacker Seeder	0.8	1.0	0.2	0.7
Mean	1.6	1.4	1.4	

L.S.D. For Methods of Seeding 5% = 0.8 1% = 1.2

No significance between methods of Seedbed Preparation. Methods of Seeding 1 & 2 highly significant over Method of Seeding 3.

TABLE 8:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON TOTAL GRASS COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	7.6	4.8	6.3	6.3
Grain Drill & Cultipacker	7.7	6.8	7.5	7.3
Cultipacker Seeder	3.7	2.9	3.3	3.3
Mean	6.4	4.9	5.7	

L.S.D. For Methods of Seeding 5% = 1.9 1% = 2.7

No significance between methods of Seedbed Preparation. Methods of Seeding 1 & 2 highly significant over Method of Seeding 3.

TABLE 9:- EFFECT OF METHOD OF SEEDING AND SEEDBED PREPARATION ON TOTAL GRASS AND LEGUME COUNTS (PLANTS PER SQ. FT.)

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	13.7	13.9	11.9	13.1
Grain Drill & Cultipacker	17.4	18.0	17.8	17.8
Cultipacker Seeder	10.6	8.5	8.4	9.2
Mean	13.9	13.4	12.7	

L.S.D. For Methods of Seeding 5% = 4.1 1% = 5.7

No significance between methods of Seedbed Preparation. Method of Seeding 2 highly significant over Method of Seeding 3 and significantly better than Method of Seeding 1.

Discussion of Plant Count Results

With the exception of orchard grass, plant counts in 1954 compared favourably with those of 1953. The Grain Drill followed by the cultipacker giving the better seedling establishment. Packing following the drilling of Brome grass has not indicated a beneficial effect. With reference to Table 1. Hay yield results indicate that plant counts cannot be used as an indication of what the final yield (by weight) will be. Total plant counts in 1953 showed the cultipacker seeder to have the highest plant count, however, the final hay yield was significantly lower than the other two methods of Seeding.

Summary: Results obtained to date using three methods of seedbed preparation and three methods of seeding indicate that the method of seedbed preparation may not be as important as was originally expected. A trend has been established indicating the Conventional Grain Drill followed by a packer to be the better method of placing seeds on a loam soil.

Methods Of Seeding Alfalfa And Bromegrass

Fulkerson, R.S. and Byers, G.L. (Field Husbandry and Ag. Engineering)

R.P.O. Number: F.H. 33-7 Year Initiated: 1954

Objectives: The purpose of this study is to ascertain the effect of the following factors on the establishment of a mixture of alfalfa and bromegrass on a heavy clay soil.

1. A firm vs. a loose seed bed.
2. Different methods of seeding.

Procedure: The plot area at Brampton was a Haldimand clay soil that had been fall plowed and on which the seed beds were prepared in the following manner. Discing three times followed by harrowing was carried out on the loose seedbed, whereas the firm seedbed was prepared in the same manner with the addition of cultipacking followed by harrowing. All plots were 13' by 50', seeded May 20th, with oats at 2-1/2 bu., 4-24-12 fertilizer at 300 lbs. and a mixture of 10 lbs. alfalfa and 10 lbs. of bromegrass per acre, respectively.

Five core samples 3-1/2" in diameter and 4" deep were taken per plot for volume weight determinations as an index to the compactness of the various seeding methods. Six square foot plant counts were made per plot on September 20th as the establishment index.

Results and Discussion: The establishment of the alfalfa and brome seeding is given in Table 1. The stand is not high but satisfactory for alfalfa. Brome did not establish well. The low stand of both species in all plots was probably due to the extremely dry season. No differences in stand were obtained with either brome or alfalfa on firm vs. loose seed beds. The volume weight determinations on these seed beds were not significantly different nor was there a significant correlation between the volume weights and the stands of alfalfa obtained.

Significant differences in stand were obtained between methods of seeding with alfalfa. Packing after seeding was important and gave a higher stand of alfalfa than unpacked land. The band and Brillion seeders gave the poorest stands. With bromegrass the same general trend in establishment was present. The different methods of seeding, though not significant gave fewer brome plants per unit area with the band and Brillion seeders than the other methods used.

It is interesting to note the stand when expressed as a percentage of the number of seeds sown. This was calculated from the seed weight of the samples of alfalfa and bromegrass used. The percent establishment is low in both species, but much poorer in brome than alfalfa.

Summary: In 1954 there were no significant differences in the establishment of a mixture of alfalfa and bromegrass on a loose vs. a firm seed bed on Haldimand clay soil. Brome grass established poorly, alfalfa fair. Establishment practices involving packing after seeding gave significantly higher stands of alfalfa than methods that did not include this practice. The methods of seeding used had little effect on brome grass establishment. On the average, only 15 percent of the alfalfa and 4 percent of the brome grass seed sown, established.

TABLE 1:- ALFALFA AND BROME ESTABLISHMENT (PLANTS PER SQUARE FOOT) ON HALDIMAND CLAY SOIL AT BRAMPTON IN 1954

Method of Seeding	Alfalfa				Bromegrass				Volume weight (grams)**
	Loose	Firm	Mean	Mean in Percent*	Loose	Firm	Mean	Mean in Percent*	
Grain drill & harrow	8.7	7.6	8.1	16.1	1.4	1.6	1.5	4.8	2144
Grain drill & pack before	8.4	6.6	7.5	15.1	1.9	1.2	1.6	5.2	2053
Grain drill & pack after	9.7	8.8	9.3	18.7	1.6	1.4	1.5	4.8	2163
Grain drill & pack before & after	9.6	9.2	9.4	18.9	1.2	1.4	1.3	4.2	2132
Brillion seeder	5.5	6.5	6.0	12.0	1.0	0.8	0.9	2.9	2108
Band seeder	4.9	5.3	5.1	10.2	1.0	1.2	1.1	3.5	2106
Band seeder and pack	8.4	7.6	8.0	16.1	1.3	1.6	1.5	4.8	2082
Mean	7.9	7.4	7.6	15.3	1.4	1.3	1.3	4.2	2113
L.S.D. (0.05)			1.7				N.S.		N.S.
C.V.			21.5				42.8		6.1

* percentage of seeds sown which established seedlings.
** total of five, three inch cores four inches deep per plot.

Rate Of Seeding Alfalfa Alone And In Combination With Timothy Or Smooth Brome Grass

Tossell, W. E. (Field Husbandry)

R. P. O. Number: F. H. 33-4 Year Initiated: 1950

Objectives: Alfalfa is a valuable legume for hay-pasture mixtures in Ontario, especially for fields which are to remain in sod for several years. It has been commonly observed that even under satisfactory conditions of drainage, soil fertility and crop management, alfalfa stands thin out. One of the factors determining plant population is rate of seeding. These experiments were initiated to study the effect of seeding rate on plant establishment, plant survival, hay yield and hay quality in alfalfa grown alone and with timothy or brome grass.

Evidence is accumulating which indicates that brome is a good grass in a simple mixture with alfalfa for many farms in Ontario. Any further increase in the use of brome grass in hay-pasture mixtures will depend on its performance in comparison with timothy, the grass grown most commonly with alfalfa at present. These trials were designed to provide a comparison of timothy and brome grass in mixtures with alfalfa.

Procedure: The experiments were carried out on a Burford loam soil at Guelph from 1950 to 1954. The first seeding was made in May 1950 and involved five seeding rates of alfalfa grown alone, four seeding rates of alfalfa in a mixture with eight pounds of brome grass and three seeding rates of alfalfa with two pounds of timothy. The treatments were broadcast on plots 6 x 20 feet in size, oats were seeded at one bushel per acre as a companion crop and then the area was cultipacked. A randomized complete block design with four replications was used. Two crops of hay were removed in each of the three years following seeding. Because the general level of forage seedling establishment is so dependent on environmental conditions following seeding, an identical series was seeded in 1951. The only change in this series was that six replications were used in place of four.

Prior to and/or after each cutting treatment the alfalfa plants per square foot were counted using a 24" x 6" quadrat with six counts stratified throughout each plot. Botanical separations to measure the percentage of alfalfa in the alfalfa-grass mixtures were made in the hay cut each year in the 1951 seeding and in the second and third harvest years of the 1950 seeding. Separations on the second cut were made on selected seeding rates. Measurements were taken of the number of stems per plant, stem size and height of the alfalfa plants grown alone in 1951, the first harvest year of the 1950 seeding, to study the effect of seeding rate on these components of yield per acre. Fifteen plants were picked at random per plot. The number of stems was recorded for each plant and the diameter of one average stem per plant was measured six inches above the crown.

Results and Discussion: Plant Stands

The 1950 season was fair for establishment while the 1951 season was excellent for establishment as far as soil moisture was concerned. The stands were good in each year but the general level of establishment differed widely being 5.0 plants per square foot in the first harvest year from the 1950 seeding and 11.6 in the first harvest year of the 1951 seeding. These data are shown in Table 1. The three pound rate in the 1951 seeding provided as many plants per square foot as the 15 pound rate in the 1950 seeding.

TABLE 1:- NUMBER OF ALFALFA PLANTS PER SQUARE FOOT IN MAY AT GUELPH

Rate of seeding lbs. per acre		1950 Seeding			1951 Seeding			
		1951	1952	1953	1951+	1952	1953	1954
Alfalfa	3	2.8	2.6	2.3	8.2	7.6	3.7	4.8
	6	4.7	4.3	2.8	17.0	12.1	6.2	6.1
	9	5.9	5.3	3.2	25.0	15.7	6.8	6.0
	12	6.4	5.4	3.2	26.7	17.6	8.1	6.5
	15	7.5	6.8	4.1	36.2	20.7	8.6	7.0
Alfalfa-timothy	3-2*	3.4	3.1	2.4	8.4	5.3	4.5	4.7
	6-2	3.9	3.8	3.0	13.0	8.3	5.6	6.6
	9-2	5.6	4.2	3.1	19.3	10.8	6.3	6.5
Alfalfa-brome	3-8**	4.2	3.4	3.2	7.3	7.3	4.3	4.8
	6-8	4.3	3.7	2.2	14.1	8.8	6.1	6.1
	9-8	4.4	4.5	2.6	18.7	11.9	5.9	6.2
	12-8	7.0	6.4	3.3	28.1	13.0	5.9	6.6
Mean		5.0	4.4	2.9	19.1	11.6	6.0	6.0
L.S.D. (0.05)		1.9	1.3	1.0	4.9	2.3	1.1	1.5
C.V.		26.5	20.8	24.0	14.6	17.1	16.1	21.8
Mean of 3, 6 and 9 lb. rates								
Alfalfa		4.5	4.1	2.8	16.7	11.8	5.6	5.6
Alfalfa-timothy		4.3	3.7	2.8	13.6	8.1	5.5	5.9
Alfalfa-brome		4.3	3.9	2.7	13.4	9.3	5.4	5.7
L.S.D. (0.05)					2.3	1.3	0.6	0.9

* 3 lbs. alfalfa + 8 lbs. brome

** 3 lbs. alfalfa + 2 lbs. timothy

\+ July count in year of establishment

The relationship between seeding rate and plant stand is illustrated in Figure 1. In both seedings increases in seeding rate resulted in increases in seeding rate resulted in increases in plant stand. The response curve was studied in the pure stand alfalfa group in the first and third harvest years, this relationship was found to be linear in both tests. That is, the higher seeding rates established more plants and maintained a higher number throughout the three year period. Plant stands declined each year in both tests. The rate of decline was greater with increasing seeding rates as indicated by the decline in the slope of the response curve in succeeding years in Figure 1. Intraspecific competition is indicated.

The brome grass or timothy seedlings competing with the alfalfa seedlings in the 1951 trial lowered the establishment of alfalfa plants slightly. Stand counts in July 1951 indicated 12.5 brome grass and 19.8 timothy seedlings per square foot as a mean over the 3, 6 and 9 pound rates of seeding alfalfa. The presence of the grass seedlings reduced the number of alfalfa plants from 16.7 in the pure stand alfalfa to 13.4 and 13.6 in the alfalfa-brome and alfalfa-timothy mixtures respectively. This differential in alfalfa stand was maintained in the first harvest year but was not found in subsequent years. No similar interspecific competition was found in the 1950 seeding, possibly because the general level of establishment was much lower so that seedling competition may have been reduced. In general, the addition of brome grass or timothy had no serious effect on alfalfa plant establishment and survival. Fribourg and Kennedy (1) came to a similar conclusion regarding timothy.

The five alfalfa rates used had no effect on the seedling stand of brome grass or timothy.

Dry Matter Yields

The data on dry matter yield are summarized in Table 2. The differences in plant stands found in these studies were not reflected in dry matter yields. No difference was shown in the 1950 seeding in either hay or aftermath in any of the three years. In the 1951 seeding a treatment difference was found in one instance only, the first hay cut in 1952. These results are similar to those reported by Fribourg and Kennedy (1).

There was a tendency at the hay stage for the alfalfa-grass mixtures to yield slightly more than the pure stands of alfalfa in both tests and for the alfalfa-timothy mixtures to yield slightly more than the alfalfa-brome mixtures. The difference observed were not statistically significant in the 1950 seeding. In the 1951 seeding, alfalfa-timothy mixtures outyielded the alfalfa-brome mixtures and pure stand alfalfa at the hay stage but all three produced similar aftermath yields.

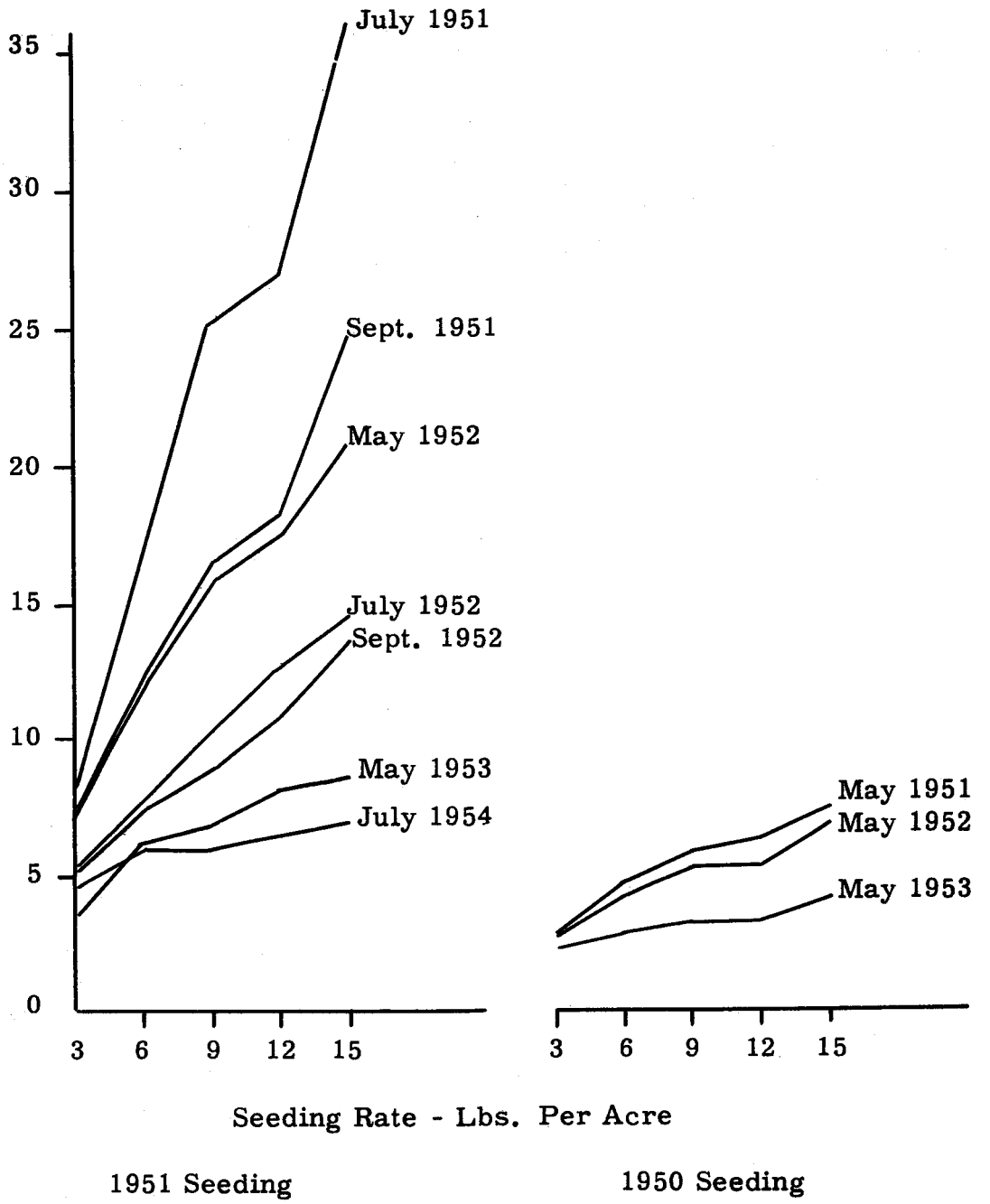

Figure 1. Plant stand in five rates of seeding alfalfa at intervals from seeding.

TABLE 2:- DRY MATTER PRODUCTION (HAY + AFTERMATH) IN TONS PER ACRE FROM THE ALFALFA AND ALFALFA-GRASS MIXTURES AT GUELPH

Rate of seeding lbs. per acre		1950 Seeding				1951 Seeding			
		1951	1952	1953	3 year average	1952	1953	1954	3 year average
Alfalfa	3	2.80	3.63	----	----	3.08	5.17	3.61	3.95
	6	2.99	3.43	----	----	2.94	5.36	3.82	4.04
	9	3.02	3.14	----	----	3.00	5.38	3.38	3.92
	12	2.88	3.02	----	----	3.04	5.06	3.66	3.92
	15	3.20	3.85	----	----	3.01	5.14	3.77	3.97
Alfalfa-timothy	3-2*	3.19	3.78	4.10	3.69	3.76	5.36	3.93	4.35
	6-2	2.92	3.45	3.57	3.31	3.12	5.22	4.13	4.16
	9-2	3.06	3.38	3.80	3.41	3.24	5.42	3.83	4.17
Alfalfa-brome	3-8**	2.90	3.59	3.65	3.38	3.07	4.97	3.76	3.93
	6-8	3.14	3.53	3.78	3.48	3.16	5.20	3.82	4.06
	9-8	3.06	3.32	3.39	3.26	3.32	5.14	3.81	4.09
	12-8	3.09	3.46	3.54	3.36	3.09	5.20	3.75	4.01
Mean		3.02	3.47	3.69	3.41	3.15	5.22	3.86	4.08
L.S.D. (0.05)		N.S.	N.S.	N.S.		0.35	N.S.	N.S.	
C.V.		8.9	10.6	11.9		9.7	6.0	10.6	
Mean of 3, 6 and 9 lb. rates									
Alfalfa		2.94	3.40	----	----	3.01	5.30	3.60	3.97
Alfalfa-timothy		3.06	3.54	3.82	3.47	3.37	5.33	3.96	4.22
Alfalfa-brome		3.03	3.48	3.61	3.37	3.18	5.10	3.80	4.03
L.S.D. (0.05)						0.27			

* 3 lbs. alfalfa + 2 lbs. timothy
** 3 lbs. alfalfa + 8 lbs. brome

Hay Quality

The botanical composition data are shown in Tables 3 and 4. Rate of seeding had no appreciable effect on the percentage of alfalfa in the mixture at the hay stage in June, and did not affect the amount of alfalfa in the aftermath in 1954. Brome grass was more competitive with alfalfa than timothy at the seeding rates used. In the 1951 seeding the alfalfa percentage was considerably lower in the alfalfa-brome mixtures and the decline in alfalfa percentage over the three year period was marked in brome mixtures.

From an inspection of the hay and aftermath herbage it was apparent that brome grass had reduced the vigor of the alfalfa slightly. Alfalfa percentage was higher in the brome mixtures in the 1950 seeding. The different levels of establishment in 1950 and 1951 could account for this difference in the relative effect of brome grass on alfalfa in the two seedings. The higher plant population of the 1951 seeding could have resulted in greater interspecific plant competition in the 1951 seeding. If this was the case, species differences in aggressiveness would show up in this seeding.

TABLE 3:- PERCENT ALFALFA IN THE ALFALFA-TIMOTHY AND ALFALFA-BROME MIXTURES AT THE HAY STAGE IN JUNE

Rate of seeding lbs. per acre	1950 Seeding			1951 Seeding			
	1952	1953	Mean	1952	1953	1954	Mean
Alfalfa-timothy 3-2*	51	41	46	77	81	67	75
6-2	52	41	47	73	84	77	78
9-2	60	38	49	71	72	60	68
Alfalfa-brome 3-8**	76	42	59	76	65	36	59
6-8	66	42	54	66	50	66	61
9-8	72	50	61	65	56	26	49
12-8	64	58	61	63	55	73	64
Mean of 3, 6 and 9 lb. rates							
Alfalfa-timothy	54	40	47	74	79	68	74
Alfalfa-brome	71	45	58	69	57	43	56

* 3 lbs. alfalfa with 2 lbs. timothy
** 3 lbs. alfalfa with 8 lbs. brome

TABLE 4:- PERCENT ALFALFA IN THE AFTERMATH OF THE ALFALFA-TIMOTHY AND ALFALFA-BROME MIXTURES IN THE 1951 SEEDING

Rate of seeding lbs. per acre	1952	1953	1954	Mean
Alfalfa-timothy 3-2*	--	--	82	
6-2	--	--	81	
9-2	96	90	82	89
Alfalfa-brome 3-8**	--	--	70	
6-8	--	--	70	
9-8	88	61	65	71
12-8	--	--	70	

* 3 lbs. alfalfa with 2 lbs. timothy
** 3 lbs. alfalfa with 8 lbs. brome

Although timothy and brome mixtures gave similar aftermath yields, the alfalfa-brome mixtures were the better balanced for pasture. The larger percentage of grass in the brome mixtures would aid in reducing the danger of bloat in alfalfa aftermath pastures.

Samples from the 9 pound rate of seeding were analyzed for crude protein percentage in 1954 by the Nutrition Department. The results are as follows:

	% Crude Protein
Alfalfa	18.7
Alfalfa + timothy	17.6
Alfalfa + brome	14.5
Brome	9.4
Timothy	8.8

Brome grass was higher in crude protein than timothy but the alfalfa-timothy mixture was higher than the alfalfa-brome mixture because of the higher percentage(60 vs. 26) of alfalfa in the mixture.

In 1951 three attributes of yield-number of stems per plant, stem size, and height were studied in pure stand alfalfa to assess the effect of rate of seeding on hay quality.

TABLE 5:- MEASUREMENTS ON PLANT DEVELOPMENT TAKEN ON ALFALFA PLANTS AT THE HAY STAGE IN 1951 (1950 SEEDING)

Rate of seeding alfalfa lbs. per acre	Alfalfa Plants per sq. foot	No. stems per plant		Stem size in mms.		Height in inches	
		Hay	After	Hay	After	Hay	After
3	2.8	10.9	9.2	3.3	2.1	30.0	33.4
6	4.7	7.0	8.7	3.4	2.0	30.8	34.5
9	5.9	6.6	7.7	3.2	2.0	31.8	32.8
12	6.4	6.2	7.3	2.7	2.1	31.2	31.6
15	7.5	8.0	7.5	2.6	2.1	30.0	31.5
Mean	5.4	7.7	8.1	3.0	2.1	30.8	32.8
L.S.D. (0.05)	1.9	N.S.	1.3	0.3	N.S.	N.S.	1.5
C.V.	26.5	36.1	10.5	6.7	4.8	3.5	3.0

Plant height was not affected by seeding rate. Number of stems and stem size decreased in a linear manner with increased rates of seeding. The greater number of stems per plant at low seeding rates would at least partially explain the fact that no yield differences were found even though plant stands were different. Smaller size of stem at the higher seeding rates indicates a finer type of hay. Hence, although seeding rate within the range used in this study, did not greatly influence yield, it did have an effect on hay quality.

Summary: A study was initiated in 1950 to study the effect of seeding rate on yield and hay quality of alfalfa grown alone and in mixtures with timothy and brome grass. The study was completed in 1954. Plant stands responded in a linear manner to increases in seeding rate. Stands declined over the three year period, and the percentage decline was most rapid in high plant populations.

Seeding rate had no appreciable effect on dry matter yields or on the amount of alfalfa in the hay, but affected hay quality in that plants in the high populations had smaller stem size, hence produced a finer type of hay. Considering stand assurance, hay yield and hay quality on intermediate rates of approximately 9 pounds or slightly higher would be satisfactory for alfalfa in simple mixtures with brome grass or timothy.

Timothy-alfalfa mixtures outyielded brome-alfalfa mixtures slightly and contained a higher percentage of alfalfa, but were less satisfactory at the aftermath stage in that the brome grass mixtures contained a higher percentage of grass, a desirable feature in the aftermath. More information is needed comparing these two grasses.

References:

1. Fribourg, H.A. and W.K. Kennedy. The effect of rates of seeding on the yield and survival of alfalfa in meadow mixtures. Agron. Jour. 45: 251-257. 1953.

The Effect Of Seed Treatment With Fungicides On Seedling Establishment

Fulkerson, R.S. (Field Husbandry)

R.P.O. Number: F.H. 33-1 Year Initiated: 1949

Objectives: This study has been carried on to evaluate the usefulness of fungicide seed treatments in the establishment of forage species.

Procedure: The methods followed in 1954 were similar to those in previous reports. Fungicide seed treatment studies on alfalfa and red clover were conducted in field experiments at O.A.C. and the Barrie area.

Results and Discussion: The data in Table 1 show that treatment with some fungicides significantly increased the initial stand establishment with alfalfa and red clover at Barrie. However, as the summer progressed these differences became much smaller and the final count taken at the end of September showed no significant difference between the establishment obtained from treated and untreated seed.

A similar test seeded at Guelph in the early spring failed to establish uniformily and was discarded. A second test seeded on July 12 and counted on September 2, showed highly significant increases with alfalfa and insignificant increases in stand with red clover from fungicidal seed treatments. In all tests the treatment using Leytosan P in excess amounts

tended to five superior stands over the other treatments.

In acre drill strips in a field at Barrie, fungicide treatment seemed to have little effect on the number of plants established (Table 2). Leytosan P tended to increase the number of alfalfa plants on July 1 and this treatment also seemed to have more plants per square foot in the fall. With red clover, however, little differences in establishment could be observed. The two year summary of the red clover results obtained at Guelph and Barrie is given in Table 3. Seed treated with Leytosan P established well at both locations in each of the two years.

Summary: Fungicide seed treatments in the Barrie area increased the stand of alfalfa in field studies by July 1 but had little effect on the final stand on September 28 in 1954. With red clover, the fungicides had little effect on establishment at both Barrie and Guelph in 1954 but gave highly significant increases in establishment in 1953 at both locations.

TABLE 1:- THE EFFECT OF FUNGICIDE SEED TREATMENT ON ESTABLISHMENT PLANTS PER SQUARE FOOT, 1954

	BARRIE						GUELPH	
	Alfalfa			Red Clover			Alfalfa	Red Clover
	July 1	July 29	Sept. 28	July 1	July 29	Sept. 28	Sept. 2	Sept. 2
Leytosan P .5%	26.2	23.2	19.8	23.5	23.8	21.0	28.2	31.8
Arasan	20.7	21.6	20.6	34.3	23.0	20.8	28.6	29.6
Phygon	22.5	23.1	19.2	24.2	25.8	23.8	30.4	31.6
Ceresan M	24.2	19.3	19.8	25.3	26.0	21.4	26.2	26.8
Leytosan Ex	29.7	31.4	22.7	23.6	24.4	21.4	35.4	32.7
Check	18.8	22.6	20.8	22.2	25.3	20.6	25.6	26.9
L.S.D. (0.05)	5.2	5.0		7.5			4.0	
C.V.	14.7	14.2	24.8	19.5	14.0	26.0	11.2	13.9

TABLE 2:- FUNGICIDE TREATMENTS IN DRILL STRIPS PLANTS PER SQUARE FOOT AT BARRIE, 1954

Fungicide	July 1		Sept. 28	
	Alfalfa	Red Clover	Alfalfa	Red Clover
Arasan	8.0	4.7	6.8	4.8
Leytosan P	12.0	4.0	9.3	3.5
Phygon	10.4	4.8	8.7	3.5
Check	9.6	3.1	7.8	3.3

TABLE 3:- TWO YEAR SUMMARY OF THE EFFECT OF FUNGICIDES ON RED CLOVER ESTABLISHMENT

Fungicide	Barrie			Guelph		
	1954	1953	Mean	1954	1953	Mean
Leytosan P	23.5	47.6	35.5	31.8	40.7	36.2
Arasan	34.3	47.6	40.9	29.6	31.4	30.5
Phygon	24.2	31.0	27.6	31.6	31.2	31.4
Ceresan M.	25.3	41.6	33.4	26.8	31.6	29.2
Leytosan P Ex	23.6	45.2	34.4	32.7	36.8	34.7
Check	22.2	33.2	27.2	26.9	27.8	27.3
L.S.D. (0.05)	7.5	9.3		N.S.	6.3	
C.V.	19.5	15.0		13.9	12.6	

Seed Treatment Of Forage Legumes And Grasses With Three Antibiotics

Fulkerson, R.S. and Tossell, W.E. (Field Husbandry)

R.P.O. Number: F.H. 33-2 Year Initiated: 1953

Objectives: These studies were initiated to evaluate three antibiotics - aureomycin, penicillin and terramycin, as seed treatments to aid seedling establishment in forage legumes and grasses.

Procedure: Aureomycin, penicillin and terramycin were applied as seed treatments to alfalfa, red clover, timothy, brome grass and reed canary grass in greenhouse and field studies. The antibiotics were applied at the rate of 1/32, 1/8, 1/2 and 2 gms. per bushel of seed. Solutions or suspensions of the antibiotic were made using distilled water and diluted so that one cc. of the material on one oz. of seed gave the required application. After treatment the seed was dried, and planted immediately in all green-

house studies and planted the following day in field trials.

Greenhouse studies were conducted with alfalfa, red clover and timothy in 1953 using Haldimand clay soil. The alfalfa series was replanted on a Guelph loam soil in 1954. An experimental unit in the greenhouse consisted of 100 seeds planted at a depth of 3/4 inches in a 4 inch clay pot. In 1953 alfalfa, red clover, brome grass and reed canary grass were grown in field trials at Guelph. In these studies, 100 seeds were placed at a depth of 3/4 inches in a 2-1/2 foot row. Four replications were used in all trials. Plant stands were taken at 2 to 4 weeks from planting. Vigor indices by scores, plant weights or heights were recorded at 10 to 16 weeks after seeding. The data on stand counts were transformed for analysis but the actual percentage data are reported.

Results and Discussion: Alfalfa

Treatment with antibiotics had no effect on number of seedlings established as shown in Tables 1 and 2. Striking effects were observed in seedling vigor in both greenhouse trials. Figure 1 shows the increase in vigor resulting from treatment in 1953 and Table 1 lists the height data from the 1954 greenhouse trial. All three antibiotics were effective in increasing vigor in both trials and in each case aureomycin and terramycin were equally effective. Penicillin was nearly as effective as these in the 1953 trial but only one-half as effective in increasing vigor in the 1954 study. In 1954 the mean seedling height for check, aureomycin, terramycin and penicillin was 10.6, 21.9, 20.6 and 14.9 gms. respectively.

In both years the medium concentrations gave the greatest response as indicated in Figure 2 and Table 1. No phytotaxic effects were observed at the high rates. Although the stimulation of seedling growth was striking in the greenhouse no such effects were detected in the three field trials.

Red Clover

The data in Table 3 indicate that the antibiotics did not affect plant stands. An increase in seedling vigor was observed in the greenhouse trial but, as shown in Figure 1, the increase was not as marked as in alfalfa. The response was similar at the 1/32, 1/8 and 1/2 gm. rates and superior to the check. At the 2 gm. rate the seedling vigor was similar to that in the check for terramycin and penicillin and slightly better than the check for aureomycin. In a subsequent test using rates of 4 and 8 grams of each antibiotic a depressing effect on growth was observed. In most cases the leaves were smaller, curled and slightly chlorotic, but plant stands were not reduced. No effects on plant stand or vigor were found in the row and plantings in the field.

Grasses

The results of studies with grasses are summarized in Table 4. Anti-

TABLE 1:- RESPONSE OF ALFALFA TO SEED TREATMENT WITH ANTIBIOTICS IN GREENHOUSE STUDIES

Gms. Antibiotic per Bushel of Seed	Percent Stand*		Seedling Height at 16 weeks, 1954	
	1953	1954	Cms.	Percent of Check
Aureomycin 1/32	60.9	59.5	15.5	146
1/8	58.2	60.7	24.1	227
1/2	63.8	69.4	24.5	231
2	60.1	59.7	19.6	185
Terramycin 1/32	63.3	61.7	15.0	142
1/8	65.8	64.3	24.1	227
1/2	62.3	62.6	24.6	232
2	56.1	66.1	18.6	175
Penicillin 1/32	58.8	69.0	10.6	100
1/8	57.0	56.6	16.9	159
1/2	62.3	64.1	18.6	175
2	65.3	68.7	11.6	109
Check	61.4	70.8	10.6	100
L.S.D. (0.05)	N.S.	N.S.	3.2	
(0.01)	----	----	4.3	
C.V.	10.0	10.5	12.4	

* stand at 8 and 6 weeks in 1953 and 1954 respectively

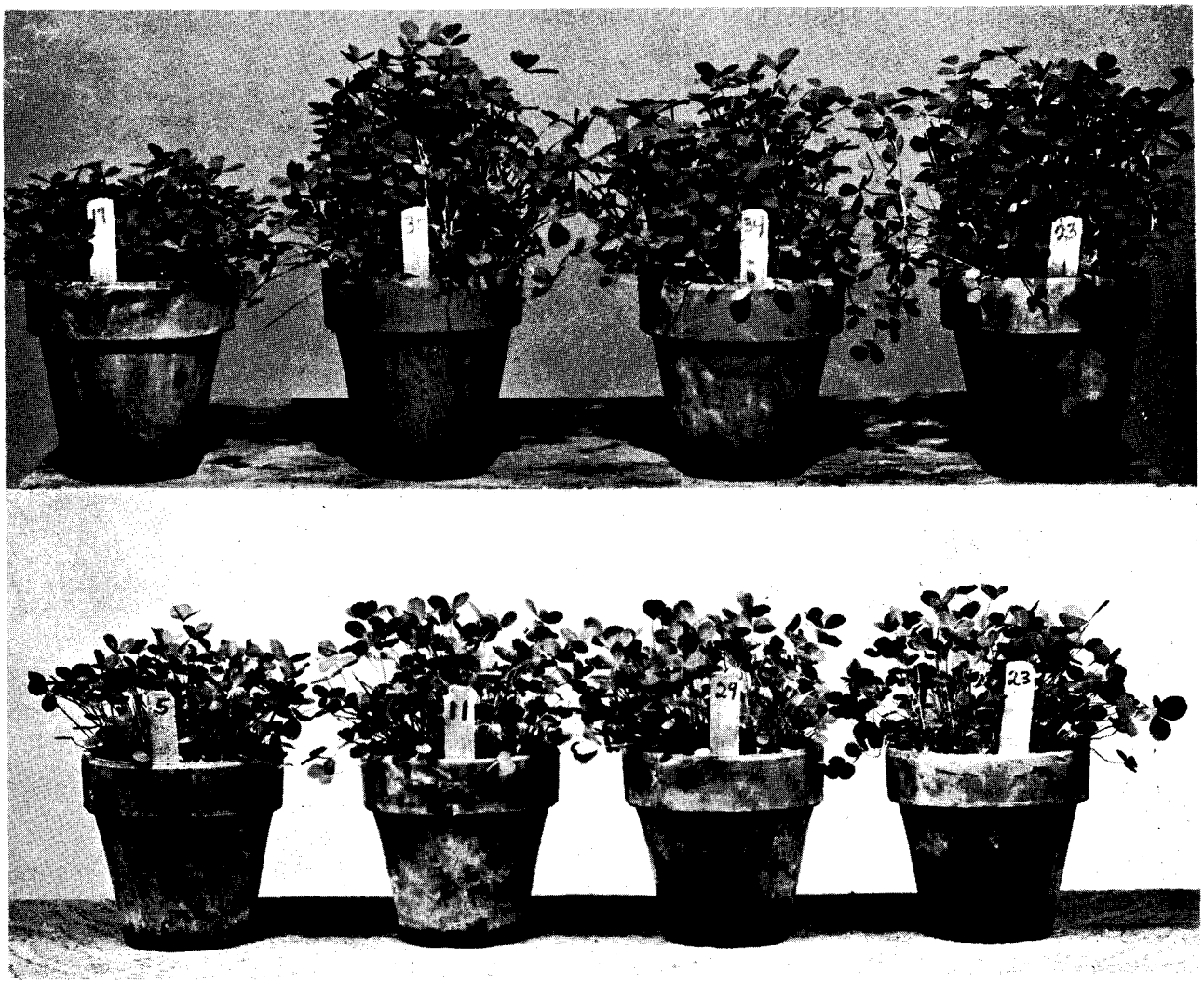

FIGURE 1:- Comparison of the response of alfalfa and red clover to seed treatment with antibiotics at 10 weeks from seeding in 1953. The most effective rate in each antibiotic is shown along with the check.

Top: Alfalfa, left to right, check, aureomycin 1/2, penicillin 1/2 and terramycin 1/8 gms.

Bottom: Red clover, left to right, check, aureomycin 1/2, penicillin 1/8, and terramycin 1/32 gms.

FIGURE 2:- Effect of aureomycin (top), terramycin (centre) and penicillin (bottom) on vigor of alfalfa seedlings at 10 weeks from seeding in 1953. From left to right in each group, check, 1/32, 1/8, 1/2 and 2 gms. antibiotics.

TABLE 2:- RESPONSE OF ALFALFA TO SEED TREATMENTS WITH ANTIBIOTICS IN FIELD PLANTINGS AT GUELPH IN 1953

Gms. Antibiotic per bushel of seed	Row Plantings			Broadcast planting May	
	May Seeding	August Seeding			
	% Stand at 5 weeks	% Stand at 4 weeks	Vigor*	No. plants per sq. foot at 5 weeks	Dry Weight 25 plants at 8 weeks
Aureomycin 1/32	29.7	47.4	2.3		
1/8	21.0	42.2	2.5		
1/2	27.6	46.2	2.5	25.4	74.2
2	31.7	39.4	2.5		
Terramycin 1/32	24.6	42.9	1.5		
1/8	37.1	40.3	1.8		
1/2	30.1	47.2	2.8	28.8	79.2
2	31.3	46.0	2.8		
Penicillin 1/32	35.5	33.5	2.8		
1/8	28.4	46.2	2.8		
1/2	25.1	45.8	2.5	24.9	84.0
2	25.3	44.4	2.0		
Check	27.6	47.4	2.8	24.0	82.5
L.S.D. (0.05)	N.S.	N.S.		N.S.	N.S.
C.V.	17.5	12.2		8.3	10.7

* vigor index 1 (good) to 5 (poor) at 9 weeks

TABLE 3:- RESPONSE OF RED CLOVER TO SEED TREATMENT WITH ANTIBIOTICS IN GREENHOUSE AND FIELD TRIALS AT GUELPH IN 1953

Gms. Antibiotic per bushel of seed	Greenhouse	Field row planting			Field broadcast planting	
	% stand at 8 weeks	May seeding % stand*	August seeding % stand*	August seeding vigor+	Plants per sq. foot at 5 weeks	Dry Weight of 25 plants at 8 weeks
Aureomycin 1/32	60.4	33.5	15.1	3.8		
1/8	64.3	35.0	15.5	2.8		
1/2	60.7	39.3	18.7	3.0	39.7	55.2
2	63.8	41.8	26.4	2.8		
Terramycin 1/32	64.3	44.6	14.3	3.5		
1/8	65.1	44.4	26.7	2.5		
1/2	65.1	43.7	25.8	2.5	35.2	56.2
2	64.5	38.4	20.1	3.2		
Penicillin 1/32	60.1	37.6	20.9	3.0		
1/8	57.3	35.0	19.4	3.2		
1/2	57.1	53.0	25.8	3.2	39.7	55.0
2	70.2	43.9	23.2	3.0		
Check	61.6	38.1	13.3	3.2	37.2	57.8
L.S.D. (0.05)	N.S.	N.S.	N.S.		N.S.	N.S.
C.V.	6.1	12.4	20.1		18.0	14.9

* stand counts at 5 and 4 weeks for May and August seeding respectively

+ vigor index 1 (good) to 5 (poor) at 9 weeks

TABLE 4:- RESPONSE OF GRASSES TO SEED TREATMENT WITH ANTIBIOTICS IN GREENHOUSE AND FIELD PLANTING AT GUELPH IN 1953

Gms. of Antibiotic per bushel of seed	Greenhouse	Field Row Plantings*					
	Timothy	Bromegrass I		Bromegrass II		Reed Canary Grass	
	Percent stand at 7 weeks	Percent stand	Dry Weight 25 plants	Percent stand	Dry Weight 25 plants	Percent stand	Dry Weight 25 plants
Aureomycin 1/32	94.5	68.9	6.44	55.6	4.82	51.7	6.04
1/8	90.2	62.9	5.97	52.4	6.35	49.7	5.09
1/2	93.2	61.6	8.74	55.2	6.36	47.7	7.04
2	90.2	60.0	7.65	46.3	5.24	50.5	5.36
4	----	67.4	6.10	55.6	5.24	47.6	5.66
Terramycin 1/32	92.2	48.6	7.49	61.6	5.32	44.4	5.62
1/8	89.6	57.9	6.36	61.6	4.74	51.4	5.54
1/2	87.6	61.6	7.58	54.4	5.13	47.2	5.90
2	83.1	55.7	6.52	44.4	4.85	39.4	5.78
4	----	48.6	6.60	44.6	4.76	47.4	5.92
Penicillin 1/32	92.6	67.1	6.32	61.7	6.31	51.4	5.37
1/8	80.1	65.9	7.98	49.3	5.94	49.5	5.30
1/2	89.6	61.1	6.68	52.3	5.30	46.0	6.02
2	90.8	59.9	8.97	49.6	5.22	43.9	8.06
4	----	67.3	7.25	58.3	5.42	52.6	6.57
Check	93.4	66.1	7.50	47.7	5.40	50.5	5.48
L.S.D. (0.05)	N.S.	Sig.	N.S.	Sig.	N.S.	N.S.	N.S.
C.V.	8.2	9.4	21.6	10.4	22.2	14.4	24.1

* stand counts at 2 weeks and dry weight measurements at 6 weeks

biotic seed treatments had no effect on the stand or seedling vigor of timothy grown in the greenhouse in 1953. Since more difficulty is experienced in obtaining satisfactory stands of brome grass and reed canary grass these grasses were used in the field trials. In addition one higher rate, 4 gms. per bushel, was included to widen the range of concentrations tested. In general, there was no response to treatment although differences were found in plant counts in each of the two brome grass tests. These differences were variable and of questionable significance. In the first trial, the 1/32 and 4 gram rates in terramycin gave lower stands than the check but no treatment increased stands. In the second trial, three treatments, terramycin 1/32 and 1/8 and penicillin 1/32 gave higher stands than the check, while stand counts were similar in other treatments.

Vigor differences were not detected in the three field trials. However, an average over the three tests gives 6.45, 6.14, 5.87 and 6.13 gms. dry matter for penicillin, aureomycin, terramycin and check respectively. This suggests that penicillin may have slightly increased and terramycin slightly decreased vigor. Such differences are small, and of little practical importance.

Summary: Aureomycin, penicillin and terramycin were applied as seed treatments at several concentrations to five forage species. All three antibiotics stimulated seedling growth markedly in alfalfa, moderately in red clover and not at all in timothy in greenhouse trials. No stimulation was detected in field trials with alfalfa, red clover, brome grass and reed canary grass. The antibiotics had no effect on the number of seedlings established except in brome grass where small variable differences were obtained. In these experiments seed treatment of these five forage species with these antibiotics was not beneficial.

The Effect Of Rate Of Seeding And Row Spacing Of An Oat Companion Crop Upon Forage Seeding Establishment

Fulkerson, R.S. (Field Husbandry)

R.P.O. Number: F.H. 34-3 Year Initiated: 1953

Objectives: This study has been undertaken to ascertain the effect of oat seeding rates upon the establishment of grasses and legumes. It should be possible from the data collected to select the rate of seeding and row spacing for the most satisfactory establishment of grasses and legumes.

Procedure: Simcoe oats were seeded with a Planet Jr. in plots 6' by 20' at rates varying at 1/2 bu. intervals from 1/2 to 4 bu. per acre in 7" drills and 1/2 to 2 bu. per acre in 14" drills. These plots were overseeded with a hay-pasture mixture composed of alfalfa 6, red clover 4, timothy 2, orchard 3, brome 5. The plots were not harrowed or packed due to several days of heavy spring rains after seeding. The test was seeded on May 14,

alfalfa plant heights taken on July 23, oats harvested on August 9, and stand counts made on September 8.

Results and Discussion: The growing season in 1954 was not good. The spring planting was late, cold and wet. The summer was extremely dry and cool. These weather conditions were probably the main reasons for the high variability obtained in the stand counts. Yield and stand data are given in the table.

The yield of oats in 7" drills increased with an increase in seeding rate to 1-1/2 bu. per acre. Further increases beyond this seeding rate had little effect on yield. In the 14" drills, increasing the seeding rate increased the yield of oats with the heavy seeding rate giving a very favourable yield of grain.

In establishment, only with red clover were there significant differences in stand caused by rates of seeding. These differences were present in both the 7" and 14" drill widths. In all species however, the stands tended to decrease as the seeding rate of oats increased in the 7" drills. In the 14" drills, the establishment increased with the seeding rate of oats to the 1-1/2 bu. level, above which increasing the seeding rate seemed to depress the establishment of all species except bromegrass.

On July 23, ten alfalfa plants were measured per plot as an index to seedling vigor under the various seeding rates of oats. This data, given in the table, show that as the seeding rate increased, the plant heights significantly decreased in the 7" drills. This however, was not the case in the 14" drills where a uniform plant height was obtained. The seedlings growing in the wide drills were also observed to be more sturdy and vigorous than those in the 7" drills.

The interaction of seeding rates X row spacings was significant only in the oat yield data.

Summary: Seeding oats at different rates had a significant effect on the yield of grain obtained. A maximum seeding rate for oats was obtained in 7" drills but not in 14" drills. Alfalfa, red clover, timothy, orchard and brome were established under the oats seeded at the various rates and spacings, but significant differences in stand were not obtained with any species. There was a definite trend in all species however, to give poorer establishment as the seeding rate increased. Seeding down without a companion crop gave about the same grass-legume establishment as when a light seeding rate of oats was used.

TABLE 1:- EFFECT OF SEEDING RATE OF OATS ON OAT YIELD AND FORAGE ESTABLISHMENT IN PLANTS PER SQUARE FOOT - 1954

Rate of Seeding	Oat Yields Bus./acre	Legume Stand and Vigor				Grass Stand				Total Stand
		Alfalfa Stand	Alfalfa Heights Cms.	Red Clover Stand	Total Legume Stand	Timothy	Orchard	Brome	Total Grass	
7" Drills 0	----	14.4	----	6.9	21.2	3.7	10.4	3.8	17.9	39.2
1/2	48.9	12.9	26.3	4.9	19.3	3.9	12.3	3.8	20.0	39.3
1	60.2	15.0	25.8	4.7	17.6	4.2	11.6	2.9	18.8	36.4
1-1/2	67.9	14.1	21.3	4.3	19.4	3.1	9.0	2.8	14.9	34.3
2	64.5	14.0	22.2	4.7	18.8	3.0	10.2	2.7	16.0	34.8
2-1/2	67.8	13.4	19.7	3.7	17.6	2.4	10.6	3.5	16.5	34.1
3	65.7	11.2	20.8	3.3	16.8	3.5	10.2	3.3	17.1	33.9
3-1/2	65.0	12.2	20.8	2.8	14.0	2.5	7.6	2.7	12.8	26.9
4	67.5	14.4	19.5	3.5	15.7	3.3	10.0	2.6	15.9	31.5
L.S.D. (0.05)	8.2	N.S.	3.2	1.3	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C.V.	11.1	25.2	12.2	39.5	26.5	41.2	33.5	38.7	31.2	26.3
14" Drills 1/2	44.3	14.0	24.5	4.9	18.9	3.5	12.2	3.0	18.8	37.7
1	52.3	14.9	23.6	4.6	19.5	4.5	11.9	3.2	19.6	39.1
1-1/2	57.1	15.8	25.0	6.0	21.8	4.3	11.7	3.4	19.4	41.2
2	60.5	12.7	24.5	3.7	16.4	3.2	10.5	3.5	17.2	33.6
L.S.D. (0.05)	3.7	N.S.	N.S.	1.0	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C.V.	5.6	24.6	9.1	23.4	22.4	44.0	23.4	34.0	24.8	20.2
Interaction-Rates and Spacings	**	----	----	----	----	----	----	----	----	----
Mean over 1/2 through 2 bu. rates										
7" drills	60.4	14.1	23.9	4.6	18.8	3.6	10.8	3.1	17.4	36.2
14" drills	53.6	14.4	24.4	4.8	19.1	3.9	11.6	3.3	18.8	37.9

** highly significant

Evaluation Of Species And Mixtures Of Grasses And Legumes For Hay

Tossell, W. E. and Motzok, I. (Field Husbandry and Nutrition)

R. P. O. Number: F. H. 29-1 and Nutrition 4-1 Year Initiated: 1950

Objectives: 1. To evaluate 5 grasses and 3 legumes as components of hay-pasture mixtures.
2. To compare pure stands, simple mixtures, and complex mixtures.
Consideration is given to D. M. yield, seasonal distribution of production, hay and aftermath pasture quality, and effect on the succeeding crops.

Procedure: The grasses, legumes and mixtures used were seeded in a randomized block design at Guelph in 1950. A crop of hay was removed at the regular hay stage, then two aftermath clippings were taken in each of the 3 years to simulate aftermath grazing management.

Results and Discussion: The data have been collected but have not been completely summarized.

Summary: The summary to date is in the Progress Report of Hay Investigations, 1953, pp. 35 - 39.

The Productivity And Longevity Of Alfalfa As Related To Management

Twamley, B. E. and Tossell, W. E. (Field Husbandry)

R. P. O. Number: F. H. 29-2 Year Initiated: 1954

Objectives: It is known that Ontario hay and pasture fields deteriorate in value through continuous reduction in the legume fraction. Low fertility, poor management and disease may contribute to this reduction. This study was set up to:
1. Study, over a period of at least four years, the effect of three different cutting treatments on forage yield and on maintenance of stands of alfalfa.
2. Determine how the application of fertilizers - phosphorous, potash, phosphorus + potash, farmyard manure - affects stands and whether judicious application of fertilizer can compensate in part for undesirable management practices.
3. Compare the effects on stands and on yields of varieties displaying differences in winter hardiness and disease resistance.
Through this study it may be possible to assess, within the limits of the experiment, the relative importance of these factors.

Procedure: The treatments involved are:

Varieties: 1. Ontario variegated - winter hardy, susceptible to bacterial wilt.
2. Vernal - winter hardy, resistant to bacterial wilt.
3. Du Puits - not fully hardy, susceptible to bacterial wilt.
4. Ranger - not fully hardy, resistant to bacterial wilt.

Fertilizer 1. no treatment
2. Potash
3. Phosphorous
4. P. + K.
5. Higher level of P. + K.
6. Farmyard manure

Cutting Management 1. Cut in June and August.
2. Cut in June, August, and September.
3. Cut in June, August, September, and October.

The design is a split-plot with varieties, fertilizer and cutting treatments as main plots first sub plots and second sub plots respectively. Four replications were used. The area (Arkell farm) was seeded to alfalfa at the rate of 10 pounds per acre in May, 1954 but the stand failed because of the dry weather and so was reseeded on August 10th. Data will be collected on dry matter yield and plant stand.

Results and Discussion: The stand was satisfactory in the Fall of 1954 and the first data will be obtained in 1955.

Prior to the initiation of this project a preliminary study comparing three cutting treatments was conducted on an established stand of alfalfa. In 1953 two crops of hay were removed then the three treatments shown in Table 1 were applied.

Three replicates were used. The section which was not cut would provide for maximum build up of root reserves. The area not cut until October 26 (after killing frost) would also allow maximum accumulation of root reserves but the top growth was removed for the winter. The third treatment corresponded to the common practice of grazing alfalfa heavily during the fall period when root reserves are ordinarily accumulated.

TABLE 1:- EFFECT OF FALL CUTTING ON SURVIVAL AND YIELD OF ALFALFA AT GUELPH

Cutting treatment after August 24, 1953	D. M. yields in tons per acre				% stand 1954
	Fall 1953	1954			
		Hay	Aftermath	Total	
Not cut	0	2.48	1.80	4.28	100
Cut late (Oct. 26)	1.01	2.12	1.60	3.72	100
Cut 4 times	0.34	1.80	1.14	2.94	60

The removal of top growth late in the fall after growth had ceased reduced hay yields slightly the following year, but had no effect on plant survival. The frequent cutting treatment severely reduced both stand and yield.

TABLE 2:- INTERACTION OF CUTTING TREATMENTS WITH DRAINAGE CONDITIONS IN RELATION TO YIELD AND SURVIVAL OF ALFALFA AT GUELPH IN 1954

Cutting treatment after August 24, 1953	Drainage Good Rep. 1		Drainage Fair Rep. 2	
	D.M. tons/acre	% stand	D.M. tons/acre	% stand
Not Cut	4.26	100	4.41	100
Cut late (Oct. 26)	3.94	100	3.38	100
Cut 4 times	3.45	75	2.25	25

The effect of the treatments was related to drainage conditions (Table 2). Replicate 1 was on a well-drained, good alfalfa soil while replicate 3 was on an area where drainage was only fair. The reductions in stand and yield caused by the frequent cutting treatment were more severe on the replicate with fair drainage.

Summary: Frequent cutting or grazing of alfalfa stands in the early fall period when root reserves should be accumulated weakened alfalfa stands and reduced hay yields in the following year. The effect of the cutting treatment was more pronounced on an area with fair drainage than on one with good drainage. Cutting after growth ceased in the fall reduced yields only slightly the following year. On the basis of this information a research project was initiated in 1954 to study simultaneously the relative importance of cutting treatment, soil fertility level, and alfalfa variety in relation to survival and yield, and to study the associated interactions.

Evaluation Of The Hay-Pasture Mixtures Commonly Grown In Ontario

Tossell, W.E. (Field Husbandry)

R.P.O. Number: F.H. 29-3 Year Initiated: 1954

Objectives: A number of hay-pasture mixtures which have not been tested carefully are being used and recommended in Ontario. It is essential that data be secured comparing these mixtures for dry matter production as hay, legume-grass balance, and hay quality; and pasture production and seasonal distribution of pasture production in the final year (third) before the sod is ploughed.

Procedure: The following 12 mixtures were seeded in a small plot (8' x 22') trial at Guelph in May, 1954. A randomized complete block design with four replicates was used.

Species	Composition in lbs. per acre of mixture number:											
	1	2	3	4	5	6	7	8	9	10	11	12
Alfalfa	5	4	9	6	4	6	5	5		5		6
Red Clover	5	5		4	3	4	3			4*	8	4
Ladino		1			1	1	1	1				
Alsike							1	2		1	2	
Birdsfoot Trefoil									5			
Timothy	2	2	5	2	5	2	3	5	5	8	8	5
Orchard	5	5	3	3	3	3	2		5			
Brome	5	5		5	5	5	5					
Meadow Fescue								3				
Reed Canary								4				

* Late Red Clover

The management will be for hay and aftermath pasture for 2 years and for pasture in the third (last) year. This is the management system for which the mixtures were formulated. Aftermath pasture dry matter yields will be obtained by clipping the mixture either once or twice depending on crop growth. Four or five clippings will be made to determine dry matter production as pasture in the third year. The exact number will depend on crop growth in that particular year. Some botanical separations may be made to estimate the legume-grass balance if this is considered necessary during the course of the test.

Results and Discussion: Establishment is satisfactory and the first data will be collected in 1955.

Comparison Of Red Clover And Ladino Clover In Hay-Pasture Mixtures

Tossell, W. E. (Field Husbandry)

R. P. O. Number: F. H. 29-4 Year Initiated: 1954

Objectives: Alfalfa and red clover are the most commonly used legume components of hay-pasture mixtures on well drained soils in Ontario. In recent years ladino clover has been included in place of or in addition to red clover in many mixtures. Information collected in Research Project F. H. 29-1 suggests (1) that ladino may be superior to red clover in hay-pasture mixtures on fields suited to ladino clover and when the mixture is harvested for 2 or more years, and (2) that the inclusion of both red clover and ladino clover in the same mixture may give lower yields than if either is included alone. Insufficient data are available from Research Project F. H. 29-1 to draw definite conclusions on these two points. The present

project was designed to provide these critical data.

Procedure: The 15 mixtures used are:

Species	Composition in lbs. per acre of Mixture number:														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Alfalfa			6	6	6	6	6	6	6	6	6	6	6	6	6
Red Clover	9	9	4	4	2		4	2		4	2		4	2	
Ladino					1	2		1	2		1	2		1	2
Timothy	5	5	5	2	2	2	3	3	3				3	3	3
Orchard	3			3	3	3	5	5	5	5	5	5			
Brome				5	5	5				7	7	7	7	7	7

Mixtures 4 to 15 provide the comparisons for this study. Mixtures 4 to 6 include three grasses and mixtures 7 to 15 are two grass mixtures. The latter group consists of all combinations of two grass mixtures involving timothy, orchard and brome grass. Mixtures 1, 2 and 3 were included for another purpose - to evaluate these as short-term (1 year) mixtures and to compare the three with standard (2-3 year) mixtures such as numbers 4, 7, 10 and 13.

The mixtures were seeded in 8' x 22' plots in a randomized complete block design with four replicates at Guelph in May 1954. The management used will be hay + aftermath pasture in the first and second years and pasture in the third year. The number of aftermath clips (1 or 2) and pasture clips (4 or 5) taken will depend on the growth of the crop each year.

Botanical separations will be carried out to determine the contribution of red clover and ladino to the total dry matter yield of the mixture and the effect of each on the other species in the mixture.

Results and Discussion: The establishment was excellent and the first data will be collected in 1955.

Formulation Of Hay-Pasture Mixtures

Tossell, W. E. (Field Husbandry)

R. P. O. Number: F. H. 29-5 Year Initiated: 1954

Objectives: In formulating a mixture three steps are involved. First the species of legumes and grasses must be selected. Second, the proportion of legume to grass must be defined and, third, a seeding rate for each species of legume and grass must be selected. This experiment was undertaken to obtain information on steps 2 and 3 above.

Procedure: A commonly used mixture consisting of alfalfa, red clover, ladino, timothy, orchard and brome grass was selected as the basic mixture. The seeding rates used were:

	Seeding rate Lbs./acre
Alfalfa	6, 8, 10
Red Clover	2, 4
Ladino	1
Timothy	3
Orchard	0, 2, 4, 8
Brome	5

In the legumes the rate of ladino was held constant and that of alfalfa and red clover varied so that the best proportion of alfalfa to red clover could be selected. Orchard grass is aggressive and in many cases dominates the mixture. The rates of timothy and brome were held constant at practical levels and the orchard rates varied to allow selection of the best proportion of orchard grass to other grasses and to the legumes.

Fourteen formulations were seeded in 8' x 22' plots in a randomized complete block design with four replications at Guelph in 1954. Management will be for hay + aftermath pasture for two years and for pasture in the third year. Botanical separations of the herbage will be made to determine the contribution to the mixture of each species at each seeding rate.

Results and Discussion: Establishment was excellent. The first data will be collected in 1955.

Variety Tests In Forage Grasses And Legumes

Tossell, W. E. and Twamley, B. E. (Field Husbandry)

R. P. O. Number: F. H. 8 to 12 and 28 Year Initiated: 1953

Objectives: The improvement of the varieties used in hay-pasture mixtures is one means through which hay yield and quality can be improved. A number of varieties are available but have not been sufficiently evaluated for Ontario. The strain testing program was initiated in 1953 with two objectives:

1. To evaluate available strains as a basis for immediate variety recommendations.
2. To evaluate these strains as a basis for the legume and grass breeding projects.

Procedure: The strain testing project includes two phases:

1. Screening Trials. All potential varieties are placed in a screening trial at Guelph. These trials include a large number of strains (28 in

orchard grass in 1954) and are used to provide information on possible parent materials for the breeding projects and to allow selection of the best varieties for further tests.

2. Regional Uniform Forage Strain Trials. Strains which have shown promise in the screening trials at Guelph and at Federal Stations are included in a regional testing program. Regional trials were seeded at Guelph (Central) Kemptville (Eastern) and Ridgetown (Southern) in 1953 and will be reseeded at these and other stations as new strains require testing. Variety recommendations will be based on the performance of varieties in these regional tests.

Results and Discussion: The legume strain trials are discussed in the Legume Research Report, 1955 and the data are not included in this report. The legume trials involve:

Species	Location	Number of Strains	Year Seeded
Alfalfa			
Screening and Regional trial	Guelph	11	1953
Regional trial	Ridgetown	7	1953
Regional trial	Kemptville	7	1953
Regional trial	Hespeler	7	1954
Red Clover			
Screening trial	Guelph	20	1953
Regional trial	Guelph	6	1953
Regional trial	Ridgetown	6	1953
Regional trial	Kemptville	6	1953
Regional trial	Hespeler	5	1954
Birdsfoot Trefoil			
Regional trial	Kemptville	3	1953
Regional trial	Hespeler	3	1954
White Clover			
Screening trial	Guelph	18	1954
Sweet Clover			
Screening trial	Guelph	13	1954

Data from the grass trials are shown in Tables 1 to 8. No conclusions can be drawn at this stage in the project since the results are available for only one year.

TABLE 1:- ORCHARD GRASS STRAIN TRIAL 1953-SUMMARY 1954

Strain	Origin	Date in Bloom June/54	Leaf*	Panicle Volume**	Tons D. M./Acre 1954		
					Hay	Aftermath	Total
Common	Canada	15	8.5	8.0	2.72	0.42	3.13
-Oron	Ontario	16	9.0	8.0	2.74	0.40	3.16
-Wisc. 52	Wisc.	16	6.2	8.2	3.02	0.48	3.48
-Beltsville	Md.	14	6.5	8.0	2.84	0.48	3.30
Past Lab 1	Penn.	15	7.2	7.5	2.90	0.47	3.37
-Past Lab 5	Penn.	20	3.2	8.2	2.88	0.33	3.21
Past Lab 7	Penn.	22	3.0	4.8	2.68	0.43	3.14
H-2	U.S.A.	20	1.0	1.8	2.33	0.57	2.92
M2-11142	Iowa	16	9.0	7.5	2.72	0.46	3.20
P-2453	Wash.	19	7.8	6.2	2.61	0.39	2.98
233	Oregon	20	1.8	1.0	1.74	0.45	2.20
oS-37	Wales	20	1.0	2.2	2.36	0.51	2.87
oS-143	Wales	20	1.5	2.2	2.25	0.48	2.72
oGartons 337	England	19	1.8	2.2	2.17	0.47	2.63
oScotia	Scotland	19	6.0	6.0	2.44	0.40	2.83
Akaroa	N. Zealand	19	4.7	3.0	2.23	0.47	2.72
+Tammisto	Finland	18	4.5	7.2	2.82	0.26	3.10
+Otofte Late 11	Denmark	19	3.8	7.0	2.76	0.46	3.19
+Frode	Sweden	20	2.0	4.8	2.79	0.61	3.45
+Tardus 11	Sweden	19	3.5	5.8	2.76	0.45	3.20
Weibull H-11	Sweden	20	6.8	8.0	2.74	0.57	3.35
Leth. 627	Alta.	11	9.0	8.8	2.74	0.23	2.96
Leth. 628	Alta.	12	8.8	10.0	3.12	0.29	3.44
Leth. 629	Alta.	12	9.0	9.8	2.82	0.24	4.01
Leth. 630	Alta.	11	9.5	8.8	2.98	0.19	3.14
Mean		17	5.4	6.2	2.65	0.42	3.07
L.S.D. (0.05)					0.34	0.10	0.38
C.V.					9.0	17.7	8.6
Mean - N. American (-)		16	6.2	8.1	2.87	0.42	3.29
European (+)		19	3.4	6.2	2.78	0.59	3.24
British (o)		20	2.6	3.2	2.30	0.46	2.76

+ 1 (good) to 5 (poor)
* 1 (good) to 10 (poor)
** 1 (low) to 10 (high)

TABLE 2:- REGIONAL UNIFORM ORCHARD GRASS STRAIN TRIALS
YIELD IN TONS DRY MATTER PER ACRE IN FIRST HARVEST YEAR - 1954 DATA

Strain	Ridgetown Hay	Kemptville			Guelph			Mean over Kemptville and Guelph		
		Hay	Aftermath	Total	Hay	Aftermath	Total	Hay	Aftermath	Total
Hercules	0.28	1.30	1.34	2.64	2.90	0.38	3.28	2.10	0.86	2.96
Oron	0.33	1.41	1.17	2.58	2.52	0.35	2.87	1.96	0.76	2.72
Danish	0.40	1.13	1.24	2.37	2.54	0.37	2.91	1.84	0.80	2.64
S-26	0.27	0.68*	1.25*	1.93*	1.96	0.42	2.38	----	----	----
Common	0.34	1.20	1.22	2.42	2.58	0.39	2.97	1.89	0.80	2.69
Mean	0.32	1.26	1.24	2.50	2.50	0.38	2.88	1.88	0.81	2.69
L.S.D. (0.05)	N.S.	N.S.	N.S.	N.S.	0.30	N.S.	0.37			
C.V.	24.2	17.7	11.3	11.3	8.0	11.8	8.5			

* Mean over reps. 1 and 2

TABLE 3:- BROMEGRASS STRAIN TRIAL, GUELPH - SUMMARY 1954

Strain	Fall Vigor* 15/10/53	Spring Vigor* 22/4/54	Date in Head June/54	Tons D. M. /acre Hay	Aftermath	Total
*Can. Common	7.2	7.5	8	3.48	0.39	3.87
*Parkland	8.5	8.8	12	3.34	0.35	3.69
*Superior	8.2	7.8	11	3.21	0.33	3.54
*S-4088	6.8	7.6	11	3.49	0.36	3.85
*Manchar	3.0	4.2	4	4.02	0.50	4.52
*Martin	3.8	4.0	10	3.94	0.58	4.52
+Achenbach	2.5	2.8	8	4.28	0.67	4.95
+Fischer	2.2	2.8	8	4.39	0.49	4.88
+Lincoln	1.8	2.6	5	4.30	0.64	4.94
+Lyon	3.0	3.0	9	4.83	0.64	5.47
+Lancaster	4.8	4.9	8	4.34	0.44	4.78
+Southland	1.5	1.1	9	4.75	0.64	5.39
Elsberry	1.8	2.0	9	3.97	0.76	4.73
Homesteader	4.0	4.5	8	3.94	0.56	4.50
B-in-12	6.5	5.2	8	3.83	0.51	4.44
Br. 3	2.5	5.4	8	4.05	0.63	4.68
Mandan 404	6.0	7.4	9	3.76	0.41	4.17
N. Y. B.	1.2	2.1	5	3.83	0.66	4.49
N. Y. H.	1.0	1.9	9	4.38	0.62	5.00
Mean				4.01	0.54	4.55
L. S. D. (0.05)				0.56	0.20	0.64
Mean Northern (*)	6.2	6.6	9	3.58	0.42	4.00
Mean Southern (+)	2.6	2.9	8	4.48	0.59	5.07
C. V.				10.0	26.2	9.8

TABLE 4:- REGIONAL UNIFORM BROMEGRASS STRAIN TRIALS
YIELD IN TONS DRY MATTER PER ACRE IN FIRST HARVEST YEAR - 1954

Strain	Ridgetown	Kemptville			Guelph			Kemptville and Guelph Mean over 2 stations		
	Hay	Hay*	Aftermath	Total	Hay	Aftermath	Total	Hay	Aftermath	Total
Achenbach	0.66	0.66	1.00	3.55	4.28	0.67	4.95	3.42	0.84	4.26
Fischer	0.55	2.49	0.94	3.43	4.39	0.49	4.88	3.44	0.72	4.16
Common	0.31	2.18	0.88	3.06	3.48	0.39	3.87	2.83	0.64	3.47
Mean	0.50	2.41	0.94	3.35	4.05	0.52	4.57	3.23	0.73	3.96
L.S.D. (0.05)	0.10	N.S.	N.S.	N.S.	0.56	0.20	0.64			
C.V.	11.0	9.3	18.4	10.3	10.0	26.2	9.8			

* protein % of Achenbach and Common was 7.6 and 9.9 respectively. Mean of three replicates.

TABLE 5:- FESCUE STRAIN TRIAL 1953, GUELPH - SUMMARY 1954

Strain	Date in Bloom June 1954	% Lodged 21/6/54	Tons D. M. /acre			% Leaf*
			Hay	Aftermath	Total	
+Commercial	17	100	3.40	0.23	3.63	40.0
+Mefon	18	80	3.05	0.26	3.31	44.6
+Ensign	19	55	3.02	0.35	3.37	45.6
S-53	18	55	2.91	0.28	3.19	52.6
S-215	17	100	3.38	0.33	3.71	41.8
-Ottawa 39	16	0	4.40	0.53	4.93	41.6
-Alta	15	35	3.87	0.73	4.60	42.6
-Kentucky 31	17	10	3.83	0.45	4.28	49.2
Medon timothy	--	0	3.88	0.57	4.45	51.6
Mean			3.53	0.42	3.94	
L.S.D. (0.05)			0.49	0.14	0.54	
C.V.			9.8	23.8	9.5	
Mean						
Meadow fescues (+)	18	78	3.16	0.28	3.43	43.4
Tall fescues (-)	15	15	4.03	0.57	4.60	44.5

* Mean of 4 replicates separated by hand. Includes blade and sheath.
Mean of 2 replicates in S-53

TABLE 6:- REGIONAL UNIFORM FESCUE STRAIN TRIALS. YIELD IN TONS DRY MATTER PER ACRE IN FIRST HARVEST YEAR - 1954

Strain	Ridgetown	Kemptville			Guelph			Mean Kemptville & Guelph		
	Hay	Hay	Aftermath	Total	Hay	Aftermath	Total	Hay	Aftermath	Total
Ensign	0.41	1.53	0.76	2.29	3.02	0.35	3.37	2.28	0.56	2.84
Mefon	0.38	1.57	0.74	2.31	3.05	0.26	3.31	2.31	0.50	2.81
Ottawa 39	0.20	2.15	1.22	3.37	4.40	0.53	4.93	3.28	0.88	4.16
Common	0.47	1.84	0.70	2.54	3.40	0.23	3.63	2.62	0.46	3.08
Mean	0.36	1.77	0.86	2.63	3.47	0.34	3.81	2.62	0.60	3.22
L.S.D. (0.05)	0.14	0.38	0.16	0.50	0.49	0.14	0.54			
C.V.	23.2	13.8	11.6	12.0	9.8	23.8	9.5			

Kemptville Uniform Fescue Strain Trial

	% protein in hay
Ensign	8.4
Mefon	8.0
Ottawa 39	8.1
Common	7.1

TABLE 7:- TIMOTHY STRAIN TRIAL 1953, GUELPH - SUMMARY 1954

Strain	Establishment* Fall/53	Tons D. M./acre 1954			% Leaf**
		Hay	Aftermath	Total	
Medon	3.0	3.67	0.61	4.28	51.3
Climax	3.0	3.58	0.56	4.14	51.8
Milton	2.5	3.85	0.54	4.39	40.0
S-48	3.7	2.92	0.38	3.30	----
S-51	4.2	3.06	0.48	3.54	
S-50	2.5	2.78	0.14	2.92	
Danish Selection	4.0	3.55	0.77	4.32	
Medon Selection	2.2	3.74	0.32	4.06	
Paton Selection	3.5	3.34	0.56	3.90	
Finnish Selection	3.2	3.28	0.43	3.71	
Common	3.2	3.66	0.59	4.25	41.4
Mean		3.40	0.49	3.89	
L. S. D. (0.05)		0.57	0.20	0.65	
C. V.		11.8	28.8	11.8	

* 1 (good) to 5 (fair)

** mean over 2 replicates except Medon which is from 1 replicate only.

TABLE 8:- REGIONAL UNIFORM TIMOTHY STRAIN TRIALS; YIELD IN TONS DRY MATTER PER ACRE IN FIRST HARVEST YEAR - 1954

Strain							Mean over Kemptville and Guelph		
	Hay	Aftermath	Total	Hay	Aftermath	Total	Hay	Aftermath	Total
Climax	2.15	1.17	3.32	3.58	0.56	4.14	2.86	0.86	3.72
Milton	2.09	1.08	3.17	3.85	0.54	4.39	2.97	0.81	3.78
Medon	1.89	1.16	3.05	3.67	0.61	4.28	2.78	0.88	3.66
S-48	1.84	1.09	2.93	2.92	0.38	3.30	2.38	0.74	3.12
Common	1.95	1.50	3.45	3.66	0.59	4.25	2.80	1.04	3.84
Mean	1.98	1.20	3.18	3.54	0.54	4.07	2.76	0.87	3.62
L.S.D. (0.05)	N.S.	N.S.	----	0.57	0.20	0.65			
C.V.	11.3	16.7	10.4	11.8	28.8	11.8			

Summary: The strain testing project initiated in 1953 provided the first data in 1954. Results from the legume trials are discussed in the "Legume Research Report, 1955".

Orchard Grass

The strains which gave the best performance were Frode, Pasture Laboratory Synthetic 5, Tardus 11, Otofte Late 11, and Weibull H-11 considering lateness, leafiness and yield. These were also satisfactory in panicle volume. It is of interest to note that in the dry summer of 1954 differences in aftermath production were found. Frode, Weibull H-11, and H-2 were superior to common.

Brome Grass

Southern varieties were superior to Northern varieties, the common type grown in Ontario, in both hay and aftermath yield, spring vigor and fall vigor. Six varieties were one ton or more higher in dry matter yield per acre than Canadian common.

Fescues

Tall fescues outyielded meadow fescues in both hay and aftermath but were too coarse for good hay quality. Medon timothy outyielded all meadow fescue varieties in both hay and aftermath and had a higher percentage of leaf. This is further evidence that timothy is superior to meadow fescue as a hay plant on well drained soils.

Timothy

No strains outyielded common in dry matter production but Medon and Climax had a higher leaf percentage. The three British strains were lower in yield than common timothy and the Canadian varieties.

Emergency Hay Crops

Fulkerson, R. S. and Tossell, W. E. (Field Husbandry)

R. P. O. Number: F. H. 31 Year Initiated: 1950

Objectives: Additional hay is occasionally needed when new seedings fail, when established meadows are winterkilled and when late spring frosts injure the legumes. This study was undertaken to evaluate a number of crops which might be suitable as emergency hay crops.

Procedure: The crops are to be grown in a small plot trial at Guelph. Data comparing the crops over a 3 year period will be collected.

Results and Discussion: This project was inactive in 1954. The information collected in 1950 and 1951 was summarized in the Progress Report of Hay Investigations 1953, pp. 42 - 43.

Basic Drying Experimentation

Hedlin, C. and Theakston, F. H. (Agricultural Engineering)

R. P. O. Number: Ag. Eng. 29 Year Initiated: 1953

Objectives: To investigate the relative efficiency of drying various thicknesses of hay.

Procedure: The experimentation carried on during the season of 1954 was similar to that described in the progress report for 1953 under "Second Dryer 50 Pounds Size". The most important differences in the method were:

1. Three boxes (2' x 2' x 3') were used simultaneously.
2. The rate of air flow to each of the boxes were different.
3. The temperature of the air supplied was controlled.
4. The hay used was artifically wetted due to the difficulty in obtaining supplies of fresh hay.
5. The temperature was recorded at only three points inside the hay mass in each box.
6. The condition of the outlet air was determined by restricting the outlet area sufficiently to raise the air velocity to a point where wet bulb temperature readings could be obtained with a thermocouple and wet sock.
7. Hay depth in all boxes was approximately 18 inches. In all cases an attempt was made to place 14.3 pounds of dry matter in this volume regardless of moisture content.
8. No attempt was made to determine actual air velocity in passage through the hay.

The air was supplied at a different rate to each box. The rates were approximately 225, 150 and 90 cubic feet per minute. The rate of flow was controlled by varying the size of inlet to each box. The air temperature was thermostatically controlled and for all the tests was approximately 105°F.

The hay was rewetted by spraying with water until the desired moisture content was obtained. Tests were carried out with moisture contents ranging from 36 to 54%.

In the first tests, the thermocouples were placed in the hay as described in the Progress Report for 1953. In later tests the hay was weighed into four equal batches for each box. A thermocouple was placed between each batch; thus the amount of hay through which the air passed in going from one thermocouple to the one above it was known rather than the exact thickness of hay through which it travelled.

Results and Discussion: Difficulty was experienced in getting even flow of air through the hay in the boxes. There appeared to be a tendency for the air to flow more rapidly along the sides of the box than through the middle. This resulted in more rapid drying at the edge than in the middle. This unevenness of flow was apparent because of the difference in temperature recorded by the thermocouple lying on the top of the hay at the mid-point in the box and the temperature of the outlet air as it left the box. The former represented the temperature of air that had come through the middle of the hay mass and the latter represented a mixture of all the air that had come through the box. In nearly all cases the temperature of the outlet air was higher than that emerging from the middle of the hay mass shortly after the beginning of a drying cycle.

When the existence of uneven flow in the boxes was observed, an attempt was made to correct it by placing baffles around the edges of the box. It seemed probable that the resistance to air flow near to the sides of the box was less than in the hay mass. By placing the baffles it was hoped to reduce the unevenness of flow by increasing resistance to air flow along the sides. The baffles consisted of 5/16'' plywood 2'' wide laid flat in the hay and as near to the edge as possible and extending around the inside of the box. Two baffles were placed in each box, one at the time the box was half filled and the other at the completion of filling. The use of baffles appeared to improve the condition in the box in which the rate of air flow was high (about 50 f. p. m.) but not in the boxes having lower air velocity.

It was apparent that the rate of air flow through the hay could not be assumed to be the air supplied divided by the area of the box as would be the case if the air flow was uniform. An attempt was made to obtain corrected value for the rate of air flow using the temperature at the top of the hay and the temperature of the outlet air.

The amount of moisture picked up by the air between entry and leaving the box was proportioned to the difference in temperature or temperature depression. The fact that the temperature of the outlet air was higher than that emerging from the middle of the hay indicated that the former had picked up less moisture than the latter and since the drying time for the box as a whole was the same as the drying time for the middle section the air speed in the middle section must have been lower. This is based on the assumption that the moisture content is the same throughout the box.

$M = \text{Constant} \times G \times \Sigma\Delta \times T = \text{constant value for a given test.}$ (1)

M = moisture removed per square foot of cross-sectional area of box during the drying period.

G = rate of air flow in pounds per hour per square foot of cross-sectional area.

$\Sigma\Delta t$ = summation of the temperature depression (difference between entering and leaving temp.) where measurements of depression are taken at regular intervals throughout the drying period.

DT = drying time hours.

N = number of tests of temp. depression.

M for box as a whole = M for the middle section assuming even mois-

ture content initially.

$$\frac{G_b}{G_c} = \frac{(t_c)\,(N_b)\,\text{const}_{\,c}T_c}{(t_b)\,(N_c)\,\text{const}_{\,b}T_b}$$

$\text{const}_{\,c} = \text{const}_{\,b}$ see (1)

$T_c = T_b$ since drying times are equal, if $N_b = N_c$ they can be cancelled.

$$\frac{G_b}{G_c} = \frac{t_c}{t_b}$$

where subscripts "b" and "c" designate value for box as a whole and value for centre test area respectively.

G_c is unknown and can be determined since the other values are known.

From the recorded temperatures, the efficiencies of drying were calculated as described in the Progress Report for 1953. The following table includes the calculated efficiencies for the different conditions of moisture content, rate of air flow and hay thickness.

TABLE 1:- CALCULATED AVERAGE EFFICIENCY OF USE OF HEAT AND DRYING TIME FOR VARIOUS THICKNESSES OF HAY

M. C.	Vel.	4'' n	4'' DT	8'' n	8'' DT	12'' n	12'' DT	18'' n	18'' DT
36%	34.2	(32.81)	144	(34.50)	168?	(51.34)	240?	(47.29)	336?
	26.0	(37.65)	144	(40.61)	144?	(53.67)	192?	(53.29)	288?
	17.1	(34.88)	336	(40.52)	576	(42.23)	624	(50.32)	768
38%	53.5	(28.23)	60	(36.82)	84	(54.05)	168	(52.95)	204
45%	36	(39.5)	168	(42.64)	300	(55.09)	336	(61.76)	396
	20.2	(42.84)	228	(48.76)	336	(49.76)	912	(53.60)	936
	18.0	(41.82)	468	(56.37)	612	(55.96)	960	(55.65)	1200
45%	49.6	(42.46)	120	(45.04)	168	(46.28)	216	(44.71)	288
	20.7	(48.20)	120	(56.55)	288	(56.68)	444	(58.14)	468
54%	48.1	(33.90)	108	(44.08)	228	(52.47)	276	(49.31)	348
		(47.43)	228	(50.42)	324	(56.23)	396		
		429.82/11		496.31/11		573.76/11		527.02/10	
		Av. -39.07		Av. -45.12		Av. -52.16		Av. -52.70	

TABLE 2:- EFFICIENCY AND DRYING TIME FOR VARIOUS THICKNESSES OF HAY

		1''		2''		3''		4''		6''		8''	
M.C.	Vel.	n	DT	n	DT	n	DT	n	DT	n	DT	n	DT
36%	43.3	(9.37)	36	(13.10)	36	(19.45)	36	(18.80)	48				
	17.5	(3.73)	24	(27.89)	72	(38.40)	72	(32.07)	72				
	11.6	(17.08)	120	(29.98)	156	(36.04)	192	(43.80)	192				
38%	29.5			(21.35)	36			(39.85)	60	(47.10)	108	(52.24)	120
	17.7	(31.35)	60	(41.23)	96	(43.81)	132	(41.68)	168				
		61.53/4		133.55/5		137.70/4		176.20/5					
		Av. -15.38		Av. -26.71		Av. -34.42		Av. -35.24					

NOTE: for table 1 and 2

M.C. - moisture content
Vel. - velocity in f.p.m.
n - efficiency
DT - drying time in minutes.

In the experimentation, there was variation in moisture content, air speed and hay thickness.

There appears to be some difference in the efficiency of drying at the various moisture contents. The figures in Table 3 represent average efficiency at the stated moisture content and hay thickness without regard for air velocity. The last column indicates the total average for the given moisture contents without regard for thickness of air velocity.

TABLE 3:- TABLE OF EFFICIENCY VS. MOISTURE CONTENT AT DIFFERENT HAY THICKNESSES

Moisture Content %	Hay Thickness Inches				Total Average
	4	8	12	18	
36-38	33.39	38.11	50.32	50.96	43.19
45	42.96	49.87	52.75	54.77	50.09
54	40.66	47.25	54.35	-----	47.42

There appears to be little difference in the efficiency of drying for different air velocities at the hay thicknesses above 4''. At the very small thicknesses (up to 4'') the efficiency for high rates of air flow is markedly lower than for low air flow rates.

The efficiency of drying appeared to be most affected by the hay thickness. The efficiency increases quite rapidly up to about an 8'' thickness. Further increase in hay thickness has less effect on the efficiency.

All the tests were carried out with entering air temperature of approximately 105°F. It is very probable that the efficiency would be affected by difference in entering air temperature.

Summary: An investigation of the efficiency of use of heat in drying by a number of different thicknesses of hay was carried out in the laboratory. The investigation was made over a limited range of air flow rates, hay moisture contents and hay thicknesses.

The results were averaged for all conditions of drying at each hay thickness. The efficiencies of drying were as follows:

Thickness	1	2	3	4	6	8	12	18
Efficiency	15.4	26.7	34.4	35.2	38.0	45.1	52.2	52.7

For the conditions of operation, the efficiency appeared to increase markedly up to a thickness of 12''. A further increase to 18'' did not appear to increase efficiency. The figures have not yet been analysed statistically to determine the significance of the results.

The results were averaged for all conditions of drying at each level

of moisture content. The results were as follows:-

Moisture Content %	36-38	45	54
Efficiency	43.2	50.1	47.4

The results as indicated by these figures appear inconclusive.

The process of drying is essentially one of heat transfer. It is possible that an analog method might be used to extend the information available. The advantage of the use of analog method would be that a large number of tests could be made in a short period of time and the number of test that would have to be made with hay would be reduced. The possibility of this approach should be investigated. This method would have major application in the type of investigation that was carried out in the laboratory during the summers of 1953 and 1954.

Continuous Type Hay Drier

Hedlin, C. P. and Garland, J. W. (Agricultural Engineering)

R. P. O. Number: A. Eng. 42 Year Initiated: 1954

Objectives: To investigate the use of a single pass continuous type dryer for hay drying.

Procedure: The equipment consisted of a fan and domestic oil burner to supply heated air. The hay was dried by blowing the heated air through it. The drying section was constructed in such a way that hay was placed in the unit at one end, was carried horizontally on an endless raddle for a distance of 10' travelling in a direction that carried it toward the air supply so that air flow was counter to the hay movement. The direction of flow was then turned through 180° by dropping the hay to a level below the level of the hay moving toward the air supply as described above. The hay was then moved along the underside of the endless raddle in a direction away from the air supply and was ejected from the dryer at the same end at which it entered.

The time during which the hay was contained in the dryer was controlled by raddle speed. The temperature of the air could be determined by selection of the proper fuel nozzle for the burner. The rate of air flow could be determined by the size of opening to the fan.

Results and Discussion: Two batches of hay were dried. The first load which was grass, had an initial moisture content of 36%. The air was supplied at a temperature of approximately 200 degrees and at a volume of approximately 2500 c. f. m. Approximately 20 minutes were required for the hay to go from the inlet to the outlet. The hay on leaving had a moisture content of approximately 14%. It was dried at a rate of approximately 300#/hour.

The second batch of hay had an initial moisture content of 40%. Air was supplied at approximately the same conditions for the second test as

for the first. The hay emerged after 20 minutes in the dryer with a moisture content of approximately 20%.

Observations were made during the second test, of the time required for air to reach equilibrium relative humidity. This was done by placing thermocouples at intervals along the duct. At the point at which the temperature of the air stopped decreasing it was considered to have reached equilibrium relative humidity. This distance was approximately 50 inches. At the rate of air flow being used this corresponded to approximately 0.5 seconds.

The condition of the air after passing through the hay was determined (relative humidity and temperature) and the efficiency of use of heat was determined on the basis of the inlet and outlet condition.

$$\text{efficiency} = \frac{t_i - t_o}{t_i - t_{D.P.}}$$

A second basis for determination was

$$\text{coefficient of performance} = \frac{t_i - t_o}{t_i = t_{WB.}}$$

t_i = dry bulb temp. of inlet air

t_o = dry bulb temp. of inlet air

t_{DP} = dew point temp. of inlet air

t_{WB} = wet bulb temp. of inlet air

The efficiency was determined as being approximately 70%. The coefficient of performance was approximately 95%.

Additional information should be obtained regarding the operation of the unit.

Summary: Research was carried out with a dryer in which hay was fed continuously into the dryer and dried as it passed through it. The drying air was heated. Some results were obtained using hay of about 40% moisture content. Efficiency of use of heat was approximately 70%.

The drying unit was constructed on a small scale and was designed to handle approximately 300 pounds of hay per hour.

The length of exposure time necessary for air to reach equilibrium relative humidity was approximately 0.5 seconds for about 4 feet of travel in the hay. The air flow speed was about 500 f.p.m.

As regards the future work with the continuous dryer, further work should be done with a view to obtaining information on the operating characteristics of this type of dryer. The efficiency, fuel consumption, volume of material handled, time of exposure necessary should be investigated when changes are made in moisture content, air temperature and air flow

rate. It should be possible to complete this investigation in the coming summer.

Investigation Of Static Pressure Losses In Hay Driers

Theakston, F. H. and Hedlin, C. P. (Agricultural Engineering)

R. P. O. Number: A. Eng. 28 Year Initiated: 1953

Objectives: To design a drier in which some of the sources of static pressure loss are removed.

Procedure: See 1953 Progress Report.

Results and Discussion: The Hay Investigations Progress Report for 1953 contains a detailed report on the investigation of static pressure losses in hay driers.

An installation of the type described in the above report was constructed and used by a farmer in 1954. If differed inasmuch as the distance between supply flues and exhaust flues was approximately 8 feet and the distance between supply flues and the edge of the mow was approximately 10 feet. Static pressure measurements made in the main duct indicated that the pressure requirement there was approximately 0.31 inches of water. This value is similar to that obtained with this type of system at the O. A. C.

Conclusions: The results indicated that static pressure requirements in hay driers depend on the design of the air distribution system. Reduced static pressure requirements result in an increased flow of air which in turn increases the drying capacity of the system.

Air Distribution Tests

Hedlin, C. P., Theakston, F. H. and Garland, J. W. (Agricultural Engineering)

R. P. O. Number: A. Eng. 26 Year Initiated: 1952

Objectives: To investigate the velocity of air emerging from the hay at number of points in mows to obtain information which will lead to improved drier design.

Procedure: See Hay Investigations Progress Report 1953.

Results and Discussion: A small amount of work was done in 1954 which substantiated the previous results.

Conclusions: The conclusions are as follows:

Central Duct

The depth of hay above a central duct should be approximately 2/3 of the distance from the duct to the side of the mow.

Slatted Floor

In general a distance of six feet from the edge of the slatted floor to the edge of the mow is satisfactory. Better air distribution can be obtained if the ratio of hay depth to the distance from the slatted floor to the edge of the mow is approximately 3:2.

Flue System

There appeared to be good air distribution when the distance between flues was equal to the least distance between the edge of the mow and any flue.

Effect Of Hay Handling Methods And Moisture Content On Nutrient Loss

Hedlin, C. P., Byers, G. L. and Evans, E. V. (Ag. Engineering and Nutrition)

R. P. O. Number: A. Eng. 27 Year Initiated: 1953

Objectives: To investigate the comparative shatter loss resulting from handling hay under a number of conditions of moisture content.

Procedure: In an attempt to obtain better control over variable factors the method of conducting the experiment was changed from that used in 1953.

In place of rakes, a tumbling unit was used to simulate the effect of raking. The tumbling unit consisted of a 2' x 2' x 3' frame covered with a 1'' wire mesh. The frame was supported at corners of the box diagonally across from one another. The supported corners were mounted on bearings so that the unit could be rotated. This equipment was set up in a tent adjacent to the crop area. The purpose of the tent was to provide protection from sun and wind effects.

A uniform stand of mixed hay with a high percentage of alfalfa was selected as the experimental material.

Trial 1

On June 24th a small area was mowed for a trial of the equipment and experimental plan. Immediately after mowing, a quantity of the crop was transferred to the tent and ten samples of 1000 grams each were weighed into cotton bags for moisture determination. Ten other samples of 1500 grams each were weighed and spread out as uniformly as possible on individual heavy plastic sheets for drying in the sun in an area sheltered from

the wind. The use of plastic sheets was an attempt to achieve uniformity of drying in all samples. Since the initial weight was known, the progress of the drying could be followed by weighing a sample at any time. After a period of drying, the samples were wrapped individually in their plastic sheets and all transferred at one time to the tent. For the test each sample was placed in the tumbler and the tumbler rotated at constant speed (approx. 16 R. P. M.) for a given period of time. Shattered material fell through the wire mesh and was collected in a pan below the unit for weighing. In the trial run, weights of shattered material were recorded after 1-1/2 minutes and 3 minutes. The material remaining in the cage was weighed and placed in a bag for moisture determination and subsequent protein analysis.

Trial 2

On June 28th, a further area of the hay was mowed. The purpose was to test 10 samples at each of five moisture levels, approximately 60%, 50%, 40%, 30% and 20%. To this end, 50 samples of 1500 grams each were placed on plastic sheets as in trial 1, and in addition, 10 samples for determination of initial moisture content were taken as before. In practice, drying of the samples occurred more rapidly than expected as the result of very warm dry atmospheric conditions, and tests were obtained at only two moisture levels (approximately 40% and 25%). A tumbling time of 1-1/2 minutes was used in this trial, other details being as outlined for Trial 1.

Results and Discussion: The results of the two trials are assembled in table 1.

The dry-matter figures indicate, as would be expected, a greater loss through shattering at the lower moisture contents. The mean losses at average moisture contents of 71.0, 38.3 and 23.4% were, respectively, 3%, 3.7% and 6% of total dry matter. The difference between handling at 71.0% moisture and at 38.3% moisture is not great, but a more marked increase in loss occurred in handling at 23.4% moisture as compared with 38.3% moisture.

The results of the protein analyses of the residues do not reveal any definite effects on this nutrient, in view of the relatively small losses of dry matter and the sample variability with respect to protein.

It may be of interest, although certainly not surprising, to note that, in all tests, the material lost through shattering consisted of the dry parts of the crop, averaging about 10% in moisture content.

The losses found here, although appreciable, are not extremely large, and it is quite possible that they are less than would be obtained in a practical raking operation. Observation of the tumbling process in operation suggested that the hay was not receiving a treatment as rough as would be administered by a mechanical rake.

It is becoming apparent that the differences sought in this investigation are relatively small, smaller than can be demonstrated readily by the present sampling and experimental techniques.

TABLE 1:- EFFECT OF TUMBLING AT DIFFERENT MOISTURE CONTENTS ON THE COMPOSITION OF HAY

Trial No.	Original Moisture %	Moisture at Tumbling %	Dry Matter lost (gms.)		Dry Matter in Residue (gms.)		Protein %	
			1-1/2 min.	3 min.	1-1/2 min.	3 min.	Original	Residue
1.	(68.9-73.1)	(68.6-74.7)	(10-18)	(15-24)	-------	(380-440)	(12.4-15.9)	(13.3-14.6)
	71.2	71.0	13	20		418	14.0	13.8
2.	(68.8-71.7)	(35.7-40.3)	(12-20)	-----	(400-456)	-------	(13.5-15.6)	(13.6-17.2)
	70.3	38.3	17		438		14.4	15.5
		(14.8-27.9)	(21-34)	-----	(396-440)	-------		(13.0-15.0)
		23.4	27		424			14.2

Note: Bracketed figures show the range of values in the group of samples; the single unbracketed figures are the mean values.

Summary: Although slightly greater loss of dry matter was observed when the hay was handled at a lower moisture content, no definite conclusions in this regard are justified from the work to date. The tumbling machine as presently constructed does not adequate simulate field raking action.

It is recommended that further studies be deferred until results from Projects "Nutrition-13-1" and "An. Husb. 1" indicate that information on effects of raking is necessary or desirable.

Effects Of Curing Practices On Nutritive Value Of Hay

Evans, E. V., Motzok, I. and Kennedy, W. O. (Nutrition and An. Husbandry)

R. P. O. Number: Nutrition 13-1 Year Initiated: 1951

Objectives: Study of protein and carotene in hay crops at time of cutting, at various stages of field-curing and barn-curing and after various storage periods.

Procedure: (a) General plan

In the 1954 experiments, four types of curing and harvesting procedure were under study. A large field of mixed hay, high in legumes, was divided into 4 large plots, each to be harvested by a different procedure, according to the following plan:

Plot 1 - Field-cured, loose hay (using hay-loader)
Plot 2 - Field-cured, chopped hay (using forage harvester)
Plot 3 - Field-cured, baled
Plot 4 - Barn-cured, baled

The hay on all plots was mowed on one day (July 5), and immediately after cutting, samples from each plot were collected for determination of moisture, protein and carotene. Further samples were taken at the time the hay was ready for transfer to the barn (Plot 4 on July 6th, others on July 8th). In the case of Plots 3 and 4 a comparable number of bales, coinciding as closely as possible with the earlier sampling locations, were tagged for later analysis. It is the intention to analyse samples from all of the lots of hay about mid-way through the feeding trial on these days (Animal Husbandry Project 1). These samples will be collected during late February.

(b) Sampling procedure

In previous work in this and other projects dealing with forages, marked sample variability has been noted. This variability has been sufficient that only extremely large differences in average nutrient analysis figures could be interpreted. At the outset of such investigations a sampling procedure involving the collection of 10 samples of approximately 2 pounds each was arbitrarily adopted. It became apparent that this was not adequate sampling for the highly variable forage crops under study.

In the 1954 experiments, a more elaborate sampling procedure was tried, as follows:

(a) Each individual sample consisted of at least 4 pounds, was removed from the wind row by cutting with grass shears, and was collected on a plastic sheet. The latter two steps were an attempt to minimize the shattering and loss of leaves etc., during handling.

(b) Instead of sampling each plot at 10 locations as had been done on previous occasions, each plot was ampled at 40 locations, and the 40 samples were composited at random into 10 composite samples for analysis. Although the analysis of as many samples as possible is desirable, laboratory facilities and time place limits on the numbers which can be analysed, and it was for this reason that the expedient of using composite samples was employed.

In an attempt to evaluate the advantages, if any, of this broader sampling scheme, the fresh samples from one of the plots were analysed on the individual basis (40 samples) as well as on the composite basis (10 composite samples) and the variabilities of the results were compared.

Results and Discussion: No results on the major phase of the project can be reported, since the final sampling analysis have not been done.

Some information on the sampling investigation is presented in Table 1. Sampling variability is indicated in terms of the number of samples required to detect differences of various magnitudes in protein content. Similar information is available for carotene.

TABLE 1:- COMPARISON OF SAMPLING VARIABILITY FOR 1953 AND 1954

To detect differences (P = 0.05) in protein content of:	No. of Samples Required per Treatment		
	1954-Composites	1954-Individuals	1953-Individuals
0.5%	8 to 20*	25	66
1.0%	2 to 5*	7	17
1.5%	1 to 2*	3	8

*-Separate calculations were made for each of the 4 plots.

From these figures it is evident that the variability among "individual" samples in 1954 was considerably less than in 1953, and the advantages in the use of composite samples in 1954 although marked, were not as striking as might have been found with a higher variability in individual samples.

The lowered variability observed in 1954 may have resulted, at least in part, from the use of the improved handling method and the larger sample size.

Recommendations: It is recommended that the study of harvesting methods and of sampling methods be repeated along identical or similar lines in 1955.

Does It Pay To Barn Dry Hay?

Campbell, D. R. (Agricultural Economics)

R. P. O. Number: Ag. Economics 14 Year Initiated: 1952

Objectives: 1. To ascertain the extra costs involved in barn drying hay as compared to field curing hay.
2. To ascertain the extra recovery, nutritive qualities and feeding value of barn-dried hay over field cured hay.
3. To compute the extra revenue (if any) of barn dried hay over field cured hay.
4. To ascertain "break-even points" based on size of mow, and price of milk, at which it would pay to barn dry rather than field cure hay.

Results: See Progress Report 1953, page 68.

Economics Of Crops, Cultural Practices, Machines And Methods On Livestock Farms In Ontario

MacGregor, M. A., Caldwell, H. W. and Muirhead, R. C. (Ag. Economics)

R. P. O. Number: Ag. Economics 10 Year Initiated: 1953

Objectives: The study land use, farm practices and methods in producing cereal and forage crops to determine:
1. Economics of selected harvesting machines (baler, forage harvester, hayloader etc.);
2. Costs of alternative methods of handling hay (silage, chopped, loose, baled);
3. Relative costs of production of cereals and forages;
4. Yields of various cereal and forage crops as related to cultural practices and methods.

Procedure: See Progress Report, Hay Investigations 1953, page 44.

Results and Discussion: In studying the relationship between cost and use of farm machinery approximately 33,000 calculations were required to compute the 35 curves upon which the analysis was based. This project is almost completed and will be published in the late spring of 1955.

The calculations pertaining to the second section of this study dealing with the costs of alternative methods of handling forage have also been completed. This involved an additional 51,000 calculations and tabulations. The analysis is proceeding and it is intended to have a publication edited during 1955.

Summary: Awaiting finalization of results.

Comparison Of The Feeding Value Of Hay Subjected Different Methods Of Curing

Rennie, J. C. (Animal Husbandry)

R. P. O. Number: An. Husb. 1 Year Initiated: 1952

Objectives: To determine if there is any significant difference in the feeding value of hay measured in terms of milk and butterfat production when the hay is harvested by the following methods:

1. Field cured - loose, harvested with hay loader
2. Field cured - baled
3. Barn cured - baled
4. Field cured - chopped - harvested with forage harvester.

Procedure: The general procedure of the feeding program will be the same as for the previous experiments reported in "Progress Report - Hay Investigations 1953, O.A.C." pages 68 to 74.
Differences (1) Four different hays will be fed at one time rather than three as in the previous experiments.
(2) The trial will consist of four feeding periods of three weeks each instead of three feeding periods as in the past.
The double change-over type of design involving twelve cows will be followed as in the previous experiments.

Results and Discussion: The results of the 1953-54 hay feeding experiments were reported in "Progress Report - Hay Investigations 1953, O.A.C." pages 71 to 73.

The 1954-55 feeding experiment was commenced on January 17, 1955 and will continue until April 10, 1955.

Papers Presented at Scientific Meetings

1. Byers, G. L. and Webber, L. R. The effect of tillage methods on crop yields and soil structure. Annual Meeting Agric. Inst. Can., June, 1954.
2. Byers, G. L. and Fulkerson, R. S. Methods of seeding and seedbed preparation for grasses and legumes. Annual Meeting North Atlantic Section, Amer. Soc. Agric. Eng., Vermont, August, 1954.

NOT FOR PUBLICATION

PROGRESS REPORT

FORAGE CROP INVESTIGATIONS

1954

Field Husbandry Department
Ontario Agricultural College
Guelph

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Evaluation of Species and Mixtures for Hay and Pasture 1950

Tossell, W.E. and McConkey, O.M.

R.P.O.: F.H. 29-1 and 30-1 Year Initiated: 1950

Objective:

In the fall of 1953 five 3" x 6" cores were taken from plots of selected mixtures, bulked and, during winter of 1954-1955, the root weight per plot was determined. The area was ploughed in the fall of 1953 and seeded to Simcoe oats in 1954 to measure effect of selected mixtures on the yield of a succeeding crop. Becauss of the 6' plot width, the oat crop was selected as the most feasible crop to use.

Table 1:- Root Development (1953) and Oat Yields (1954) Following the Hay Trial, 1950.

Combination	Root Production D.M./acre tons	lbs.	Oat Yield bus/acre	% Lodged
Timothy	3.05	6,100	46.3	3
Orchard	5.75	11,500	48.2	5
Brome	2.88	5,760	56.6	23
Meadow Fescue	4.34	8,680	42.7	3
Reed Canary	5.28	10,560	46.9	7
Alfalfa	3.54*	7,080	44.1	
Ladino	1.38	2,760	52.1	
Alfalfa + Timothy	4.28	8,560	46.4	57
+ Orchard	5.27	10,540	66.7	52
+ Brome	3.47	6,940	59.6	63
+ Meadow Fescue			50.0	38
+ Reed Canary			49.1	28
Ladino + Timothy	3.79	7,580	53.8	72
+ Orchard	4.21	8,420	47.2	68
+ Brome	3.36	6,720	37.0	68
+ Meadow Fescue			52.0	73
+ Reed Canary			40.1	52
Alfalfa + Ladino + Timothy			63.0	82
+ Orchard			60.4	63
+ Brome	4.30	8,600	51.6	95
Alfalfa + Lad. + Tim. + Orch.			45.0	77
+ Tim. + Brome			51.1	65
+ Orch. + Brome			47.3	67
+ Tim. + Orch. + Brome			48.6	68
+ Tim. + Orch. + Brome + M. Fesc.			55.2	62
Alfalfa + R. Clover + Tim. + Orch. + Brome	4.86	9,720	44.8	18
Alfalfa + Lad. + R. Clover + Tim. + Brome			46.8	65
Alfalfa + R. Clover + Tim. + Brome			62.7	30
R. Clover + Tim.	4.49	8,980	54.5	13
Kentucky Blue	1.92**	3,840	45.3	5
Kentucky Blue + White Dutch			42.7	68
Mean	4.01	8,020	50.2	48
L.S.D. (0.05)	1.55		N.S.	
C.V.	27.3		23.8	

** not included in analysis
* one missing value

Table 2:- Root Development (1953) and Effect on Lodging and Oat Yields (1954) of Selected Combinations in the Hay Trial, 1950.

	No. Combination	Root Prod. lbs. D.M./acre	% Lodged	Oats bu./acre
Grasses	3	7787	8	50.4
Alfalfa	1	7080	52	44.1
Ladino	1	2760	65	52.1
Alfalfa + 1 grass	3	8680	50	57.6
Ladino + 1 grass	3	7573	69	46.0
Alf. + Lad. + 1 grass	3	----	80	58.3
Alf. + Lad. + 2 grasses	3	----	70	47.8

Table 3:- Comparison of Root Development (lbs. D.M./acre) under the Three Grasses in the Hay Trial 1950. Data Collected in 1953.

	Alone	With Alfalfa	With Ladino	Mean
Timothy	6,100	8,560	7,580	7,413
Orchard	11,500	10,540	8,420	10,153
Brome	5,760	6,940	6,720	6,473
Mean	7,787	8,680	7,573	

Table 4:- Root Development (lbs. D.M./acre) under Hay vs. Pasture Management in 1950 trials. Data collected in 1953.

	Hay	Pasture
Orchard	11,500	9,486
Alfalfa + orchard	10,540	10,427
Ladino + orchard	8,420	6,664
Alf. + lad. + tim. + orch. + brome	8,600	8,546
Mean	9,765	8,781

Table 5:- Root Development in Alfalfa Rate of Seeding Study (1951 seeding) at end of second harvest year, 1953.

	Rate of Seeding lbs./acre	D.M. of Roots lbs./acre
Alfalfa	9	8,663
Alfalfa + timothy	9:2	12,504
Alfalfa + brome	9:8	10,074

The Productivity and Longevity of Alfalfa as related to Management

Twamley, B.E. and Tossell, W.E. (Field Husbandry)

R.P.O.: F.H. 29-2 Year Initiated: 1954

Objectives:

It is known that Ontario hay and pasture fields deteriorate in value through continuous reduction in the legume fraction. Low fertility, poor management and diseases may contribute to this reduction.

This study was set up to:

1. To study, over a period of at least four years, the effect of three different cutting treatments on forage yield and on maintenance of stands of alfalfa.
2. To determine how the application of fertilizers - phosphorous, potash, phosphorous-potash, farmyard manure - affects stands and whether judicious application of fertilizer can compensate in part for undesirable management practices.
3. To compare the effects on stands and on yields of varieties displaying differences in winter hardiness and disease resistance.

Through this study it may be possible to assess, within the limits of the experiment, the relative importance of these factors.

Procedure: The treatments involved are:

Varieties:
1. Ontario variegated - winter hardy, susceptible to bacterial wilt.
2. Vernal - winter hardy, resistant to bacterial wilt.
3. Du Puits - not fully hardy, susceptible to bacterial wilt.
4. Ranger - not fully hardy, resistant to bacterial wilt.

Fertilizer:
1. No treatment
2. Potash
3. Phosphorous
4. P. + K.
5. Higher level of P. + K.
6. Farmyard manure

Cutting management:
1. Cut in June and August.
2. Cut in June, August and September.
3. Cut in June, August, September and October.

The design is a split-plot with varieties, fertilizer and cutting treatments as main plots, first sub plots and, second sub plots, respectively. Four replications were used. The area (Arkell farm) was seeded to alfalfa at the rate of 10 pounds per acre in May, 1954, but the stand failed because of the dry weather and so was reseeded on August 10th. Data will be collected on dry matter yield and plant stand.

Results:

The experiment, located at Arkell, was originally seeded in May, 1954, using a Planet Junior, on top of 100 pounds of 3-18-9 fertilizer. The stand, being irregular, the area was torn up in early August.

August 9 - 225 pounds of 4-12-6, broadcast,

August 10 - broadcast seeded, chain harrowed,

September 10 - stand in general is good. Ranger and Du Puits show much faster development than Vernal. Grimm is even slower.

On October 7-9, permanent quadrats, marked by stakes, were located in 64 plots and in these plant counts were taken. Information on the disposition of these quadrats is provided in the table below:

Variety	Number of Plots	Number of Samples per plot	Fertilizer Treatment	Cutting Treatment
Du Puits	16	2	Check, P+K	Two and
Vernal	16	2	"	four
Ranger	16	1	"	times
Grimm	16	1	"	a year

In October, 1954, at which time the only treatment imposed was variety, average plant counts per square foot were as follows:

Ranger	24.1
Vernal	23.5
Du Puits	22.8
Grimm	21.8

Prior to the initiation of this project a preliminary study, comparing three cutting treatments, was conducted on an established stand of alfalfa. In 1953 two crops of hay were removed then the three treatments shown in Table 1 were applied.

Three replicates were used. The section which was not cut would provide for maximum build up of root reserves. The area not cut until October 26 (after killing frost) would also allow maximum accumulation of root reserves but the top growth was removed for the winter. The third treatment corresponded to the common practice of grazing alfalfa heavily during the fall period when root reserves are ordinarily accumulated.

Table 1:- Effect of Fall Cutting on Survival and Yield of Alfalfa at Guelph.

Cutting Treatment (after Aug. 24, 1953)	D.M. Yields in tons per acre				% Stand 1954
	Fall 1953	1954 Hay	1954 Aftermath	1954 Total	
Not cut	0	2.48	1.80	4.28	100
Cut late (Oct. 26)	1.01	2.12	1.60	3.72	100
Cut 4 times	0.34	1.80	1.14	2.94	60

The removal of top growth late in the fall after growth had ceased reduced hay yields slightly the following year, but had no

effect on plant survival. The frequent cutting treatment severely reduced both stand and yield.

Table 2: Interaction of Cutting Treatments with Drainage Conditions in Relation to Yield and Survival of Alfalfa at Guelph in 1954.

Cutting Treatment after Aug. 24, 1953	Drainage Good Rep. 1		Drainage Fair Rep. 2	
	D.M. tons/acre	% Stand	D.M. tons/acre	% Stand
Not cut	4.26	100	4.41	100
Cut late (Oct. 26)	3.94	100	3.38	100
Cut 4 times	3.45	75	2.25	25

The effect of the treatments was related to drainage conditions (Table 2). Replicate 1 was on a well-drained, good, alfalfa soil, while replicate 3 was on an area where drainage was only fair. The reductions in stand and yield, caused by the frequent cutting treatment, were more severe on the replicate with fair drainage.

Summary:

Frequent cutting, or grazing, of alfalfa stands in the early fall period when root reserves should be accumulated weakened alfalfa stands and reduced hay yields in the following year. The effect of the cutting treatment was more pronounced on an area with fair drainage than on one with good drainage. Cutting after growth ceased in the fall reduced yields only slightly the following year. On the basis of this information a research project was initiated in 1954, to study simultaneously the relative importance of cutting treatment, soil fertility level, and alfalfa variety, in relation to survival and yield and to study the associated interactions.

Evaluation of the Hay-Pasture Mixtures commonly grown in Ontario

Tossell, W.E. (Field Husbandry)

R.P.O.: F.H. 29-3 Year Initiated: 1954

Objective:

A number of hay-pasture mixtures, which have not been tested carefully, are being used and recommended in Ontario. It is essential that data be secured comparing these mixtures for dry matter production as hay, legume-grass balance and hay quality, and pasture production and seasonal distribution of pasture production in the final year (third) before the sod is ploughed.

Procedure:

The following 12 mixtures were seeded in a small plot (8' x 22') trial at Guelph in May, 1954. A randomized complete block design with four replicates was used.

Species	Composition in lbs. per acre of Mixture number:											
	1	2	3	4	5	6	7	8	9	10	11	12
Alfalfa	5	4	9	6	4	6	5	5		5		6
R. Clover	5	5		4	3	4	3			4*	8	4
Ladino		1			1	1	1	1				
Alsike							1	2		1	2	
Birdsfoot Trefoil									5			
Timothy	2	2	5	2	5	2	3	5	5	8	8	5
Orchard	5	5	3	3	3	3	2		5			
Brome	5	5		5	5	5	5					
Meadow Fescue								3				
Reed Canary								4				

* Late Red Clover

The management will be for hay and aftermath pasture for 2 years and for pasture in the third (last) year. This is the management system for which the mixtures were formulated. Aftermath pasture dry matter yields will be obtained by clipping the mixture

either once or twice, depending on crop growth. Four or five clippings will be made to determine dry matter production as pasture in the third year. The exact number will depend on crop growth in that particular year. Some botanical separations may be made to estimate the legume-grass balance, if this is considered necessary, during the course of the test.

Results:

Establishment is satisfactory and the first data will be collected in 1955.

Comparison of Red Clover and Ladino Clover in Hay-Pasture Mixtures

Tossell, W.E. (Field Husbandry)

R.P.O.: F.H. 29-4 Year Initiated: 1954

Objectives:

Alfalfa and red clover are the most commonly used legume components of hay-pasture mixtures on well drained soils in Ontario. In recent years ladino clover has been included in place of, or in addition to; red clover in many mixtures. Information collected in Research Project F.H. 29-1 suggests (1) that ladino may be superior to red clover in hay-pasture mixtures on fields suited to ladino clover and when the mixture is harvested for 2 or more years, and (2) that the inclusion of both red clover and ladino clover in the same mixture may give lower yields than if either is included alone. Insufficient data are available from Research Project F.H. 29-1 to draw definite conclusions on these two points; the present project was designed to provide these critical data.

Procedure:

The 15 mixtures used are:

Species	Composition in lbs. per acre of Mixture number:														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Alfalfa			6	6	6	6	6	6	6	6	6	6	6	6	6
Red Clover	9	9	4	4	2		4	2		4	2		4	2	
Ladino					1	2		1	2		1	2		1	2
Timothy	5	5	5	2	2	2	3	3	3				3	3	3
Orchard	3			3	3	3	5	5	5	5	5	5			
Brome				5	5	5				7	7	7	7	7	7

Mixtures 4 to 15 provide the comparisons for this study. Mixtures 4 to 6 include three grasses and, mixtures 7 to 15 are two grass mixtures. The latter group consists of all combinations of two grass mixtures involving timothy, orchard and brome grass. Mixtures 1, 2 and 3 were included for another purpose - to evaluate these as short-term (1 year) mixtures and, to compare the three with standard (2-3 year) mixtures, such as numbers 4, 7, 10 and 13.

The mixtures were seeded in 8' x 22' plots in a randomized complete block design with four replicates at Guelph in May, 1954. The management used will be hay + aftermath pasture in the first and second years and, pasture in the third year. The number of aftermath clips (1 or 2) and pasture clips (4 or 5) taken will depend on the growth of the crop each year.

Botanical separations will be carried out to determine the contribution of red clover and ladino to the total dry matter yield of the mixture and, the effect of each on the other species in the mixture.

Results:

The establishment was excellent and the first data will be collected in 1955.

Formulation of Hay-Pasture Mixtures

Tossell, W.E.

R.P.O.: F.H. 29-5 Year Initiated: 1954

Objectives:

In formulating a mixture, three steps are involved. First, the species of legumes and grasses must be selected. Second, the proportion of legume to grass must be defined and, third, a seeding rate for each species of legume and grass must be selected. This experiment was undertaken to obtain information on steps 2 and 3 above.

Procedure:

A commonly used mixture consisting of alfalfa, red clover, ladino, timothy, orchard and brome grass was selected as the basic mixture. The seeding rates used were:

	Seeding Rate lbs./acre
Alfalfa	6, 8, 10
Red Clover	2, 4
Ladino	1
Timothy	3
Orchard	0, 2, 4, 8
Brome	5

In the legumes, the rate of ladino was held constant and, that of alfalfa and red clover varied so that the best proportion of alfalfa to red clover could be selected. Orchard grass is aggressive and, in many cases, dominates the mixture. The rates of timothy and brome were held constant at practical levels and the orchard

rates varied to allow selection of the best proportion of orchard grass to other grasses and, to the legumes.

Fourteen formulations were seeded in 8' x 22' plots in a randomized complete block design with four replications at Guelph in 1954. Management will be for hay + aftermath pasture for two years and, for pasture in the third year. Botanical separations of the herbage will be made to determine the contribution to the mixture of each species at each seeding rate.

Results:

Establishment was excellent. The first data will be collected in 1955.

Miscellaneous Hay and Grass Silage Projects

Tossell, W.E.

1. Mixtures Seeded on College Farm (Puslinch 1) in 1953.

	lbs./acre in Mixture Number						
	1	2	3	4	5	6	7
Alfalfa	15	15		20			6
Red Clover			9				4
Timothy			5			14	2
Orchard		10	3		12		3
Brome	20						5
Total	35	25	17	20	12	14	20

The mixtures were originally seeded for silage research. They were cut for hay on May 9th and, the aftermath pastured in 1954. Mixture 7 was sampled on May 9th to check on the contribution of each component to the mixture in the first harvest year.

The separation data are as follows:

	Sample 1 gms. D.M.	Sample 2 gms. D.M.	Mean %
Alfalfa	5	3	2
Red Clover	30	27	16
Timothy	37	35	20
Orchard	102	105	56
Brome	18	6	7

2. Mixtures Seeded on College Farm in 1954

a. Puslinch Field 2

The following two mixtures were seeded to (1) observe the performance of Redon red clover and Medon timothy on a field basis and, (2) observe a timothy-brome mixture with ladino-alfalfa base for hay and aftermath pasture production.

	lbs./acre	Mixture 1	Mixture 2
Alfalfa	6	Common	Common
Red Clover	4	"	Redon
Ladino	2	"	Common
Timothy	5	"	Medon
Brome	7	"	Common

b. Field B-2

The following two mixtures were seeded to observe the performance of Oron orchard grass and Rhizoma alfalfa on a field basis. Vernal was not available so Rhizoma was substituted. This field is droughty in some areas and will allow observation

of the performance of ladino clover under varying moisture conditions.

	lbs./acre	Mixture 1	Mixture 2
Alfalfa	6	Common	Rhizoma
Red Clover	4	"	Common
Ladino	1	"	"
Timothy	2	"	"
Orchard	3	"	Oron
Brome	5	"	Common

Hay Section in Rotation in A and B Sections (Field Husb. Area)

Samples were taken from ranges 3B, 5B and 6B on June 14, 1954 the day before the block was harvested as grass silage, to check on yield and composition of the standard mixture. Range 3B was heavy in orchard grass due to variation in seeding. The data for the hay cut in the first harvest year are as follows:

	Variety	Samples from Ranges 5 and 6			Mean %	Sample from Range 3
		No. 1	No. 2	No. 3		
Alfalfa	Grimm	20	32	30	27	9
Red Clover	Redon	43	34	42	40	15
Timothy	Medon	5	7	8	7	5
Orchard	Oron	32	25	20	26	71
Brome	Common	0	2	0	1	1
D.M.-tons/acre					2.4	2.4
% Moisture					79	75
% Protein					12.6	9.6

Orchard vs. Brome in a Beef Pasture

Tossell, W.E.

R.P.O.: F.H. 30-2 Year Initiated: 1954.

Objective:

To compare the value of orchard grass with that of brome grass in a beef pasture, considering beef production per acre and longevity of the productive pasture.

Procedure:

The trial is set up at the Arkell farm with three replicates each containing 2 three acre units. The two mixtures are:

	lbs./acre		lbs./acre
Alfalfa	10	Alfalfa	10
Ladino	1.5	Ladino	1.5
White Dutch	1.5	White Dutch	1.5
Orchard	12	Brome grass	15.

The area was seeded in May 1954 with a Brillion seeder and the stand was satisfactory in the fall of 1954 although the brome grass plots contained less grass than the orchard plots.

Recommended Long-Term Pasture Mixtures, 1954

Tossell, W.E.

R.P.O.: F.H. 30-3 Year Initiated: 1954

Objective:

Compare several long-term pasture mixtures currently recommended in Ontario.

Procedure:

The following mixtures were seeded on range 10A in 1954 without a companion crop. Establishment was good.

Species	lbs./acre in Mixture Number							
	Mixture Number							
	1	2	3	4	5	6	7	8
Alfalfa	3		6	4		3		5
Red Clover	5	5		3		3		2
Ladino	1	1	1		1.5	1	2	
White Dutch			1	1	1.5	1	1	1
Alsike				1	3		2	1
Timothy			2	3	5	4	4	4
Orchard	5	5	4	4		3	2	
Brome	6	4	7	6	6	6	7	
M. Fescue	3	5	2	3	4	3	2	
Reed Canary		4			4		4	
Kentucky Bluegrass								3
Red Top								1
Red Fescue								4

Rate of Seeding Ladino and Orchard Grass for Pasture

Tossell, W.E.

R.P.O.: F.H. 30-4 Year Initiated: 1954

Objective:

To estimate the optimum proportion of ladino to orchard in a long-term pasture and to estimate the optimum rate of seeding the mixture.

Procedure:

Four rates of ladino (½, 1, 2 and 3 lbs./acre) and 4 rates of orchard (3, 6, 9 and 12 lbs./acre) were seeded in all combinations in a split-plot design with ladino rates as the main plots. Establishment was excellent in 1954.

Results:

Establishment was excellent. The level was as follows:

	Seeding Rate lbs./acre	Approximate Number Plants/sq. foot October, 1954	Summary
Ladino	½	2-3	1 lb. rate and above contained sufficient. ½ lb. rate satisfactory but little light.
	3	5-7	
Orchard	3	2	6 lb. rate and above gave good stands; 3 lb. rate little thin.
	9	8	

Selection of Grasses for Use in Mixtures Containing Birdsfoot Trefoil

Tossell, W.E.

R.P.O.: F.H. 29-6. Year Initiated: 1954.

Procedure:

The following mixtures were established in 1954:

	lbs. of seed/acre				
Mixture No.	Birdsfoot Trefoil	Meadow Fescue	Brome	Timothy	Orchard
1	8	9			
2	8		12		
3	8			9	
4	8				9
5	8	3	4	3	3
6	8		4	3	3
7	8	3		3	3
8	8	3	4		
** 9	8	3	4	3	3
* 10			5	2	

* + 6 lbs. alfalfa
** + 6 lbs. alfalfa and 4 lbs. red clover

Evaluation of Species and Mixtures of Legumes and Grasses for Pasture under Irrigation

Tossell, W.E. and Ayers, H.D. (Field Husb. and Agric. Eng.)

R.P.O.: F.H. 30-5. Year Initiated: 1954.

Objectives:

1. Study of the effect of irrigation on pasture production considering dry matter yield, distribution of production throughout the growing season, and effect on survival and production of ladino clover.

2. Many pasture mixtures are in use in Ontario at present. Experimental work has shown that certain mixtures will respond more to applied fertilizers than others. This experiment was designed to determine whether there is a similar differential response of species or mixtures to applied water and, if so, to determine which mixture(s) are best suited for irrigated pastures.

The following comparisons will be made:

(a) Response of a legume-grass mixture compared with response from an all grass mixture such as would be present in a pasture field after the legumes have gone out,

(b) Response of ladino vs. white dutch clover to irrigation,

(c) Comparison of response of orchard, brome and timothy,

(d) Comparison of simple mixtures (1 legume: 1 grass) with complex mixtures (1-2 legumes; 3-4 grasses).

Procedure:

The eight mixtures, listed in Table 1, were seeded at Guelph in 1954. One set will be irrigated and one set not irrigated in subsequent years. The experimental design is a split-plot with irrigated and non-irrigated as the main plots. Four replications were seeded. The plot size is 10' x 22' for the non-irrigated plots and 10' x 44' for the irrigated plots.

Table 1: Mixtures seeded for Irrigation Trial.

	lbs./acre of each Component in Mixture number:							
	1	2	3	4	5	6	7	8
Alfalfa							6	
Ladino	2	2	2	2	1	2	1	
W. Dutch					1		1	
Orchard	8			5	5	4	4	4
Brome		12		7	7	6	7	6
M. Fescue						3	2	3
Timothy			8					

An application of 1500 pounds of 2-12-16 analysis fertilizer was made one week prior to seeding. Fertilizer will be applied each year to maintain available fertility at a high level and remove fertility as a major limiting factor in this experiment.

The plots will be clipped 4-6 times during each growing season for dry matter yield determinations. The number of clips each year will vary with the growing conditions. Botanical separations of the herbage will be made to collect information on the effect of irrigation, species and mixture on the survival and production of the legumes.

Two applications of water were made in 1954 to aid in establishing a uniform stand. The area was clipped twice for weed control. Establishment was excellent. Ladino growth was heavy in late fall so the area was clipped at a height of three inches on November 8, to remove some of the top growth and reduce the danger of smothering of the ladino during the winter.

Results:

The stand is excellent and the first data will be collected in 1955.

Rape and Kale Varieties

R.S. Fulkerson

R.P.O.: F.H. 31. Year Initiated: 1952.

Objectives:

In 1954 the objective of this study was to compare the yielding ability of several new varieties of rape and kale with old standard varieties.

Procedure:

The rape and kale variety test was seeded on July 12, in 24 inch rows, at approximately 2 lbs. of seed per acre. The test was cultivated once and harvested for green yield and dry matter determinations on October 6.

Results:

The 1954 results are shown in Table 1. The yields of all varieties are not high since the crop did not germinate, due to the very dry summer, until 3-4 weeks following seeding. As a group, the rape varieties outyielded the kale, with the exception of Sharpes' Hungry Gap Kale. The percent dry matter and green matter yields are shown.

Summary:

In 1954, as in previous years, rape, in general, outyielded kale. Improved varieties of rape yielded the same as the standard variety, Dwarf Essex, which, in 1953, was much below the newer varieties. One variety of kale yielded as high as the rape varieties.

Table 1:- Rape and Kale Yields per acre.

	Green Weight	% Dry Matter	tons D.M./acre 1954	1953	Mean
Gartons' English Rape	36,727	9.22	1.69		
Gartons' Early Giant Rape	39,622	9.06	1.79	2.54	2.16
Dwarf Essex Rape	37,305	9.40	1.74	2.30	2.02
Sharpes' Rape-Kale	38,656	8.72	1.68		
Sharpes' Hungry Gap Kale	39,255	9.23	1.80		
Sharpes' 1000 Headed Kale	28,602	9.39	1.34		
Gartons' Marrowstem Kale	29,711	8.60	1.28	2.07	1.68
Green Marrowstem Kale	31,005	8.85	1.37		
L.S.D. (0.05)			0.29		
C.V.			12.6		

Studies on Seed Production in Forage Grasses

R.S. Fulkerson

R.P.O.: F.H. 32

Objective:

The objectives of these studies are to obtain data on production practices which may influence the seed yield obtained from forage grasses and legumes.

Procedure:

(a) In this study ammonium nitrate was applied as an early spring application to several grass species in 1954. The rate of application ranged from 100 to 500 pounds per acre,

(b) A broadcast seeding of orchard grass at Brampton was harvested by three different methods in 1954, swathing, binding and direct combining. Each method was approximately one sixth of an acre in size and replicated three times.

(c) Two new seed production studies were initiated at Brampton in 1954, one with timothy and, one with orchard grass. The purpose of these studies is to ascertain the effect of row width and rate of seeding upon the seed yield. The two species were seeded in split-plot experiments with four replications. The main plots are row widths, which vary from 7 to 35 inches at 7 inch intervals and, the sub-plots are seeding rates, which range from 2½ to 15 pounds per acre, with orchard grass and, 2½ to 10 pounds with timothy, at 2½ pound intervals.

Results:

(a) The results of ammonium nitrate on orchard grass are given in Table 1. In all cases the application of the fertilizer increased

the yield of seed above control yield. In most cases the rate of application had little effect on the yield of seed with the lower rates giving nearly as high a yield as the higher ones. Row seedings at Brampton gave higher yields than those at Arkell, and the rows outyielded the broadcast planting at Brampton in 1953. The similar results with this fertilizer on three other species are given in Table 2.

(b) The effect of harvesting methods on the yield and quality of orchard grass seed is given in Table 3. Direct combining gave the lowest seed recovery of the three methods tried. It also gave more trash in the seed to be cleaned out but produced a marked reduction in the amount of hulled seed. The seed weight of the direct combined seed was high but the germination percentage was lower than with the other three methods tried.

(c) No results in 1954.

Summary:

Ammonium nitrate applications increased the seed yield of several grass species. Applications of this fertilizer, above 100 pounds per acre, may not be economical. Orchard grass, grown in rows, yielded more seed per acre than when sown broadcast and, the latter type of seeding gave a higher seed recovery when cut with a binder, or swathed, than when directly combined in 1954.

Table 1:- The Effect of Ammonium Nitrate Applications on the Seed Yields of Orchard Grass in pounds Clean Seed per acre.

Rate of Application	Row Seedings						Broadcast Seedings			Mean of Tests
	Arkell Farm			Brampton Farm			Brampton Farm			
	1953	1954	Mean	1953	1954	Mean	1953	1954	Mean	
100 lbs.	527	202	364	787	322	554	506	287	396	438
200 lbs.	455	233	344	729	320	524	558	334	446	438
300 lbs.	465	243	354	893	409	651	534	298	416	474
400 lbs.	496	246	371	696	339	518	586	455	520	470
500 lbs.	488	236	362	847	361	604	525	385	455	504
Check	418	109	264	746	283	514	345	220	282	353
Mean	475	212		783	339		509	330		446

Table 2:- The Effect of Ammonium Nitrate on the Seed Yields in pounds Clean Seed per acre of Three Grass Species.

Rate of Application	Red Fescue			Meadow Fescue	Timothy
	1953	1954	Mean	1954	1953
100 lbs.	638	135	386	186	386
200 lbs.	668	199	433	202	425
300 lbs.	737	163	450	176	417
400 lbs.	697	178	438	194	390
500 lbs.	682	169	425	187	362
Check	590	95	342	127	376

Table 3:- The Effect of Harvesting Methods on Seed Yield and Quality of Orchard Grass.

Methods of Harvest	Clean seed lbs./acre	Cleaning %	Hulled Seed %	Weight 100 Seeds mgms.	Germination %
Binder	298	15.9	18.5	109	82.7
Swath	261	11.7	14.7	110	80.7
Direct Combine	188	16.2	9.5	121	75.5

Alsike Seed Production Project

Fulkerson, R.S.

Five acres of alsike clover were seeded at Brampton in 1953. At the request of the Legume Research Committee this crop was treated with recommended practices and harvested for seed in 1954. The crop was sprayed by the Entomology Department and harvested by the Ag. Engineering Department. The crop data are listed below:

Date of seeding - May, 1953.

Rate of seedingof alsike-10 lbs. per acre.

Companion Crop - Simcoe oats seeded in 14" drills at the rate of 2 bus. per acre and harvested for grain.

Fertilizer - 350 lbs. of 4-24-12 at seeding time,
- 300 lbs. of 4-24-12 early spring, 1954.

Pollination - 3 colonies of honey bees per acre were placed in field on June 15th.

Sprayed - evening of June 18th at the rate of 1 lb. actual D.D.T. toxicant per acre.

Harvested - July 19th.

	Size of Area Harvested	Seed Yields per acre lbs.	bus.
Actual seed produced	24 sq. yds.	510	8.50
Direct Combined	1.86 acres	407	6.78
Swathed and combined	3.58 acres	346	5.77

Method of Seed Production in Redon Red Clover

Fulkerson, R.S.

A 6 acre field of Redon was seeded in May, 1953 at the Brampton farm for foundation seed production in 1954.

Seeding rate - 10 lbs. Redon per acre.

Companion crop - Simcoe oats at 2 bu. per acre in 14" drills.

Part of oats clipped at heading time.

All oats harvested for grain.

Fertilizer - 300 lbs. of 4-24-12 at seeding time

300 lbs. of 4-24-12 early spring 1954

Pollination - Colonies placed by the field for second crop seed.

Date hay removed	Acres	Sprayed 1 lb. D.D.T.	Seed Harvested
Not cut	2.3	June 25 evening Rained shortly after	Aug. 8
June 15 (1st bloom)	2.0	July 7	Sept. 20
June 25 (full bloom)	2.0	July 7	Sept. 20

Date hay removed	Seed Yield lbs./ac.	Florets per head	Wt. Seed per 100 heads	100-Seed Wt./mgms.
Not cut	192	105	8.0 gms.	200
June 15	99	130	15.8 gms.	154
June 25	40	---	--	---

Foundation Seed Production - 1954

Crop	Rate Seeding lbs./ac.	Year Seeded	Acres Harvested	Yield lbs./ac. 1953	1954	Mean	Date Harvest	Method Harvest
Brampton								
Medon	3	Fall '51	7	285	270	278	Aug. 12	binder
Oron								
Broadcast ✱	12	Spring '52	4					
Row	4	Fall '51	4	320	230	275✱✱	July 15	combine
Mefon	4	Spring '53	3	---	85		July 20	binder
Peron	4	Spring '52	1-1/2	160	200	180	July 25	binder
Redon ✱	10	Spring '53	6	---	110		Sept. 12	combine
Alon ✱	10	Spring '53	5-1/2	---	375		July 20	swath
Arkell								
Medon	3	Fall '51	1	360	200	280	Aug. 12	binder
Mefon	4	Fall '51	3/4	240	200	220	July 20	binder
Refon	4	Fall '51	1/4	400	150	275	July 20	binder
Oron	4	Fall '51	3/4	420	150	285	July 15	binder

✱ broadcast seedings, others are row seedings.
✱✱ mean over the two plantings.

Foundation Seed Stocks (lbs.)

	Carry over 1953	Produced 1954	Distributed 1954
Medon	3400	1900	302
Oron	1300	1400	731
Mefon	100	300	20
Peron	75	--	15
Canon	--	--	--
Redon	150	725	--
Alon	400	2000	10

Alfalfa Seed Source Tests

Twamley, B.E.

R.P.O.: F.H. 32-2. Year Initiated: 1952

Because some areas in the United States are much superior to others for the production of alfalfa seed it has become a common practice to have seed stocks of a variety, developed in one region, increased in an entirely different region. This practice brought to the forefront the question as to whether thereby a change in genetic constitution was introduced.

To answer this question seed of three varieties was collected in various states from fields which had been planted with breeder, foundation or registered seed, the fields varying in duration of stand from two to nine years. This seed was distributed to 14 stations in Canada and the U.S.A.

At the O.A.C. the seed received consisted of nine samples of Ranger, six of Buffalo, one of Grimm. It was planted in Range 8B on April 25, 1952 as a 6 - replicate test using a randomized block design. Establishment was uniformly good. The test was harvested twice for hay in 1953 and once in June, in 1954. Leaf spot ratings were taken in June, 1954 and recovery notes in October 1953: 400 pounds of 0-12-12 fertilizer were applied in September, 1953. The summer of 1954 was quite dry and, by late August, the test displayed such unevenness, presumably due to sub-soil heterogeneity, that it was plowed under.

The summary of the data collected during 1953-54 is given in the accompanying table.

Identification of Seed

Key No.	Variety	Class	State	Age of Stand	F.C. No.
1	Buffalo	Breeder's	Kansas	10	24373
2	Ranger	Found.	Nebraska	7	24456
3	Ranger	Cert.	Nebraska	5	24443
4	Buffalo	Cert.	Utah	4	24389
5	Ranger	Reg.	Idaho	5	24415
6	Ranger	Cert.	Arizona	6	24432
7	Buffalo	Reg.	Utah	5	24374
8	Ranger	Found.	Montcalm	-	24429
9	Ranger	Cert.	Utah	5	24430
10	Buffalo	Found.	Kansas	3	24394
11	Ranger	Cert.	Idaho	5	24423
12	Ranger	Reg.	Utah	5	24419
13	Buffalo	Cert.	California	4	24386
14	Ranger	Cert.	Calif.	5	24416
15	Grimm	Cert.	Utah	-	24438
16	Buffalo	Cert.	Kansas	5	24391

Summary of Data on Alfalfa Seed Source Test

Key No.	Variety	Yield in tons of D.M. per acre			Recovery Rating	Leaf Spot Rating
		June 1953	Aug. 1953	June 1954	Oct. 1953	June 1953
1	B	2.7	1.37	2.63	3.3	4.2
2	R	2.9	1.37	2.66	5.5	4.3
3	R	2.9	1.39	2.80	5.3	3.8
4	B	2.6	1.32	2.26	3.3	4.0
5	R	2.6	1.30	2.47	5.0	3.5
6	R	2.8	1.23	2.41	4.5	4.0
7	B	2.7	1.28	2.51	3.7	4.5
8	R	2.9	1.29	2.30	5.3	3.7
9	R	2.8	1.34	2.49	5.2	3.5
10	B	2.8	1.29	2.59	3.2	4.8
11	R	2.8	1.30	2.55	5.8	3.5
12	R	2.7	1.23	2.43	5.8	3.8
13	B	2.8	1.20	2.34	3.3	3.8
14	R	2.5	1.26	2.71	5.3	4.2
15	G	2.8	1.22	2.51	6.0	4.2
16	B	2.6	1.30	2.44	3.3	4.2
Means for:						
Buffalo		2.70	1.29	2.46	3.3	4.2
Ranger		2.77	1.30	2.54	5.3	3.8
Grimm		2.8	1.22	2.51	6.0	4.2
C.V.		10.7	8.7	12.6		
L.S.D.		N.S.	N.S.	N.S.		

Comments:

All differences in yields were non-significant. Ranger out-yielded Buffalo slightly. Ranger showed less aftermath in October, i.e.: went dormant earlier. Ranger showed more leaf spot resistance than Buffalo. In the fourteenth Alfalfa Improvement Conference report, Graumann summarizes the data collected from all contributing stations as follows.

"To date the data do not show any "breaks" in the performance due to areas of seed production, age of seed fields, number of generations or irrigated vs. non-irrigated fields; although certain entries have been significantly different from the breeder seed lots at some testing locations, the reason for the differences cannot, as yet, be attributed to any specific factor or combination of factors."

Rate of Seeding Alfalfa Alone and in Combination with Timothy or Smooth Brome Grass

Tossell, W.E. (Field Husbandry)

R.P.O.: F.H. 33-4 Year Initiated: 1950.

Objective:

Alfalfa is a valuable legume for hay-pasture mixtures in Ontario, especially for fields which are to remain in sod for several years. It has been commonly observed that, even under satisfactory conditions of drainage, soil fertility and crop management, alfalfa stands thin out. One of the factors determining plant population is rate of seeding. These experiments were initiated to study the effect of seeding rate on plant establishment, plant survival, hay yield and hay quality in alfalfa grown alone and with timothy or brome

grass.

Evidence is accumulating which indicates that brome is a good grass in a simple mixture with alfalfa for many farms in Ontario. Any further increase in the use of brome grass in hay-pasture mixtures will depend on its performance in comparison with timothy, the grass grown most commonly with alfalfa at present. These trials were designed to provide a comparison of timothy and brome grass in mixtures with alfalfa.

Procedure:

The experiments were carried out on a Burford loam soil at Guelph from 1950 to 1954. The first seeding was made in May, 1950 and involved five seeding rates of alfalfa grown alone, four seeding rates of alfalfa in a mixture with eight pounds of brome grass and three seeding rates of alfalfa with two pounds of timothy. The treatments were broadcast on plots 6 x 20 feet in size; oats were seeded at one bushel per acre as a companion crop and, then, the area was cultipacked. A randomized complete block design with four replications was used. Two crops of hay were removed in each of the three years following seeding. Because the general level of forage seedling establishment is so dependent on environmental conditions following seeding, an identical series was seeded in 1951. The only change in this series was that six replications were used in place of four.

Prior to and/or after each cutting treatment the alfalfa plants per square foot were counted using a 24" x 6" quadrat with six counts stratified throughout each plot. Botanical separations, to measure the percentage of alfalfa in the alfalfa-grass mixtures,

were made in the hay cut each year in the 1951 seeding and, in the second and third harvest years of the 1950 seeding. Separations on the second cut were made on selected seeding rates. Measurements were taken of the number of stems per plant, stem size and height of the alfalfa plants grown alone in 1951, the first harvest year of the 1950 seeding, to study the effect of seeding rate of these components on yield per acre. Fifteen plants were picked at random per plot. The number of stems was recorded for each plant and the diameter of one average stem per plant was measured six inches above the crown.

Results and Discussion

Plant Stands

The 1950 season was fair for establishment, while the 1951 season was excellent for establishment, as far as soil moisture was concerned. The stands were good in each year, but the general level of establishment differed widely, being 5.0 plants per square foot in the first harvest year from the 1950 seeding, and 11.6 in the first harvest year of the 1951 seeding. These data are shown in Table 1. The 3 pound rate in the 1951 seeding provided as many plants per square foot as the 15 pound rate in the 1950 seeding.

Table 1:- Number of Alfalfa Plants per squarefoot in May at Guelph

	R.S. lbs./acre	1950 Seeding			1951 Seeding			
		1951	1952	1953	1951+	1952	1953	1954
Alfalfa	3	2.8	2.6	2.3	8.2	7.6	3.7	4.8
	6	4.7	4.3	2.8	17.0	12.1	6.2	6.1
	9	5.9	5.3	3.2	25.0	15.7	6.8	6.0
	12	6.4	5.4	3.2	26.7	17.6	8.1	6.5
	15	7.5	6.8	4.1	36.2	20.7	8.6	7.0
Alfalfa+ timothy	3-2*	3.4	3.1	2.4	8.4	5.3	4.5	4.7
	6-2	3.9	3.8	3.0	13.0	8.3	5.6	6.6
	9-2	5.6	4.2	3.1	19.3	10.8	6.3	6.5
Alfalfa+ brome	3-8**	4.2	3.4	3.2	7.5	7.3	4.3	4.8
	6-8	4.3	3.7	2.2	14.1	8.8	6.1	6.1
	9-8	4.4	4.5	2.6	18.7	11.9	5.9	6.2
	12-8	7.0	6.4	3.3	28.1	13.0	5.9	6.6
Mean		5.0	4.4	2.9	19.1	11.6	6.0	6.0
L.S.D. (0.05)		1.9	1.3	1.0	4.9	2.3	1.1	1.5
C.V.		26.5	20.8	24.0	14.6	17.1	16.1	21.8
Mean of 3, 6 and 9 lb. rates								
Alfalfa		4.5	4.1	2.8	16.7	11.8	5.6	5.6
Alfalfa+timothy		4.3	3.7	2.8	13.6	8.1	5.5	5.9
Alfalfa+brome		4.3	3.9	2.7	13.4	9.3	5.4	5.7
L.S.D. (0.05)					2.3	1.3	0.6	0.9

* 3 lbs. alfalfa + 2 lbs. timothy
** 3 lbs. alfalfa + 8 lbs. brome
\+ July count in year of establishment

The relationship between seeding rate and plant stand is illustrated in Figure 1. In both seedings increases in seeding rate resulted in increases in plant stand. The response curve was studied in the pure stand alfalfa group in the first and third harvest years. This relationship was found to be linear in both tests, that is: the higher seeding rates established more plants and maintained a higher number throughout the three year period.

Plant stands declined each year in both tests. The rate of decline was greater with increasing seeding rates, as indicated by the decline in the slope of the response curve in succeeding years in Figure 1. Intraspecific competition is indicated.

The brome grass or timothy seedlings, competing with the alfalfa seedlings in the 1951 trial, lowered the establishment of alfalfa plants slightly. Stand counts in July 1951 indicated 12.5 brome grass and 19.8 timothy seedlings per square foot, as a mean over the 3, 6 and 9 pound rates of seeding alfalfa. The presence of the grass seedlings reduced the number of alfalfa plants from 16.7 in the pure stand alfalfa to 13.4 and, 13.6 in the alfalfa-brome and alfalfa-timothy mixtures, respectively. This differential in alfalfa stand was maintained in the first harvest year but was not found in subsequent years. No similar interspecific competition was found in the 1950 seeding, possibly because the general level of establishment was much lower so that seedling competition may have been reduced. In general, the addition of brome grass or timothy had no serious effect on alfalfa plant establishment and survival. Fribourg and Kennedy (1) came to a similar conclusion regarding timothy.

The five alfalfa rates used had no effect on the seedling stand of brome grass or timothy.

Dry Matter Yields

The data on dry matter yield are summarized in Table 2. The differences in plant stands, found in these studies, were not reflected in dry matter yields. No difference was shown in the 1950 seeding in either hay or aftermath in any of the three years. In the 1951 seeding a treatment difference was found in one instance only, the

first hay cut in 1952. These results are similar to those reported by Fribourg and Kennedy (1).

There was a tendency at the hay stage for the alfalfa-grass mixtures to yield slightly more than the pure stands of alfalfa in both tests and for the alfalfa-timothy mixtures to yield slightly more than the alfalfa-brome mixtures. The differences observed were not statistically significant in the 1950 seeding. In the 1951 seeding, alfalfa-timothy mixtures outyielded the alfalfa-brome mixtures and pure stand alfalfa at the hay stage, but all three produced similar aftermath yields.

Table 2:- Dry Matter Production (Hay + Aftermath) in tons per acre from the Alfalfa and Alfalfa-Grass Mixtures at Guelph

	R/S lbs./acre	1950 Seeding				1951 Seeding			
		1951	1952	1953	3 year average	1952	1953	1954	3 year average
Alfalfa	3	2.80	3.63	---	---	3.08	5.17	3.61	3.95
	6	2.99	3.43	---	---	2.94	5.56	3.82	4.04
	9	3.02	3.14	---	---	3.00	5.38	3.38	3.92
	12	2.88	3.02	---	---	3.04	5.06	3.66	3.92
	15	3.20	3.85	---	---	3.01	5.14	3.77	3.97
Alfalfa+ timothy	3-2*	3.19	3.78	4.10	3.69	3.76	5.36	3.93	4.35
	6-2	2.92	3.45	3.57	3.31	3.12	5.22	4.13	4.16
	9-2	3.06	3.38	3.80	3.41	3.24	5.42	3.83	4.17
Alfalfa+ brome	3-8**	2.90	3.59	3.65	3.38	3.07	4.97	3.76	3.93
	6-8	3.14	3.53	3.78	3.48	3.16	5.20	3.82	4.06
	9-8	3.06	3.32	3.39	3.26	3.32	5.14	3.81	4.09
	12-8	3.09	3.46	3.54	3.36	3.09	5.20	3.75	4.01
Mean		3.02	3.47	3.69	3.41	3.15	5.22	3.86	4.08
L.S.D. +(0.05)		N.S.	N.S.	N.S.		0.35	N.S.	N.S.	
C.V.		8.9	10.6	11.9		9.7	6.0	10.6	
Mean of 3, 6 and 9 lb. rates									
Alfalfa		2.94	3.40	---		3.01	5.60	3.60	3.97
Alfalfa+timothy		3.06	3.54	3.82	3.47	3.37	5.33	3.96	4.22
Alfalfa+brome		3.03	3.48	3.61	3.37	3.18	5.10	3.80	4.03
						0.27			

* 3 lbs. alfalfa + 2 lbs. timothy.
** 3 lbs. alfalfa + 8 lbs. brome.

Hay Quality

The botanical composition data are shown in Tables 3 and 4. The rate of seeding had no appreciable effect on the percentage of alfalfa in the mixture at the hay stage in June, and did not affect the amount of alfalfa in the aftermath in 1954. Brome grass was more competitive with alfalfa than timothy at the seeding rates used. In the 1951 seeding the alfalfa percentage was considerably lower in the alfalfa-brome mixtures and the decline in alfalfa percentage over the three year period was marked in brome mixtures. From an inspection of the hay and aftermath herbage it was apparent that brome grass had reduced the vigor of the alfalfa slightly. Alfalfa percentage was higher in the brome mixtures in the 1950 seeding. The different levels of establishment in 1950 and 1951 could account for this difference in the relative effect of brome grass on alfalfa in the two seedings. The higher plant population of the 1951 seeding could have resulted in greater inter-specific plant competition in the 1951 seeding. If this were the case, species differences in aggressiveness would show up in this seeding.

Although timothy and brome mixtures gave similar aftermath yields, the alfalfa-brome mixtures were the better balanced for pasture. The larger percentage of grass in the brome mixtures would aid in reducing the danger of bloat in alfalfa aftermath pastures.

Samples from the 9 pound rate of seeding were analyzed for crude protein percentage in 1954 by the Nutrition Department.

The results are as follows:

	% Crude Protein
Alfalfa	18.7
Alfalfa + timothy	17.6
Alfalfa + brome	14.5
Brome	9.4
Timothy	8.8

Brome grass was higher in crude protein than timothy but the alfalfa-timothy mixture was higher than the alfalfa-brome mixture, because of the higher percentage (60 vs. 26) of alfalfa in the mixture.

In 1951 three attributes of yield-number-of stems per plant, stem size and height were studied in pure stand alfalfa to assess the effect of rate of seeding on hay quality (Table 5).

Table 5:- Measurements of Plant Development taken on Alfalfa Plants at the Hay Stage in 1951 (1950 Seeding)

Rate of Seeding Alfalfa lbs. per acre	Alfalfa Plants per sq. foot	Number Stems per plant		Stem Size in mms.		Height in ins.	
		Hay	After.	Hay	After	Hay	After
3	2.8	10.9	9.2	3.3	2.1	30.0	33.1
6	4.7	7.0	8.7	3.4	2.0	30.8	34.5
9	5.9	6.6	7.7	3.2	2.0	31.8	32.8
12	6.4	6.2	7.3	2.7	2.1	31.2	31.6
15	7.5	8.0	7.5	2.6	2.1	30.0	31.5
Mean	5.4	7.7	8.1	3.0	2.1	30.8	32.6
L.S.D.-(0.05)	1.9	N.S.	1.3	0.3	N.S.	N.S.	1.5
C.V.	26.5	36.1	10.5	6.7	4.8	3.5	3.

Table 3:- Percent Alfalfa in the Alfalfa-Timothy and Alfalfa-Brome Mixtures at the Hay Stage in June.

	R/S lbs./acre	1950 Seeding			1951 Seeding			
		1952	1953	Mean	1952	1953	1954	Mean
Alfalfa+ timothy	3-2*	51	41	46	77	81	67	75
	6-2	52	41	47	73	84	77	78
	9-2	60	38	49	71	72	60	68
Alfalfa+ brome	3-8**	76	42	59	76	65	36	59
	6-8	66	42	54	66	50	66	61
	9-8	72	50	61	65	56	26	49
	12-8	64	58	61	63	55	73	64
Mean of 3, 6 and 9 lb. rates								
Alfalfa+timothy		54	40	47	74	79	68	74
Alfalfa+brome		71	45	58	69	57	43	56

* 3 lbs. alfalfa with 2 lbs. timothy.
** 3 lbs. alfalfa with 8 lbs. brome

Table 4:- Percent Alfalfa in the Aftermath of the Alfalfa-Timothy and Alfalfa-Brome Mixtures in the 1951 Seeding.

	R/S lbs./acre	1952	1953	1954	Mean
Alfalfa+ timothy	3-2*	-	-	82	
	6-2	-	-	81	
	9-2	96	90	82	89
Alfalfa+ brome	3-8**	-	-	70	
	6-8	-	-	70	
	9-8	88	61	65	71
	12-8	-	-	70	

* 3 lbs. alfalfa with 2 lbs. timothy.
** 3 lbs. alfalfa with 8 lbs. brome.

Plant height was not affected by seeding rate. Number of stems and stem size decreased in a linear manner with increased rates of seeding. The greater number of stems per plant at low seeding rates would, at least partially, explain the fact that no yield differences were found, even though plant stands were different. Smaller size of stem at the higher seeding rates indicate a finer type of hay. Hence, although seeding rates, within the range used in this study, did not greatly influence yield, it did have an affect on hay quality.

Summary

A study was initiated in 1950 to study the effect of seeding rate on yield and hay quality of alfalfa grown alone and in mixtures with timothy or brome grass. The study was completed in 1954. Plant stands responded in a linear manner to increases in seeding rate. Stands declined over the three year period, and the percentage decline was most rapid in high plant population.

Seeding rate had no appreciable effect on dry matter yields or on the amount of alfalfa in the hay, but affected hay quality, in that plants in the high populations had smaller stem size, hence produced a finer type of hay. Considering stand assurance, hay yield and hay quality, an intermediate rate of approximately 9 pounds, or slightly higher, would be satisfactory for alfalfa in simple mixtures with brome grass or timothy.

Timothy-alfalfa mixtures outyielded brome-alfalfa mixtures slightly and contained a higher percentage of alfalfa, but were less satisfactory at the aftermath stage, in that the brome grass mixtures contained a higher percentage of grass, a desirable feature

in the aftermath. More information is needed comparing these two grasses.

References:

1. Fribourg, H.A. and W.K. Kennedy. The effect of rates of seeding on the yield and survival of alfalfa in meadow mixtures. Agron. Jour. 45: 251-257. 1953.

The Effect of Rate of Seeding and Row Spacing of an Oat Companion Crop upon Forage Seeding Establishment.

Fulkerson, R.S. (Field Husbandry)

R.P.O.: F.H. 34 - 3 Year Initiated: 1953

Objectives: This study has been undertaken to ascertain the effect of oat seeding rates upon the establishment of grasses and legumes. It should be possible, from the data collected, to select the rate of seeding and row spacing for the most satisfactory establishment of grasses and legumes.

Procedure:
Simcoe oats were seeded with a Planet Jr. in plots 6' by 20' at rates varying by ½ bu. per acre in 14" drills. These plots were overseeded with a hay-pasture mixture composed of alfalfa 6, red clover 4, timothy 2, orchard 3, brome 5. The plots were not harrowed or packed due to several days of heavy spring rains after seeding. The test was seeded on May 14; alfalfa plant heights taken on July 23; oats harvested on August 9; and stand counts made on Sept. 8.

Results and Discussion:
The growing season in 1954 was not good. The spring planting was late, cold and wet. The summer was extremely dry and cool. These weather conditions were probably the main reasons for the high variability obtained in the stand counts. Yield and stand data are given in the table.

The yield of oats in 7" drills increased with an increase in seeding rate to 1½ bu. per acre. Further increases beyond this seeding rate had little effect on yield. In the 14" drills, increasing the seeding rate increased the yield of oats with the heavy seeding rate giving a very favourable yield of grain.

In establishment, only with red clover, were there significant differences in stand caused by rates of seeding. These differences were present in both the 7" and 14" drill widths. In all species, however, the stands tended to decrease as the seeding rate of oats increased in the 7" drills. In the 14" drills, the establishment increased with the seeding rate of oats to the 1½ bu. level, above which increasing the seeding rate seemed to depress the establishment of all species except brome grass.

On July 23, ten alfalfa plants were measured per plot as an index to seedling vigor under the various seeding rates of oats. These data, given in the table, show that, as the seeding rate increased, the plant heights significantly decreased in the 7" drills. This however, was not the case in the 14" drills where a uniform plant height was obtained. The seedlings, growing in the wide drills, were also observed to be more sturdy and vigorous than those in the 7" drills.

The interaction of seeding rates x row spacings was significant only in the oat yield data.

Summary:

Seeding oats at different rates had a significant effect on the yield of grain obtained. A maximum seeding rate for oats was obtained in 7" drills but not in 14" drills. Alfalfa, red clover, timothy, orchard and brome were established under the oats seeded at the various rates and spacings, but significant differences in stand were not obtained with any species. There was a definite trend in all species, however, to give poorer establishment as the seeding rate increased. Seeding down without a companion crop gave about the same grass-legume establishment as when a light seeding rate of oats was used.

Table 1:- Effect of Seeding Rate of Oats on Oat Yield and Forage Establishment in Plants per square foot - 1954.

	Rate of Seeding	Oat Yields bus./acre	Alfalfa Stand	Alfalfa Heights cms.	Red Clover Stand	Total Legume Stand	Timothy Stand	Orchard Stand	Brome Stand	Total Grass Stand	Total Stand
7" Drills	0	--	14.4	--	6.9	21.2	3.7	10.4	3.8	17.9	39.2
	1/2	48.9	12.9	26.3	4.9	19.3	3.9	12.3	3.8	20.0	39.3
	1	60.2	15.0	25.8	4.7	17.6	4.2	11.6	2.9	18.8	36.4
	1 1/2	67.9	14.1	21.3	4.3	19.4	3.1	9.0	2.8	14.9	34.3
	2	64.5	14.0	22.2	4.7	18.8	3.0	10.2	2.7	16.0	34.8
	2 1/2	67.8	13.4	19.7	3.7	17.6	2.4	10.6	3.5	16.5	34.1
	3	65.7	11.2	20.8	3.3	16.8	3.5	10.2	3.3	17.1	33.9
	3 1/2	65.0	12.2	20.8	2.8	14.0	2.5	7.6	2.7	12.8	26.9
	4	67.5	14.4	19.5	3.5	15.7	3.3	10.0	2.6	15.9	31.5
L.S.D.-(0.05)		8.2	- -	3.2	1.3	- -	- -	- -	- -	- -	- -
-(0.01)		11.0	- -	- -	- -	- -	- -	- -	- -	- -	- -
C.V.		11.1	25.2	12.2	39.5	26.5	41.2	33.5	38.7	31.2	26.3
14" Drills	1/2	44.3	14.0	24.5	4.9	18.9	3.5	12.2	3.0	18.8	37.7
	1	52.3	14.9	23.6	4.6	19.5	4.5	11.9	3.2	19.6	39.1
	1 1/2	57.1	15.8	25.0	6.0	21.8	4.3	11.7	3.4	19.4	41.2
	2	60.5	12.7	24.5	3.7	16.4	3.2	10.5	3.5	17.2	33.6
L.S.D.-(0.05)		3.7	- -	- -	1.0	- -	- -	- -	- -	- -	- -
-(0.01)		5.1	- -	- -	- -	- -	- -	- -	- -	- -	- -
C.V.		5.6	24.6	9.1	23.4	22.4	44.0	23.4	34.0	24.8	20.2
Mean over 1/2 through 2 bus. rates											
7" Drills		60.4	14.1	23.9	4.6	18.8	3.6	10.8	3.1	17.4	36.2
14" Drills		53.6	14.4	24.4	4.8	19.1	3.9	11.6	3.3	18.8	37.9

Methods of Seedbed Preparation and Seeding

Research Project Progress Report

Byers, G.L. and Fulkerson, R.S. (Ag. Eng. and Field Husbandry)

R.P.O.: Ag. Eng. 22 and F.H. 33-6. Year Initiated: 1953

Objective:

To investigate the ability of certain machines to place small seeds and the effect of the type of seedbed on this placement.

Seedbed Preparation:

All plots were fall plowed and the following seedbed preparation methods applied in the spring:

A. Disc Harrow,

B. Spring Tooth Harrow,

C. Rotary Tillage.

Methods of Seeding Used:

1. Single Disc Grain Drill: Brome and orchard grasses mixed with oats; remainder; broadcast from the grass seed box, followed by smoothing harrows.
2. Seeds placed as in (1) but followed by cultipacker.
3. All seeds (other than oats) placed with a cultipacker seeder.

Results:

1953 Seeding

The plant stand counts, taken in September, 1953, are listed in the Hay Research Report, 1953, page 13.

Table 1:- Hay Yields in tons per acre.

14% Moisture

Method of Seeding	Tillage Treatment			
	A	B	C	Mean
1	2.72	2.72	2.82	2.75
2	2.45	2.47	2.79	2.57
3	2.24	2.51	2.49	2.41
Mean	2.47	2.56	2.70	

L.S.D. For Method of Seeding - 5% Level = 0.24

L.S.D. For Interaction - 1% Level = 0.56 5% Level = 0.41

1954 Seeding:

The plant stand counts, taken in September, 1954, are listed in Tables 2 to 9 inclusive.

Table 2:- Red Clover Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	2.0	2.9	2.1	2.3
Grain Drill & Cultipacker	2.1	2.8	3.2	2.7
Cultipacker Seeder	0.8	0.6	0.8	0.7
Mean	1.6	2.1	2.0	

L.S.D. For Methods: 5% = 1.0 1% = 1.3

Table 3:- Alfalfa Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	4.0	6.1	3.5	4.6
Grain Drill & Cultipacker	7.7	8.3	7.2	7.7
Cultipacker Seeder	6.1	4.9	4.4	5.1
Mean	5.9	6.5	5.0	

L.S.D. For Method of Seeding 5% = 2.2 plants per square foot

Table 4:- Total Legumes (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	6.1	9.1	5.6	6.9
Grain Drill & Cultipacker	9.7	11.2	10.4	10.4
Cultipacker Seeder	6.9	5.6	5.2	5.9
Mean	7.6	8.6	7.0	

L.S.D. For Methods of Seeding: 5% = 2.8; 1% = 3.9%

Table 5:- Timothy Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	1.4	1.5	2.0	1.6
Grain Drill & Cultipacker	2.2	1.9	2.7	2.3
Cultipacker Seeder	1.0	0.5	0.9	0.8
Mean	1.5	1.3	1.9	

L.S.D. For Methods of Seeding 5% = 0.6; 1% = 0.9

Table 6:- Orchard Grass Plant Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	3.8	1.9	2.1	2.6
Grain Drill & Cultipacker	3.8	2.9	3.0	3.2
Cultipacker Seeder	2.0	1.5	2.2	1.9
Mean	3.2	2.1	2.4	

Table 7:- Brome Grass Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	2.4	1.4	2.2	2.0
Grain Drill & Cultipacker	1.7	2.0	1.8	1.8
Cultipacker Seeder	0.8	1.0	0.2	0.7
Mean	1.6	1.4	1.4	

L.S.D. For Methods of Seeding 5% = 0.6; 1% = 1.2

Table 8:- Total Grasses (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	7.6	4.8	6.3	6.3
Grain Drill & Cultipacker	7.7	6.8	7.5	7.3
Cultipacker Seeder	3.7	2.9	3.3	3.3
Mean	6.4	4.9	5.7	

L.S.D. For Methods of Seeding 5% = 1.9; 1% = 2.7

Table 9:- Total Grass & Legume Counts (Plants per square foot).

Method of Seeding	Disc Harrow	Field Cultivator	Rototiller	Mean
Grain Drill & Harrow	13.7	13.9	11.[illegible]	13.1
Grain Drill & Cultipacker	17.4	18.0	17.8	17.8
Cultipacker Seeder	10.6	8.5	8.4	9.2
Mean	13.9	13.4	12.7	

L.S.D. For Methods of Seeding 5% = 4.1; 1% = 5.7

Methods of Seeding Alfalfa and Brome Grass.

Fulkerson, R.S. and Byers, G.L.

R.P.O. Number: F.H. 33-7. Year Initiated: 1954

Objectives:
The purpose of this study is to ascertain the effect of the following factors on the establishment of a mixture of alfalfa and brome grass on a heavy clay soil.
(1) A firm versus a loose seedbed.
(2) Different methods of seeding.

Procedure:
The plot area at Brampton is a Haldimand clay soil that had been fall plowed and on which the seedbeds were prepared in the following manner. Discing three times, followed by harrowing, was carried out on the loose seedbed, whereas, the firm seedbed was prepared in the same manner, with the addition of cultipacking, followed by harrowing. All plots were 13' by 50', seeded May 20th, with oats at 2½ bushels, 4-12-12 fertilizer at 300 lbs.; a mixture of 10 lbs. alfalfa, and 10 lbs. of brome grass per acre, respectively.

Five core samples, 3½" in diameter and 4" deep, were taken per plot for volume weight determinations as an index to the compactness of the various seeding methods. Six square foot of plant counts were made per plot on September 20th as the establishment index.

Results and Discussion:
The establishment of the alfalfa and brome seeding is given in the Table. The stand is not high but satisfactory for alfalfa. Brome did not establish well. The low stand of both species in all plots was probably due to the extremely dry season. No differences in stand were obtained with either brome or alfalfa on firm vs. loose seedbeds. The volume weight determinations on these seedbeds were not significantly different nor was there a significant correlation between the volume weights and the stands of alfalfa obtained.

Significant differences in stand were obtained between methods of seeding with alfalfa. Packing after seeding was important and gave a higher stand of alfalfa than unpacked land. The band and Brillion seeders gave the poorest stands; with brome grass the same general trend in establishment was present. The different methods of seeding, though not significant, gave fewer brome plants per unit area with the band and Brillion seeders than the other methods used.

It is interesting to note the stand when expressed as a percentage of the number of seeds sown. This was calculated from the seed weight of the samples of alfalfa and brome grass used. The percent establishment is low in both species, but much poorer in brome than alfalfa.

Summary -

In 1954 there were no significant differences in the establishment of a mixture of alfalfa and brome grass on a loose versus a firm seedbed on Haldimand clay soil. Brome grass established poorly, alfalfa, fair. Establishment practices, involving packing after seeding, gave significantly higher stands of alfalfa than methods that did not include this practice. The methods of seeding used had little effect on brome grass establishment. On the average, only 15 percent of the alfalfa and 4 percent of the brome grass seed sown established.

Table 1:- Alfalfa and Brome Establishment (Plants per square foot) on Haldimand Clay Soil at Brampton in 1954.

Method of Seeding	Alfalfa				Bromegrass				Volume weight (grams)**
	Loose	Firm	Mean	Mean in Percent*	Loose	Firm	Mean	Mean in Percent*	
Grain drill & harrow	8.7	7.6	8.1	16.1	1.4	1.6	1.5	4.8	2144
Grain drill & pack before	8.4	6.6	7.5	15.1	1.9	1.2	1.6	5.2	2053
Grain drill & pack after	9.7	8.8	9.3	18.7	1.6	1.4	1.5	4.8	2163
Grain drill & pack before & after	9.6	9.2	9.4	18.9	1.2	1.4	1.3	4.2	2132
Brillion seeder	5.5	6.5	6.0	12.0	1.0	0.8	0.9	2.9	2108
Band seeder	4.9	5.3	5.1	10.2	1.0	1.2	1.1	3.5	2106
Band seeder and pack	8.4	7.6	8.0	16.1	1.3	1.6	1.5	4.8	2082
Mean	7.9	7.4	7.6	15.3	1.4	1.3	1.3	4.2	2113
L.S.D. - (0.05)			1.7				N.S.		N.S.
- (0.01)			2.2						
C.V.			21.5				42.8		6.1

* Percentage of seeds sown which established seedlings.

** Total of five three-inch cores, four inches deep, per plot.

Seed Treatment of Forage Legumes and Grasses with Three Antibiotics

Fulkerson, R.S. & Tossell, W.E. (Field Husbandry)

R.P.O.: F.H. 33-2 Year Initiated: 1953

Objectives:

These studies were initiated to evaluate three antibiotics - aureomycin, penicillin and terramycin, as seed treatments to aid seedling establishment in forage legumes and grasses.

Procedure:

Aureomycin, penicillin and terramycin were applied as seed treatments to alfalfa, red clover, timothy, brome grass and reed canary grass, in greenhouse and field studies. The antibiotics were applied at the rate of 1/32, 1/8, 1/2 and 2 grams per bushel of seed. Solutions or suspensions of the antibiotic were made using distilled water and diluted so that one cubic centimeters of the material on one ounce of seed gave the required application. After treatment the seed was dried, and planted immediately in all greenhouse studies and planted the following day in field trials.

Greenhouse studies were conducted with alfalfa, red clover and timothy in 1953 using Haldimand clay soil. The alfalfa series was replanted on a Guelph loam soil in 1954. An experimental unit in the greenhouse consisted of 100 seeds planted at a depth of 3/4 inches in a 4 inch clay pot. In 1953 alfalfa, red clover, brome grass and reed canary grass were grown in field trials at Guelph. In these studies, 100 seeds were placed at a depth of 3/4 inches in a 2 1/2 foot row. Four replications were used in all trials. Plant stands were taken at 2 to 4 weeks from planting. Vigor indices by scores, plant weights and heights were recorded at 10 to 16 weeks after seeding. The data on stand counts were transformed for analysis but the actual percentage data are reported.

Results:

Alfalfa

Treatment with antibiotics had no effect on number of seedlings established as shown in Tables 1 and 2. Striking effects were observed in seedling vigor in both greenhouse trials. Figure 1 shows the increase in vigor resulting from treatment in 1953 and Table 1 lists the height data from the 1954 greenhouse trial. All three antibiotics were effective in increasing vigor in both trials and in each case aureomycin and terramycin were equally effective. Penicillin was nearly as effective as those in the 1953 trial but only one-half as effective in increasing vigor in the 1954 study. In 1954 the mean seedling height for check, aureomycin, terramycin and penicillin was 10.6, 21.9, 20.6 and 14.9 grams respectively.

In both years the medium concentrations gave the greatest response as indicated in Figure 2 and Table 1. No phytotaxic effects were observed at the high rates. Although the stimulation of seedling

growth was striking in the greenhouse no such effects were detected in the three field trials.

Red Clover

The data in Table 3 indicate that the antibiotics did not affect plant stands. An increase in seedling vigor was observed in the greenhouse trial but, as shown in Figure 1, the increase was not as marked as in alfalfa. The response was similar at the 1/32, 1/8 and 1/2 gram rates and superior to the check. At the 2 gram rate the seedling vigor was similar to that in the check for terramycin and penicillin and slightly better than the check for aureomycin. In a subsequent test, using rates of 4 and 8 grams of each antibiotic, a depressing effect on growth was observed. In most cases the leaves were smaller, curled and slightly chlorotic, but plant stands were not reduced. No effect on plant stand or vigor was found in the row and plantings in the field.

Grasses

The results of studies with grasses are summarized in Table 4. Antibiotic seed treatments had no effect on the stand or seedling vigor of timothy grown in the greenhouse in 1953. Since more difficulty is experienced in obtaining satisfactory stands of brome grass and reed canary grass these grasses were used in the field trials. In addition one higher rate, 4 grams per bushel, was included to widen the range of concentrations tested. In general, there was no response to treatment although differences were found in plant counts in each of the two brome grass tests. These differences were variable and of questionable significance. In the first trial, the 1/32 and 4 gram rates in terramycin gave lower stands than the check, but no treatment increased stands. In the second trial, three treatments, terramycin 1/32 and 1/8 and penicillin 1/32, gave higher stands than the check, while stand counts were similar in other treatments.

Vigor differences were not detected in the three field trials. However, an average over the three tests gives 6.45, 6.14, 5.87 and 6.13 grams, dry matter for penicillin, aureomycin, terramycin and check, respectively. This suggests that penicillin may have slightly increased and, terramycin slightly decreased vigor. Such differences are small, and of little practical importance.

Summary:

Aureomycin, penicillin and terramycin were applied as seed treatments at several concentrations to five forage species. All three antibiotics stimulated seedling growth, markedly in alfalfa, moderately in red clover and, not at all in timothy in greenhouse trials. No stimulations was detected in field trials with alfalfa, red clover, brome grass and reed canary grass. The antibiotics had no effect on the number of seedlings established except in brome grass where small variable differences were obtained. In these experiments, seed treatment of these five forage species, with these antibiotics, was not beneficial.

TABLE 1. - Response of Alfalfa to Seed Treatment with Antibiotics in Greenhouse Studies.

Gms. Antibiotic per bushel	Percent Stand*		Seedling height at 16 weeks, 1954.	
	1953	1954	Gms.	Percent of check
Aureomycin 1/32	60.9	59.5	15.5	146
1/8	58.2	60.7	24.1	227
1/2	63.8	69.4	24.5	231
2	60.1	59.7	19.6	185
Terramycin 1/32	63.3	61.7	15.0	142
1/8	65.8	64.3	24.1	227
1/2	62.3	62.[illegible]	24.6	232
2	56.1	65.1	18.6	175
Penicillin 1/32	58.8	69.0	10.6	100
1/8	57.0	56.6	16.9	159
1/2	62.3	64.1	18.6	175
2	65.3	68.7	11.6	109
Check	61.4	70.8	10.6	100
L.S.D. (0.05)	N.S.	N.S.	3.2	
(0.01)	--	--	4.3	
C.V.	10.0	10.5	12.4	

* stand at 8 and 6 weeks in 1953 and 1954 respectively.

TABLE 2:- Response of Alfalfa to Seed Treatments with Antibiotics in Field Plantings at Guelph in 1953.

Gms. Antibiotic per bushel of seed	Row plantings			Broadcast planting May	
	May seeding: % stand at 5 weeks	August seeding: % stand at 4 weeks	vigor*	No. plants per sq. foot at 5 weeks	Dry weight 25 plants at 8 weeks
Aureomycin 1/32	29.7	47.4	3.8		
1/8	21.0	42.2	2.8		
1/2	27.6	46.2	3.0		
2	31.7	39.4	2.8	25.4	74.2
Terramycin 1/32	24.6	42.9	3.5		
1/8	37.1	40.5	2.5		
1/2	30.1	47.3	2.5	28.8	79.2
2	31.3	46.0	3.2		
Penicillin 1/32	35.5	33.5	3.0		
1/8	28.4	46.2	2.8		
1/2	25.1	45.8	3.2	24.9	84.0
2	25.3	44.4	3.0		
Check	27.6	47.4	3.2	24.0	82.5
L.S.D.-(0.05)	N.S.	N.S.	N.S.	N.S.	N.S.
C.V.	17.5	12.2	32.1	8.3	10.7

* vigor index 1 (good) to 5 (poor) at 9 weeks.

TABLE 3:- Response of Red Clover to Seed Treatment with Antibiotics in Greenhouse and Field Trials at Guelph in 1953.

Gms. Antibiotic per bushel of seed	Greenhouse Field row plantings				Field broadcast planting	
	% stand at 8 weeks	May seeding % stand*	August seeding % stand*	Vigor/	Plants per square foot at 5 weeks	Dry weight 25 plants at 8 weeks
Aureomycin 1/32	60.4	33.5	15.1	3.8		
1/8	64.3	35.0	15.5	2.8		
1/2	60.7	39.3	18.7	3.0	39.7	55.2
2	63.8	41.8	26.4	2.8		
Terramycin 1/32	64.3	44.6	14.3	3.5		
1/8	65.1	44.4	26.7	2.5		
1/2	65.1	43.7	25.8	2.5	35.2	56.2
2	64.5	38.4	20.1	3.2		
Penicillin 1/32	60.1	37.6	20.9	3.0		
1/8	57.3	35.0	19.4	3.2		
1/2	57.1	53.0	25.8	3.2	39.7	55.0
2	70.2	43.9	23.2	3.0		
Check	61.6	38.1	13.3	3.2	37.2	57.8
L.S.D.-(0.05)	N.S.	N.S.	N.S.		N.S.	N.S.
C.V.	6.1	12.4	20.1		18.0	14.9

* Stand counts at 5 and 4 weeks for May and August seedings, respectively.

/ Vigor index 1 (good) to 5 (poor) at 9 weeks.

TABLE 4.-Response of Grasses to Seed Treatment with Antibiotics in Greenhouse Field Plantings at Guelph in 1953.

Gms. of Antibiotic per bushel of seed	Greenhouse: Timothy	Field row plantings* Bromegrass I		Bromegrass II		Reed Canary grass	
	% stand at 7 weeks	% stand	Dry weight 25 plants	% stand	Dry weight 25 plants	% stand	Dry weight 25 plants
Aureomycin 1/32	94.5	68.9	6.44	55.6	4.82	51.7	6.04
1/8	90.2	62.9	5.97	52.4	6.35	49.7	5.09
1/2	93.2	61.6	8.74	55.2	6.36	47.7	7.04
2	90.2	60.0	7.65	46.3	5.24	50.5	5.36
4	---	67.4	6.10	55.6	5.24	47.6	5.66
Terramycin 1/32	92.2	48.6	7.49	61.6	5.32	44.4	5.62
1/8	89.6	57.9	6.36	61.6	4.74	51.4	5.54
1/2	87.6	61.6	7.58	54.4	5.13	47.2	5.90
2	83.1	55.7	6.52	44.4	4.85	39.4	5.78
4	---	48.6	6.60	44.6	4.76	47.4	5.92
Penicillin 1/32	92.6	67.1	6.32	61.7	6.31	51.4	5.37
1/8	80.1	65.9	7.98	49.3	5.94	49.5	5.30
1/2	89.6	61.1	6.68	52.3	5.30	46.0	6.02
2	90.8	59.9	8.97	49.6	5.22	43.9	8.06
4	---	67.3	7.25	58.3	5.42	52.6	6.57
Check	93.4	66.1	7.50	47.7	5.40	50.5	5.48
L.S.D. (0.05)	N.S.	Sig.	N.S.	Sig.	N.S.	N.S.	N.S.
C.V.	8.2	9.4	21.6	10.4	22.2	14.4	24.1

* Stand counts at 2 weeks and dry weight measurements at 6 weeks.

The Effect of Seed Treatment with Fungicides on Seedling Establishment

Fulkerson, R.S. (Field Husbandry)

R.P.O.:-F.H. 33-1 Year Initiated: 1949

Objectives:

This study has been carried on to evaluate the usefulness of fungicide seed treatments on the establishment of forage species.

Procedure:

The methods followed in 1954 were similar to those in previous reports. Fungicide seed treatment studies on alfalfa and red clover were conducted in field experiments at O.A.C., and the Barrie area.

Results and Discussion:

The data in Table 1 shows that treatment with some fungicides significantly increased the initial stand establishment with alfalfa and red clover at Barrie. However, as the summer progressed, these differences became much smaller and the final count taken at the end of September showed no significant differences between the establishment obtained from treated and untreated seed.

A similar test, seeded at Guelph in the early spring, failed to establish uniformly and was discarded. A second test, seeded on July 12 and counted on Sept. 2, showed highly significant increases with alfalfa and marked, but insignificant, increases in stand with red clover from fungicidal seed treatments. In all tests the treatment of Leytosan P in excess amounts tended to give superior stands over the other treatments.

In acre drill strips in a field at Barrie, fungicide treatment seemed to have little effect on the number of plants establishing (Table 2). Leytosan P. tended to increase the number of alfalfa plants (July) and this treatment also seemed to have more plants per square foot in the fall. With red clover, however, little differences in establishment could be observed. The two year summary of the red clover results obtained at Guelph and Barrie is given in Table 3. Seed treated with Leytosan P. established well at both locations in each of the two years.

Summary:

Fungicidal seed treatments in the Barrie area increased the stand of alfalfa in field studies by July 1 but had little effect on the final stand on September 28 in 1954. With red clover, the fungicides had little effect on establishment at both Barrie and Guelph in 1954 but gave highly significant increases in establishment in 1953 at both locations.

Table 1:- The Effect of Fungicide Seed Treatment on Establishment of Plants per square foot - 1954

Fungicide	BARRIE						GUELPH	
	Alfalfa			Red Clover			Alfalfa	Red Clover
	July 1	July 29	Sept. 28	July 1	July 29	Sept. 28	Sept. 2	Sept. 2
Leytosan P 5%	26.2	23.2	19.8	23.5	23.3	21.0	28.2	31.8
Arasan	20.7	21.6	20.6	34.3	23.0	20.8	28.6	29.6
Phygon	22.5	23.1	19.2	24.2	25.8	23.8	30.4	31.6
Ceresan M	24.2	19.3	19.8	25.3	26.0	21.4	26.2	26.8
Leytosan Ex.	29.7	31.4	22.7	23.6	24.4	21.4	35.4	32.7
Check	18.8	22.6	20.8	22.2	25.3	20.6	25.6	26.9
L.S.D.-(0.05)	5.2	5.0		7.5			4.0	
-(0.01)	7.2	7.0					5.5	
C.V.	14.7	14.2	24.8	19.5	14.0	26.0	11.2	13.9

Table 2:- Fungicide Treatments in Drill Strips

Plants per square foot - Barrie, 1954.

Fungicide	July 1		September 28	
	Alfalfa	Red Clover	Alfalfa	Red Clover
Arasan	8.0	4.7	6.8	4.8
Leytosan P	12.0	4.0	9.3	3.5
Phygon	10.4	4.8	8.7	3.5
Check	9.6	3.1	7.8	3.3

Table 3:- Two Year Summary of the Effect of Fungicides on Red Clover Establishment

Fungicide	Barrie			Guelph		
	1954	1953	Mean	1954	1953	Mean
Leytosan P.	23.5	47.6	35.5	31.8	40.7	36.2
Arasan	34.3	47.6	40.9	29.6	31.4	30.5
Phygon	24.2	31.0	27.6	31.6	31.2	31.4
Ceresan M.	25.3	41.6	33.4	26.8	31.6	29.2
Leytosan P. Ex.	23.6	45.2	34.4	32.7	36.8	34.7
Check	22.2	33.2	27.2	26.9	27.8	27.3
L.S.D.-(0.05)	7.5	9.3		-	6.3	
-(0.01)		12.9		-	8.7	
C.V.	19.5	15.0		13.9	12.6	

Timothy Strain Trials

Tossell, W.E.

R.P.O.: F.H. 12 and 28 Year Initiated: 1952

Timothy Strain Trial 1 - Seeded 1952

A test including 11 varieties was seeded in 1952 at Guelph, in co-operation with the U.S.D.A. at Beltsville. One group was seeded alone and, one, overseeded with redon red clover. Stands were variable as follows:

Strain	Establishment[1] Fall 1952
Marietta	1.2
Ontario Common	1.3
Medon	1.5
Climax	1.5
Itasca	1.7
Milton	1.8
Drummond	2.2
Hopkins	3.4
Cornell 4059	3.7
Lorraine	3.8
Cornell 1777	4.8

[1] 1 (good) to 5 (fair)

The data collected on this trial are summarized in Tables 1, 2 and 5.

Table 1:- Timothy Strain Trial, Guelph, 1953, tons D.M./acre from Series in Pure Stand.

Strain	1953			1954*	Hay
	Hay	Aftermath	Total	Hay	2 yr. mean
Ontario Common	3.10	0.31	3.41	1.75	2.42
Milton	3.30	0.26	3.56	1.50	2.40
Medon	3.25	0.22	3.47	1.45	2.35
Marietta	2.99	0.34	3.33	1.73	2.36
Lorraine	2.88	0.22	3.10	1.39	2.14
Itasca	3.20	0.26	3.46	1.62	2.41
Climax	3.07	0.33	3.40	1.59	2.33
Drummond	3.11	0.18	3.29	1.37	2.24
Hopkins	2.96	0.17	3.13	1.27	2.12
Cornell 1777	2.61	0.30	2.91	1.57	2.09
Cornell 4059	2.95	0.32	3.27	1.66	2.30
Mean	3.04	0.26	3.30	1.54	
L.S.D.-(0.05)	0.26	0.07	0.28	0.26	
C.V.	6.1	19.2	5.9	14.5	

* Aftermath production low in all strains so not harvested.

Table 2:- Timothy Strain Trial, Guelph, 1952.- tons D.M./acre in June from Series where Timothy was overseeded with Red Clover.

Strain	Timothy + Red Clover				Timothy Component		
	1953		1954		1953	1954	Mean
	tons/ac.	% Red Clover	tons/ac.	% Red Clover	tons/ac.	tons/ac.	tons/ac.
Ontario Common	3.16	55	2.74	18	1.36	2.25	1.80
Milton	3.28	59	2.78	16	1.31	2.35	1.83
Medon	3.22	45	2.87	19	1.72	2.34	2.03
Marietta	3.20	58	2.83	18	1.54	2.53	1.84
Lorraine	3.32	73	2.82	22	0.88	2.14	1.51
Itasca	3.22	60	2.82	6	1.31	2.65	1.98
Climax	3.50	60	2.88	17	1.38	2.40	1.89
Drummond	3.24	60	2.79	18	1.29	2.31	1.80
Hopkins	3.23	68	2.51	24	1.01	2.24	1.62
Cornell 1777	3.23	69	2.76	21	0.93	2.23	1.58
Cornell 4059	3.33	55	2.95	22	1.49	2.35	1.91
Mean	3.26	60	2.80	18	1.27	2.32	
L.S.D. (0.05)	N.S.		N.S.		N.S.	N.S.	
C.V.	8.0		5.9		24.1	12.2	

Timothy Strain Trial 11 - Seeded 1953

In 1953 a second group of 11 strains was seeded at Guelph; four selections from the Hespeler introduction nurseries were included. In addition 5 strains were seeded in regional uniform tests at Kemptville and Guelph in 1953.

Table 3:- Timothy Strain Trial 1953, Guelph - Summary 1954.

Strain	Establishment* Fall 1953	tons D.M./acre			% Leaf **		
		Hay	After	Total	Rep. 1	Rep. 4	Mean
Medon	3.0	3.67	0.61	4.28	51	--	
Climax	3.0	3.58	0.56	4.14	61	43	52
Milton	2.5	3.85	0.54	4.39	40	40	40
S-48	3.7	2.92	0.38	3.30			
S-51	4.2	3.06	0.48	3.54			
S-50	2.5	2.78	0.14	2.92			
Danish Selection	4.0	3.55	0.77	4.32			
Medon Selection	2.2	3.74	0.32	4.06			
Paton Selection	3.5	3.34	0.56	3.90			
Finnish Selection	3.2	3.28	0.43	3.71			
Common	3.2	3.66	0.59	4.25	40	42	41
Mean		3.40	0.49	3.89			
L.S.D.-(0.05)		0.57	0.20	0.65			
C.V.		11.8	28.8	11.8			

* 1 (good) to 5 (fair)
** mean over 2 replicates except Medon which is from 1 replicate only.

Table 4:- Regional Uniform Timothy Strain Trials. Yield in tons Dry Matter per acre in First Harvest Year, 1954.

Strain	Kemptville			Guelph			Mean over Stations		
	Hay	After.	Total	Hay	After.	Total	Hay	After.	Total
Climax	2.15	1.17	3.32	3.58	0.56	4.14	2.86	0.86	3.72
Milton	2.09	1.08	3.17	3.85	0.54	4.39	2.97	0.81	3.78
Medon	1.89	1.16	3.05	3.67	0.61	4.28	2.78	0.88	3.66
S-48	1.84	1.09	2.93	2.92	0.38	3.30	2.38	0.74	3.12
Common	1.95	1.50	3.45	3.66	0.59	4.25	2.80	1.04	3.84
Mean	1.98	1.20	3.18	3.54	0.54	4.07	2.76	0.87	3.62
L.S.D.(0.05)	N.S.	N.S.	N.S.	0.57	0.20	0.65			
C.V.	11.3	16.7	10.4	11.8	28.8	11.8			

Table 5:- Quality Tests on Timothy Hay in 1954.

Strain	% Leaf	% Protein				
	1953 trial Guelph	1953 trial Guelph	1952 trial Red Clover	Guelph series	1953 trial Kemptville	Mean
Medon	51.3*	7.7*	6.8		8.4	7.6
Climax	51.8	7.7	7.0		8.1	7.6
Drummond	--	--	7.7		--	--
Milton	40.0	8.0	--		7.2	--
Common	41.4	7.4	6.4		7.9	7.2
S-48	--	--	--		9.8	--

* 1 replicate only: others, mean of 2 rep's, except Kemptville group which is a mean of 3 reps.

Orchard Grass Breeding and Testing

Tossell, W.E.

R.P.O.: F.H. 11 Year Initiated: 1953

Orchard grass has proven to be an excellent grass in well managed pastures. Its main disadvantage in pasture, especially freely grazed beef pasture is that it is not as palatable after it is in head as brome or bluegrass. This undesirable feature can be ascribed to the steminess of commercial orchard grass. It may be overcome by two means: first, a rotational grazing management using part of the pasture for silage, or hay if necessary, will prevent the grass reaching maturity; second, a leafy variety would minimize the problem and allow more flexible systems of pasture management.

Orchard is useful in hay-pasture mixtures because of the aftermath recovery, especially in the dry mid-summer period. It has been used only moderately in such mixtures because of the lower quality hay it produces in comparison with brome and timothy. Early maturity, steminess, and, to a lesser extent, susceptibility to certain diseases, are responsible for the lowered hay quality. If orchard is to increase in hay-pasture mixtures a later maturing, leafy variety is necessary. The leafier variety would increase its use in pasture mixtures as well since such a variety could be managed more easily.

Orchard Strain Trial 1953

A number of strains and varieties which might be of value in themselves, or as breeding materials, were collected. The strains from Europe were the best strains available at the present time. The 25 strains were seeded in broadcast plots 4.5' x 22' in size in the spring of 1953. A 5 x 5 simple lattice, repeated, was used.

The yield level (mean 3.07 tons per acre) was sufficiently high that strain differences would show up (Tables 1 and 2). The strains which gave the best performance were Frode, Pasture Laboratory Synthetic 5, Tardus 11, Otofte Late 11, and Weibull H-11, considering lateness, leafiness and yield. These were also satisfactory in panicle volume. It is of interest to note that, in the dry summer of 1954, differences in aftermath production were found. Frode, Weibull, H-11 and H-2 were superior to common.

Regional Uniform Orchard Strain Trial 1953

Five strains were seeded at Guelph, Kemptville and Ridgetown in 1953. Establishment was excellent at the first two locations but only fair at Ridgetown. Aftermath recovery in 1954 was excellent at Kemptville and, very poor at Guelph and Ridgetown because of the exceptionally dry season. The 1954 data are listed in Table 3.

Orchard Grass Breeding

The breeding program will not be stressed until the available strains are carefully assessed. In the meantime breeding stocks are being built up and carried along. The available material includes:

1. Orchard Source Nursery 1951 - 528 plants from 24 introductions or selections from introductions accumulated under Project F.H. 1.
2. Orchard Source Nursery 1952 - 5000 plants of Oron.
3. Orchard Source Nursery 1953 - Polycross seed from 115 clones, selected at U.S.A. stations was obtained from the Pasture Laboratory, Pennsylvania. These, along with several other lots were seeded in a short row observational nursery to screen for maturity (see Table 4) and also planted in a space plant nursery. The data

on maturity may be summarized as follows:

In Bloom June	No Lots	In Bloom June	No Lots
10	5	16	10
11	7	17	3
12	7	18	7
13	5	19	25
14	24	20	12
15	14	21	1

Thirty-eight lots bloomed 6 - 8 days later than Common (June 13). When general appearance, mainly leafiness was considered, along with maturity 27 lots were reasonably good. The group XLI-8,-13,-17,-23 and-24 was the best. These lots were fine, leafy, medium height and leafed well up on the stems. Pa-0-47 was similar to this group and retained colour well. The group Pa-0-13,-14,-15,-18,-19,-20,-24 was similar but not as good as above group. The lots MIV-14,-16,-17,-18, -21, and -22 were similar but not as good as the first group. These lots were tall, late, had good leaf, but were a little coarse.

4. Polycross Block, 1954. In 1953, 76 plants were selected from Oron source nursery, 1952. The selections, and bases for selection, are listed in Table 5. These were planted in an isolated polycross nursery at the Potato Farm in the spring of 1954. Single units were replicated 7 times. The purpose of the block is twofold, first, it was necessary to establish a source of breeders' seed of the Oron variety. These 76 selections will be retained in a polycross nursery and the bulb seed used to produce foundation seed at the Brampton seed farm as long as there is a demand for

the Oron variety; second, the selections may be useful for breeding purposes. Notes will be taken on the individual selections in 1955 and 1956. The best selections phenotypically will be evaluated in a polycross progeny test.

Table 1:- Orchard Grass Strain Trial, 1953 - Summary 1954.

Strain	Origin	Seed Wt. mgms.	Seedling Height in G.H. 4 weeks	Fall Vigor** 15/10/53	Fall Vigor** 12/11/54	Spring* Vigor 30/4/54	% Protein June/54
Common	Canada	0.101	8.8	1.8	2.0	4.0	9.5
- Oron	Ontario	0.115	8.8	1.5	2.0	3.0	8.6
- Wisc. 52	Wisc.	0.106	7.9	1.8	3.0	4.0	
- Potomac	Md.	0.100	9.1	1.5	2.8	2.0	
Past. Lab.1	Penn.	0.102	7.1	2.0	2.8	4.2	
- Past. Lab.5	Penn.	0.087	6.6	3.8	3.0	4.2	9.6
Past. Lab.7	Penn.			3.5	4.8	2.7	
H-2	U.S.A.	0.088	8.8	2.2	1.2	4.7	
M2-11142	Iowa	0.078	7.8	2.5	2.5	5.2	
P-2453	Wash.	0.105	8.2	3.2	4.0	2.0	
233	Oregon			2.0	1.0	10.0	10.8
o S-37	Wales	0.088	7.8	1.2	1.0	7.2	10.4
o S-143	Wales	0.101	7.6	1.5	1.0	7.7	
o Gartons 337	England	0.097	8.8	1.0	1.0	6.2	
o Scotia	Scotland	0.104	7.2	2.8	1.5	5.7	
Akaroa	N.Zealand	0.098	6.8	2.0	1.0	6.5	
/ Tammisto	Finland	0.120	7.6	4.2	4.8	3.7	
/ Otofte Late II	Denmark			1.5	1.5	4.7	
/ Frode	Sweden	0.114	8.4	2.0	2.0	4.7	8.8
/ Tardus II	Sweden	0.113	8.6	1.8	1.8	3.5	
Weibull H-II	Sweden	0.136	8.0	1.0	1.0	5.7	
Leth. 627	Alta.	0.143	8.7	4.0	5.0	2.0	
Leth. 628	Alta.	0.136	9.0	3.0	3.8	1.7	
Leth. 629	Alta.	0.138	9.4	4.5	4.8	1.7	
Leth. 630	Alta.	0.138	9.7	4.2	5.0	2.0	9.0
Mean		0.109	8.2	2.4	2.6	4.4	
L.S.D.- (0.05)						1.0	
C.V.						16.4	
Mean - N. American	(-)	0.102	8.1	2.2	2.7	3.3	
European	(/)	0.116	8.2	2.4	2.5	4.2	
British	(o)	0.098	7.8	1.6	1.1	6.7	

* 1 (good) to 10 (poor)
** 1 (good) to 5 (poor)

Table 2:- Orchard Grass Strain Trial, 1953 - Summary 1954.

Strain		Date in Bloom June/54	Leaf*	Panicle Volume**	tons D.M./acre 1954 Hay	Aftermath	Total
Common		15	8.5	8.0	2.72	0.42	3.13
- Oron		16	9.0	8.0	2.74	0.40	3.16
- Wisc. 52		16	6.2	8.2	3.02	0.48	3.48
- Potomac		14	6.5	8.0	2.84	0.48	3.30
Past. Lab. 1		15	7.2	7.5	2.90	0.47	3.37
- Past. Lab. 5		20	3.2	8.2	2.88	0.33	3.21
Past. Lab. 7		22	3.0	4.8	2.68	0.43	3.14
H-2		20	1.0	1.8	2.33	0.57	2.92
M2-11142		16	9.0	7.5	2.72	0.46	3.20
P-2453		19	7.8	6.2	2.61	0.39	2.98
233		20	1.8	1.0	1.74	0.45	2.20
o S-37		20	1.0	2.2	2.36	0.51	2.87
o S-143		20	1.5	2.2	2.25	0.48	2.72
o Gartons 337		19	1.8	2.2	2.17	0.47	2.63
o Scotia		19	6.0	6.0	2.44	0.40	2.83
Akaroa		19	4.7	3.0	2.23	0.47	2.72
/ Tammisto		18	4.5	7.2	2.82	0.26	3.10
/ Otofte Late II		19	3.8	7.0	2.76	0.46	3.19
/ Frode		20	2.0	4.8	2.79	0.61	3.45
/ Tardus II		19	3.5	5.8	2.76	0.45	3.20
Weibull H-II		20	6.8	8.0	2.74	0.57	3.35
Leth. 627		11	9.0	8.8	2.74	0.23	2.96
Leth. 628		12	8.8	10.0	3.12	0.29	3.44
Leth. 629		12	9.0	9.8	2.82	0.24	4.01
Leth. 630		11	9.5	8.8	2.98	0.19	3.14
Mean		17	5.4	6.2	2.65	0.42	3.07
L.S.D.-(0.05)					0.34	0.10	0.38
C.V.					9.0	17.7	8.6
Mean - N.American	(-)	16	6.2	8.1	2.87	0.42	3.29
European	(/)	19	3.4	6.2	2.78	0.59	3.24
British	(o)	20	2.6	3.2	2.30	0.46	2.76

* 1 (good) to 10 (poor)
** 1 (low) to 10 (high)

Table 3:- Regional Uniform Orchard Grass Strain Trials, 1953
Yield in tons Dry Matter per acre in First Harvest year - 1954.

Strain	Ridgetown	Kemptville			Guelph			Mean over Kemptville and Guelph		
	Hay	Hay	After.	Total	Hay	After.	Total	Hay	After.	Total
Hercules	0.28	1.30	1.34	2.64	2.90	0.38	3.28	2.10	0.86	2.96
Oron	0.33	1.41	1.17	2.58	2.52	0.35	2.87	1.96	0.76	2.72
Danish	0.40	1.13	1.24	2.37	2.54	0.37	2.91	1.84	0.80	2.64
S-26	0.27	0.68*	1.25*	1.93*	1.96	0.42	2.38	-	-	-
Common	0.34	1.20	1.22	2.42	2.58	0.39	2.97	1.89	0.80	2.69
Mean	0.32	1.26	1.24	2.50	2.50	0.38	2.88	1.88	0.81	2.69
S.D. - (0.05)	N.S.	N.S.	N.S.	N.S.	0.30	N.S.	0.37			
C.V.	24.2	17.7	11.3	11.3	8.0	11.8	8.5			

* Mean over reps. 1 and 2.

Regional Uniform Orchard Grass Strain Trial - 1954.

Strain	Guelph			Kemptville
	Spring Vigor* 30/4/54	Date in Bloom June/54	% Leaf	% Protein in Hay (June)
Hercules	2.3	19	63	8.4
Oron	1.5	16	55	7.8
Danish	1.3	15	58	8.1
S-26	4.5	20	84	10.4
Common	1.8	15	56	7.4

* 1 (good) to 5 (poor)
L.S.D. - (0.05) is 0.57

Table 4:- Orchard Grass Source Nursery, 1953 - 1954 Summary

Lot	Date in[1] Head	Bloom	Lot	Date in[1] Head	Bloom	Lot	Date in[1] Head	Bloom
Pa-0-1	6	14	MII 7	4	14	☆MIV 24	5	18
Pa-0-4	3	14	MII 10	3	12	XXXVII 19	31	11
Pa-0-7	4	14	MII 11	2	11	XXXVIII 8	2	14
Pa-0-8	2	14	MII 18	31	10	XXIX 11	3	14
Pa-0-9	4	14	MII 19	3	14	XXIX 21	3	15
Pa-0-10	5	16	MLL 21	3	15	☆XXIX 23	8	19
P.L.Syn 1	2	13	P.L.Syn 5	10	19	Commercial	3	13
Pa-0-11	5	17	MII 26	3	15	XXIX 34	5	16
Pa-0-12	6	19	MII 29	3	15	☆XXIX 45	8	19
☆Pa-0-13	7	18	MII 30	3	14	XXIX 52	9	19
☆Pa-0-14	8	19	MII 31	3	15	☆XXIX 53	8	14
☆Pa-0-15	5	19	MII 33	2	14	☆XXIX 55	8	19
☆Pa-0-18	8	19	MII 36	2	14	XXX 17	5	18
☆Pa-0-19	8	19	MII 44	3	12	XXX 23	4	14
Pa-0-20	9	19	MII 45	3	13	XXX 27	9	20
☆Pa-0-24	8	19	MII 46	5	15	XXX 32	9	19
P.L.Syn 1	2	12	Hercules	8	17	P.L.Syn 5	10	19
Oron	4	13	Commercial	5	15	☆XXX 38	10	19
Pa-0-28	5	16	MII 49	2	13	☆XXX 48	9	20
Pa-0-33	5	13	MII 50	3	14	XXX 54	8	18
Pa-0-38	7	16	MII 59	4	14	XLI 6	9	19
Pa-0-39	8	16	MIII 3	5	15	☆XLI 8	9	18
☆Pa-0-40	10	20	MIII 8	5	15	☆XLI 13	10	20
Pa-0-41	5	15	MIII 9	4	14	☆XLI 17	9	19
Pa-0-42	8	19	MIII 11	5	15	☆XLI 23	10	20
Pa-0-43	4	14	MIII 18	5	15	☆XLI 24	10	19
S-26	9	20	P.L.Syn 1	3	14	P.L.Syn 5	10	19
Pa-0-44	5	15	MIII 19	3	14	☆XLII 4	10	20
Pa-0-45	5	15	MIII 20	4	14	NY-49-142	5	15
☆Pa-0-46	9	19	MIII 21	8	17	NY-49-144	9	18
☆☆Pa-0-47	10	19	MIII 23	5	14	NY-49-151	8	16
Pa-0-49	8	16	MIII 24	7	16	NY-49-152	8	18
☆☆Pa-0-50	9	19	MIII 37	5	15	NY-49-154	8	16
Pa-0-51	8	19	MIII 56	2	11	NY-49-155	4	14
☆Pa-0-53	10	21	MIV 4	7	16	Min-0-54	5	16
MI-I	3	11	MIV 5	8	17	Min-0-56	5	13
P.L.Syn 5	9	19	P.L.Syn 1	2	14	Commercial	4	13
MI-5	2	11	MIV 6	9	19	Min-0-59	9	19
MI-8	31+	11	MIV 13	8	16	Min-0-62	3	12
MI-10	31+	11	MIV 14	9	20	Leth 627	31	10
MI-13	2	12	MIV 16	9	20	Leth 628	2	10
MI-16	2	12	MIV 17	8	20	Leth 629	3	10
MI-17	2	12	☆MIV 18	9	20	Leth 630	2	10
MI-19	3	12	MIV 21	8	20	88	8	19
MI-21	3	13	☆☆MIV 22	9	20	Trogden	4	14

☆ and ☆☆ - best material
+ May
June

Bromegrass Strain Trial, 1953 - Summary 1954

Tossell, W.E.

R.P.O.: F.H. 12 and 28 Year Initiated: 1953

Strain	Origin	100-Seed Weight mgms.	Blotter Germination %
✠ Can. Common	Composite 5 lots	348	94
✠ Parkland	Saskatoon	359	76
✠ Superior	Saskatoon	279	86
✠ S-4088	Saskatoon	399	83
✠ Manchar	Washington	386	87
✠ Martin	Minnesota	328	97
+ Achenbach	Kansas	288	89
+ Fischer	Iowa	305	89
+ Lincoln	Nebraska	279	90
+ Lyon	Nebraska	281	91
+ Lancaster	Nebraska	253	93
+ Southland	Oklahoma	284	90
Elsberry	Missouri	222	82
Homesteader	S. Dakota	289	63
B-in-12	Utah	294	90
Br. 3	Iowa	268	91
Mandan 404	N. Dakota	264	92
N.Y.B.	Cornell	338	90
N.Y.H.	Cornell	310	90
Mean Northern (✠)		350	87
Mean Southern (+)		282	90

Table 1:- Bromegrass Strain Trial, Guelph - Summary 1954.

Strain	Fall Vigor* 15/10/53	Spring Vigor* 28/4/54	Date in Head June/54	tons D.M./acre Hay	After	Total
* Can. Common	7.2	7.5	8	3.48	0.39	3.87
* Parkland	8.5	8.8	12	3.34	0.35	3.69
* Superior	8.2	7.8	11	3.21	0.33	3.54
* S-4088	6.8	7.6	11	3.49	0.36	3.85
* Manchar	3.0	4.2	4	4.02	0.50	4.52
* Martin	3.8	4.0	10	3.94	0.58	4.52
+ Achenbach	2.5	2.8	8	4.28	0.67	4.95
+ Fischer	2.2	2.8	8	4.39	0.49	4.88
+ Lincoln	1.8	2.6	5	4.30	0.64	4.94
+ Lyon	3.0	3.0	9	4.83	0.64	5.47
+ Lancaster	4.8	4.9	8	4.34	0.44	4.78
+ Southland	1.5	1.1	9	4.75	0.64	5.39
Elsberry	1.8	2.0	9	3.97	0.76	4.73
Homesteader	4.0	4.5	8	3.94	0.56	4.50
B-in-12	6.5	5.2	8	3.93	0.51	4.44
Br. 3	2.5	5.4	8	4.05	0.63	4.68
Mandan 404	6.0	7.4	9	3.76	0.41	4.17
N.Y.B.	1.2	2.1	5	3.83	0.66	4.49
N.Y.H.	1.0	1.9	9	4.38	0.62	5.00
Mean				4.01	0.54	4.55
L.S.D. (0.05)				0.56	0.20	0.64
Mean Northern (*)	6.2	6.6	9	3.58	0.42	4.00
Mean Southern (+)	2.6	2.9	8	4.48	0.59	5.07
C.V.				10.0	26.2	9.8

* 1 (good) to 10 (fair)

Table 2:- Regional Uniform Brome Grass Strain Trials
Yield in tons Dry Matter per acre in First Harvest Year - 1954.

Strain	Ridgetown	Kemptville			Guelph			Mean Kemptville & Guelph		
	Hay	Hay*	After.	Total	Hay	After.	Total	Hay	After.	Total
Achenbach	0.66	2.55	1.00	3.55	4.28	0.67	4.95	3.42	0.84	4.26
Fischer	0.55	2.49	0.94	3.43	4.39	0.49	4.88	3.44	0.72	4.16
Common	0.31	2.18	0.88	3.06	3.48	0.39	3.87	2.83	0.64	3.47
Mean	0.50	2.41	0.94	3.35	4.05	0.52	4.57	3.23	0.73	3.96
L.S.D. - (0.05)	0.10	N.S.	N.S.	N.S.	0.56	0.20	0.64			
C.V.	11.0	9.3	18.4	10.3	10.0	26.2	9.8			

* Protein percent Achenbach and Common was 7.6 and 9.9 respectively; mean of three replicates.

Meadow Fescue and Tall Fescue Strain Trials

Tossell, W.E.

R.P.O.: F.H. 12 and 28 Year Initiated: 1953

Eight varieties of meadow and tall fescue, along with Medon timothy, were seeded in a strain trial at Guelph in 1953. Four strains were seeded at Guelph, Kemptville and Ridgetown in 1953. Stands were excellent at Guelph and Kemptville but poor at Ridgetown.

Table 1:- Fescue Strain Trial, 1953, Guelph Summary 1954.

Strain	Date in bloom June 1954	% Lodged 21/6/54	tons D.M. / acre Hay	Aftermath	Total	Leaf* %
+ Commercial	17	100	3.40	0.23	3.63	40.0
+ Mefon	18	80	3.05	0.26	3.31	44.6
+ Ensign	19	55	3.02	0.35	3.37	45.6
S-53	18	55	2.91	0.28	3.19	5[illegible].6
S-215	17	100	3.38	0.33	3.71	4[illegible].8
- Ottawa 39	16	0	4.40	0.53	4.93	4[illegible].6
- Alta	15	35	3.87	0.73	4.60	42.6
- Kentucky 31	17	10	3.83	0.45	4.28	49.2
Medon timothy	--	0	3.88	0.57	4.45	51.6
Mean			3.53	0.42	3.94	
L.S.D.-(0.05)			0.49	0.14	0.54	
C.V.			9.8	23.8	9.5	
Mean						
Meadow Fescues (+)	18	78	3.16	0.28	3.43	43.4
Tall Fescues (-)	16	15	4.03	0.57	4.60	44.5

* mean of 4 replicates separated by hand, includes blade and sheath, mean of 2 replicates in S-53.

Table 2:- Percent Protein in Hay of Strains (1954) in Kemptville Regional Strain Trial.

Ensign	8.4
Mefon	8.0
Ottawa 39	8.1
Common	7.1

Table 3:- Regional Uniform Fescue Strain Trials
Yield in tons Dry Matter per acre in First Harvest Year - 1954.

Strain	Ridgetown	Kemptville			Guelph			Mean Kemptville & Guelph		
	Hay	Hay	After.	Total	Hay	After.	Total	Hay	After.	Total
Ensign	0.41	1.53	0.76	2.29	3.02	0.35	3.37	2.28	0.56	2.84
Mefon	0.38	1.57	0.74	2.31	3.05	0.26	3.31	2.31	0.50	2.81
Ottawa 39	0.20	2.15	1.22	3.37	4.40	0.53	4.93	3.28	0.88	4.16
Common	0.47	1.84	0.70	2.54	3.40	0.23	3.63	2.62	0.46	3.08
Mean	0.36	1.77	0.86	2.63	3.47	0.34	3.81	2.62	0.60	3.22
L.S.D.-(0.05)	0.14	0.38	0.16	0.50	0.49	0.14	0.54			
C.V.	23.2	13.8	11.6	12.0	9.8	23.8	9.5			

Alfalfa Breeding and Testing

Twamley, B.E.

R.P.O.: F.H. 8 and 28

Plant Breeding

1953 Selections

In 1953, 115 plants were selected from farmers' fields in Peel, Halton, Haldimand and Brant counties. Selection was based on high seed set and on forage quality. (See History of Strains).

The plants were asexually multiplied in the winter of 1953-54 and, in the spring of 1954, the clones were transplanted into the isolation plot at the de Vos farm and into range 1A, O.A.C. (See 1954 Field Planting Plans). Because of rabbit damage at the former, and of shading or infertility at the latter, location normal growth was prevented and no additional notes on the agronomic characteristics of these 115 clones were obtained.

1954 Selections

In 1954 a spaced single-plant nursery was established on 8B. It consisted of approximately 200 diploid and 600 tetraploid plants for genetic study, 400 plants each of Vernal and Du Puits, 40 rhizomatous types from Swift Current and 300 plants showing resistance to common leaf spot, provided by U.S.A. breeders.

During the summer, 74 plants were selected from the spaced single-plant nurseries in ranges 8B and 18D. The Du Puits, Vernal, Ontario Variegated and Ranger selections were based on agronomic characters and the remaining selections were made from clones or strains reputably resistant to leaf spot. All 74 plants were brought into the greenhouse for asexual propagation and for crossing in the

winter of 1954-55.

Strain Trials

1953 Seeding

Data are lacking on the performance, in the area surrounding Guelph, of many new and improved varieties and strains produced in Canada and in the U.S.A. In an attempt to remedy this condition in part an 11-strain, 4-replicate test was seeded on May 6, 1953 on range 10 C as a randomized block. The rate of seeding was 10 lbs. per acre. For several varieties the stand was not as thick as is desirable and it is recommended that in future a rate of 14 lbs. per acre be used. The fertilizer application at seeding time was 300 lbs. per acre of 4-24-12 and in the spring of 1954 was 300 lbs. of 3-18-9. Because of the extremely wet weather it was not found possible to fertilize the plots in the fall of 1954.

In 1954 the plots were harvested for forage on June 24 and on September 3. Plots were also left for seed production but seed yield was so small that these plots were not harvested. Spring vigor notes were taken on April 21 and aftermath notes on July 14 and October 19. Very considerable differences were found in earliness and in aftermath recovery and these differences were reflected in forage yields. No winterkilling was seen in any variety following the moderately severe winter of 1953-54.

The regional strain trial was seeded at Kemptville without a companion crop and was cut twice in 1953 and in 1954. The yields of the seven varieties were not greatly different, with the exception of Ranger which provided quite poor yields.

At Ridgetown the yields were so low that they are not included in this report.

Table 1:- Data obtained in 1954 on the Alfalfa Strain Trial seeded in 1953 at the O.A.C.

Variety	Yield of Dry Matter tons/acre			Stand Rating	Height in inches		
	June	in Sept.	Total		Apr. 21	July 14	Oct. 19
Du Puits	2.83	1.78	4.61	1	3-4	7	12
Vernal	2.64	1.92	4.56	1	2-3	4-5	9-10
M-50	2.86	1.67	4.53	1	3-4	7	12
A-224	2.54	1.96	4.50	1	2-3	3	4
Grimm x Du Puits	2.62	1.82	4.43	1	3-4	7	12
Ladak	2.20	1.71	3.91	3	1-2	3	3
Rhizoma	2.14	1.66	3.80	2	1-2	4	6
Narragansett	2.05	1.75	3.80	2	1-2	4-5	7
Ranger	2.18	1.52	3.70	1	2-3	4-5	9
Ont. Var.	1.86	1.54	3.40	3	1-2	5	7
Grimm	1.70	1.47	3.17	3	1-2	4-5	6
Mean	2.33	1.71	4.04				
C.V.	4.4	5.8	7.4				
L.S.D.-(0.05)	0.39	0.14	0.43				

Table 2: Yield data obtained in 1953-54 on the Alfalfa Regional Strain trial seeded in 1953 at Kemptville.

Variety	Yield in tons per acre						
	June 1953	Aug. 1953	Total 1953	June 1954	Aug. 1954	Total 1954	Total 1953-54
Vernal	1.48	1.16	2.64	2.94	1.64	4.58	7.22
Du Puits	1.56	1.22	2.78	2.56	1.99	4.55	7.33
Ladak	1.84	1.09	2.93	2.59	1.48	4.07	7.00
Grimm	1.55	1.16	2.71	2.71	1.77	4.48	7.19
Rhizoma	1.72	1.15	2.87	2.75	1.70	4.45	7.32
Ranger	1.32	1.18	2.50	2.13	1.47	3.60	6.10
Narragansett	1.41	1.16	2.57	2.59	1.82	4.41	6.98
Mean	1.55	1.16	2.71	2.61	1.69	4.30	7.02
L.S.D.-(0.05)	0.26	N.S.	N.S.	N.S.	0.29	0.59	--
C.V.	11	8	9	12	12	11	--

1954 Seeding

In the spring of 1954 the Regional Strain Trial experiment was enlarged to include tests at Brampton on a heavy clay soil and at Hespeler on a sandy soil. The test at Brampton was plowed under in the fall because the stand was unsatisfactory, while that at Hespeler was retained although the stand there was not as good as is desirable.

Seed for the Regional Strain Trials was also sent to Kemptville and to Ridgetown.

Red Clover Breeding and Testing

Twamley, B.E.

R.P.O.: F.H. - 9.

Plant Breeding

In the spring of 1954 a spaced single-plant nursery was established on Ranged 8B. During the summer the more desirable looking plants were rated for size, posture, leafiness, coarseness, mildew resistance, flowering date. On the basis of these phenotypic characteristics 42 selections from this nursery and two selections from a nursery established on 18D in 1953 were made. The varietal distribution was as follows:

Variety	Population Size	Numbers of Selections
LaSalle	450	9
Dollard	"	20
Wisconsin	400	12
Redon	250	2
Purdue	150	1
Leon	30	0
English Broad	"	0
Essex Late	"	0
French	"	0
Dutch	"	0

As indicated above nearly all the selections were derived from only three varieties. The varieties Redon and Leon did not mature sufficiently for note-taking, Purdue was coarse and the European varieties were small and lacking in vigor. The nursery was

left for further study in 1955.

The 44 selected plants were brought to the greenhouse and each plant divided into two sections. One half was further subdivided for asexual propagation and the other half retained for flowering and sexual propagation during the winter.

Strain Trials

1953 Seeding

In the spring of 1953 two types of strain trials were laid down. In the first, referred to as the Regional Strain Trial, six adapted varieties were included and the test was undertaken at Kemptville and Ridgetown as well as at the O.A.C. The second type, which comprised 20 varieties and strains, included material from Britain and from regions in the U.S.A. as far south as Kentucky.

For all tests the design used was a randomized block, the number of replicates was four and the seeding rate was 8 lbs./acre. For future strain trials it is recommended that the seeding rate be increased to 10 lbs./acre.

In 1953 notes were taken on fall vigor, mildew resistance and in 1954 on spring vigor and maturity. Yield data were collected for both forage and seed. The seed yield was so low, however, that the results were discarded.

Regional Uniform Red Clover Strain Trials
tons of Dry Matter per acre

Strain	Kemptville							Ridgetown	Guelph		
	June 1953	Aug. 1953	Total 1953	June 1954	Aug. 1954	Total 1954	Total 1953-54	June 1954	June 1954	Aug. 1954	Total 1954
Commercial	1.64	0.85	2.49	2.08	1.34	3.42	5.91	1.18	2.56	0.78	3.34
Pennscott	1.54	0.83	2.37	2.08	1.52	3.60	5.97	1.43	2.85	0.70	3.55
Redon	1.33	0.76	2.09	2.29	1.18	3.47	5.58	1.80	2.41	0.40	2.81
Ottawa	1.36	0.75	2.10	2.16	1.63	3.79	5.89	1.34	2.45	0.71	3.16
Dollard	1.53	0.69	2.22	2.10	1.64	3.74	5.96	1.71	2.80	0.66	3.46
La Salle	1.56	0.66	2.23	2.05	1.41	3.46	5.69	1.47	2.70	0.63	3.33
Mean	1.49	0.76	2.25	2.13	1.45	3.58	5.83	1.49	2.63	0.65	3.28
L.S.D.- 5%	0.15	N.S.	0.26	N.S.	0.21	N.S.	---	0.36	0.21	0.11	0.30
C.V.	7	13	8	10	10	7	---	16	5	11	6

Red Clover Yield Trials, 1953-1954 Guelph

Tons of D.M. per acre

Variety	1st Cut	2nd Cut	Total
Emerson	3.01	0.58	3.59
Pennscott	2.88	0.63	3.51
Common Selection	2.91	0.51	3.42
Wisconsin Composite	2.74	0.64	3.38
Dollard	2.84	0.49	3.33
LaSalle	2.84	0.49	3.33
Wisconsin 1/100 acre	2.67	0.58	3.24
Wisconsin M. R.	2.70	0.49	3.18
Redon ✱	2.75	0.41	3.16
Dorset Marl.	2.69	0.45	3.14
Ottawa	2.60	0.54	3.14
Midland	2.52	0.61	3.13
Kenland	2.55	0.58	3.13
Wegener	2.69	0.43	3.12
Delaware Selection ✱	2.57	0.40	2.97
Leon ✱	2.60	0.29	2.89
Commercial	2.30	0.58	2.88
Cumberland	2.30	0.55	2.85
English Broad	2.40	0.38	2.78
Essex Late ✱	2.38	0.14	2.52
L.S.D. at (0.05)	0.32	---	0.40
(0.01)	0.43		0.53
C.V. in %	8.5	---	9.0

✱ Cut 4 days later than the others in June.

Relative Performance of Varieties in Order of Merit

Fall Vigor September, 1953	Spring Vigor April, 1954	Maturity June, 1954	Aftermath July, 1954	Mildew Resistance
Kenland	Dorset	Pennscott	Commercial	Wisconsin M.R.
Emerson	English Broad	Wegener	Kenland	Wisconsin C.
Dollard	Pennscott	LaSalle	Ottawa	Wisconsin 1/100
Cumberland	Essex	Wisconsin M.R.	English	Essex
Wisconsin C.	Cumberland	Midland	Pennscott	Dollard
Midland	Kenland	Cumberland	Emerson	Commercial
Ottawa	Commercial	Commercial	Cumberland	La Salle
Essex	Wisconsin C.	Wisconsin C.	Wegener	Pennscott
Wegener	Wisconsin 1/100	English Broad	Midland	Midland
Wisconsin 1/100	Wisconsin M.R.	Dorset	Wisconsin C.	Cumberland
Commercial	Midland	Wisconsin 1/100	Wisconsin 1/100	Ottawa
Wisconsin M.R.	Dollard	Emerson	Wisconsin M.R.	Delaware
Dorset	La Salle	Ottawa	La Salle	Emerson
Common Sel.	Ottawa	Kenland	Dollard	English Broad
Redon	Wegener	Dollard	Redon	Kenland
Pennscott	Emerson	Common Sel.	Common Sel.	Redon
La Salle	Common Sel.	Delaware Sel.	Essex	Dorset
Delaware Sel.	Delaware Sel.	Essex	Leon	Leon
Leon	Redon	Redon		Common Sel.
English Broad	Leon	Leon		Wegener

Protein Content in percentage and in tons per acre

Variety	Protein percentage	Protein Yield	Variety	Protein percentage	Protein Yield
Redon (early)	17.3	0.415	Ottawa	15.4	0.380
Redon (late)	16.2	0.445	Wisconsin	15.2	0.410
Dollard	16.0	0.450	Kenland	15.2	0.386
LaSalle	16.0	0.432	Commercial	15.0	0.380
English	15.8	0.380	Pennscott	14.4	0.410

These data indicate that there is little to choice between Pennscott, Ottawa, Dollard, LaSalle and commercial strains at either Kemptville or Guelph and that Redon is, in general, outyielded slightly by the above five strains. Ottawa was also somewhat below the average in forage yield at Guelph. Yields in the second harvest year (1955) at Guelph may alter the picture. Dollard and Redon (late) led the group in protein percentage and in protein yield.

1954 Seeding

In 1954 strain trials were established in Range 17 D, O.A.C., and at the Hespeler Potato Farm. Due to the dry weather in July and early August stands were never excellent but varied from fair to good. A test was established at Brampton but the stand, being poor, it was torn up in the fall. Regional strain trial seed was also sent to Kemptville and to Ridgetown. A small introduction nursery, (6 strains) was also seeded at Hespeler.

On Range 10 A four varieties, LaSalle, Pennscott, Commercial and Redon, seeded at the rate of 9 lbs./acre, were sown on May 17 with Medon timothy at the rate of 5 lbs./acre in a 4-replicate, randomized block design. Establishment of both grass and legume was good.

White Clover-Trifolium repens

Twamley, B.E.

R.P.O.: F.H. - 10.

The test contained 18 varieties of white clover and ladino clover originating in Canada, U.S.A., Europe and New Zealand. It was seeded on May 15 on Range 17D. The design was a randomized block with four replicates. Establishment was good and by late summer the ground was covered completely. Weeds were clipped in June and July. On September 1 the vegetation was cut back to a height of about 2" and on November 3 to a height of about 3". The varieties seeded and their heights at various times are shown below.

	Height in inches		
Variety	Aug. 28	Sept. 21	Oct. 21
Pilgrim	9.5	6	6.4
Iowa Synthetic	11	6	6.6
Western Composite	11	5.5	7
Aberdeen S100	8	3.3	4.7
Oregon ladino	11	5.3	6.6
California ladino	10	5.3	6.5
Louisiana white	9.5	4.5	7
Common white	10	4.2	4.7
Idaho ladino	11	6	6.5
Montana ladino	10	5.3	6.6
Lodi Otofte	9	3.5	4.2
Morso Otofte	7.5	3	4.1
Kersey white	9.5	4.5	5

Height in inches

Variety	Aug. 28	Sept. 21	Oct. 21
Polyploid ladino	9	5	6.4
Pathfinder	5	3	3
POC 3. (P.Q.)	10	5.2	6.2
Commercial	8	4	5
New Zealand	8.5	3	4.1

Birdsfoot Trefoil

Twamley, B.E.

R.P.O.: F.H. - 10.

In 1953 ten varieties were seeded in a yield trial on Range 18C. A very poor stand was obtained and the vacant spaces filled in with volunteer clovers and grasses. The area was clipped off in June, 1954, but during the dry spell that followed there was little growth and little seed setting. No yield data were obtained.

In 1954 the varieties, Viking, Empire and European, were seeded in a 4-replicate test on Range 17D, O.A.C., at Hespeler and at Brampton. Seed was also sent to Kemptville. No first-class stands were obtained and the plot at Brampton was torn up.

On Range 10A, an observation nursery was seeded. It consisted of 12 strains or varieties sown with the V-belt in 3-row plots 16 - 1/2 feet long.

Viking	New York Narrow leaf
Empire (4 strains)	Hudson Narrow leaf
Roskilde	Jokioinen
French	Italian
Montour	

Also on Range 10A an experiment was undertaken to determine the relative value of nurse crops as an aid in seedling establishment and in weed control. The treatments were wheat, oats and barley, timothy, brome and ryegrass, a straw mulch, check. In all instances the trefoil seed was broadcast and covered lightly by raking. The rating of the treatments in order of merit was

(a) Seedling establishment	(b) Weed control
Straw mulch	Timothy
Check	Ryegrass
Oats	Brome
Wheat	Wheat
Brome	Oats
Barley	Check
Timothy	Straw
Ryegrass	Barley

It appears from these data that those treatments which were most beneficial in helping seedling establishment of the trefoil also permitted weed establishment.

For information on Time of Seeding see the corresponding section in alfalfa.

Sweet Clover

Twamley, B.E.

R.P.O.: F.H. - 10.

Eleven varieties consisting of both yellow and white sweet clover were seeded on Range 17D on May 15. The design was a randomized block with three replicates. An insufficiency of seeds was the reason for reducing the number of replicates. Establishment was

quite variable and ranged from poor to excellent. The list of varieties and their mean stand is shown below.

Common White	Excellent
Brandon Dwarf	"
S - 65, Wisconsin	Good
Common Yellow	"
Spanish	"
A - 46, Wisconsin	Fair to good
Erector	"
Madrid	"
N - 1, Nebraska	Fair
Evergreen	"
Arctic	Poor

This experiment was sown without a nurse crop. The weeds were clipped in June, July, September.

Miscellaneous Legume Projects

Twamley, B.E.

R.P.O.: F.H. 10.

In 1954 a number of small projects were undertaken for the purpose of investigating techniques and for providing demonstration plots.

Varietal Reaction to Bacterial Wilt

The varieties M 50, Vernal, Narragansett, Buffalo, Ranger, Ontario Variegated, Ladak and Rhizoma were sown in small, unreplicated plots in 1 A on June 8. The soil will be inoculated with bacterial wilt organism in 1955. The test can be used for demonstrating differential survival in the presence of bacterial wilt.

Bacterial Wilt Inoculation Technique in the greenhouse

Forty strains of Ontario Variegated (O.P. seed) and five varieties were used in this test. In January, 1954, 10-14 seedlings

of each strain were established in duplicate in 6 inch pots. The seedlings were cut back twice when at a height of about 15 inches. On June 26 they were inoculated, the inoculum being supplied by the Department of Bacteriology. The intact mass of roots and earth was shaken free of the pot, with a sharp knife a section was cut at right angles to the long axis and located about an inch below the surface and the lower portion of the mass was returned to the pot. Onto this the inoculum was poured to the extent of about 10 cubic centimeters and the top portion was then replaced. This operation placed a cut section of the root in contact with an inoculum-bearing suspension. The plants were then allowed to resume growth. In November the plants were examined for wilt infection. This was done by removing the root-earth mass from the pots, as before, and cutting, as before, but slightly higher.

The results were unsatisfactory. Resistant varieties and uninoculated checks frequently showed as heavy infection as any other strain. Two replicates of a single strain often displayed big differences. The cause, or causes, of this condition were not discovered. Among the possibilities were (1) inoculum, not effective, (2) some other disease was present, (3) plants were inoculated at too early a stage, (4) insufficient time interval between inoculation and examination.

In November, 1954, the experiment was set up a second time; 17 strains each of four replicates, were used and the number of seedlings per pot was five to seven.

Seeding Date

Four varieties each of alfalfa, red clover, sweet clover and birdsfoot trefoil were seeded, each without replication, in 1 A. The spring seeding date was June 11, the summer, August 21. The plots will

be examined in 1955 and a comparison made for the spring and summer seeding on the basis of stand and of spring vigor.

Mulching for Establishment

In an attempt to discover whether straw mulching would help in the establishment of legumes a 3-replicate test of alfalfa and birdsfoot trefoil was set up as a latin square. The treatments were:

A. Broadcast seed and rake ground.

B. Broadcast seed, rake, add straw.

C. Broadcast seed, add straw.

The superiority of treatments B and C was quite evident in the fall of 1954.

Spacing Trial

The objective was a comparison of different methods of seeding for establishment and yield. The treatments were

(1) Broadcast,

(2) Rows spaced 0-5' apart, V-belt seeder,

(3) Rows spaced 1' apart, V-belt seeder.

Ten grams of seed were used for all plots and the design was a latin square.

No yield data were obtained in 1954. Stand counts were highest in the broadcast plots, lowest in the plots where widely spaced.

Legume and Grass Introductions

McConkey, O.M.

R.P.O.: F.H. 1. Year Initiated: 1947

The following varieties of grasses and legumes were introduced from Canadian, American, European and other world experimental

stations and are now being tested under Ontario conditions:-

Table 1:- Summary of Introductions

Species	Yield trials 1954	Introduction Nurseries 1952	Introduction Nurseries 1954	Herbarium 1954
Alfalfa	--	25	3	--
Red Clover	2	14	12	1
Sweet Clover	10	--	--	--
White Clover	14	8	8	--
Alsike	--	5	4	--
Birdsfoot Trefoil	--	9	--	2
Misc. Legumes	--	--	--	13
Total	26	71	27	16
Timothy	--	22	13	--
Orchard	--	18	12	--
Brome	--	27		--
Meadow Fescue	--	14	8	--
Bluegrass	--	14	6	8
Ryegrass	--	13	12	--
Misc. Grasses	--	34	--	12
Total	0	142	51	20
Rape	6			

Herbarium - McConkey, P.I.

A herbarium of grasses and legumes was established in 1954 comprised of 47 grasses and 34 legumes.

This herbarium is made up of representative species and varieties of grasses and legumes from Eastern and Western Canada, N.E. States and European countries.

This herbarium material is for demonstration reference, identification, and study of species by research workers and students.

Grasses and Legumes in Herbarium

Species	Variety	Scientific Name
1. Timothy	Common	Phleum pratense
2. Timothy	Medon	Phleum pratense
3. Timothy	14 Chromosome	Phleum pratense
4. Orchard	Common	Dactylis glomerata
5. Orchard	Oron	Dactylis glomerata
6. Fescue	Common	Festuca elatior
7. Fescue	Mefon	Festuca elatior
8. Fescue	Tall	Festuca arundinacea
9. Fescue	(Red) Common	Festuca rubra
10. Fescue	(Red) Refor.	Festuca rubra
11. Fescue	Sheeps	Festuca ovina
12. Brome	Common	Bromus inermis
13. Per. Rye	Common	Lolium perenne
14. Per. Rye	Peron	Lolium perenne
15. Italian Rye	Common	Lolium multiflorum
16. Red Top	Common	Agrostis alba
17. Red Top	Tall	Agrostis gigantea
18. Colonial	Bent	Agrostis tenuis
19. Meadow	Foxtail	Alopecuris pratensis
20. Lymas	Virginia	Elymus Virginicus
21. Lymas	Canada	Elymus Canadensis
22. Tall oat		Arrhenatherum elatius
23. Yellow oat		Avena flavescens
24. Bluegrass	Kentucky Common	Poa pratensis
25. Bluegrass	Kentucky Kenon	Poa pratensis
26. Bluegrass	Kentucky Swedish	Poa pratensis
27. Bluegrass		Poa alpigena
28. Bluegrass		Poa pumila
29. Bluegrass		Poa versicolor
30. Bluegrass		Poa alpina

Species	Variety	Scientific Name
31. Bluegrass	Polish	
32. Bluegrass	Kentucky, Tylking	Poa pratensis
33. Bluegrass	Kentucky, primo	Poa pratensis
34. Bluegrass	Rough stalked	Poa trivialis
35. Bluegrass	Canada Common	Poa compressa
36. Bluegrass	Canada Canon	Poa compressa
37. Crested wheat grass		Agropyron cristatum
38. Tall wheat grass		Agropyron elongatum
39. Russian wild Rye		Elymus jaunceus
40. Green stipa grass		Stipa veridula
41. Sand Love grass		Eragrostis Trichodes
42. June grass (Western)		Koeleria cristata
43. Blue Grama Grass		Bouteloula gracilis
44. Buffalo Grass		Buchloe dactyloides
45. Blue Joint		Calamagrostis canadensis
46. Erythroxythum		
47. Canary		Phalaris arundinacea
1. Alfalfa	Variegated	Medicago sativa
2. Alfalfa	Vernal	Medicago sativa
3. Alfalfa	Rhizoma	Medicago sativa
4. Alfalfa	Creeping (Leth.)	Medicago sativa
5. Alfalfa	falcata	Medicago falcata
6. R. Clover	Common	Trifolium pratense
7. R. Clover	Redon	Trifolium pratense
8. R. Clover	Leon	Trifolium pratense
9. R. Clover	La Salle	Trifolium pratense
10. Hungarian Clover		Trifolium panonicum
11. Subterranean Clover		Trifolium subterraneum
12. Strawberry Clover		Trifolium fragiferum
13. Wild white clover		Trifolium repens
14. White Dutch Clover		Trifolium repens
15. Ladino		Trifolium repens
16. Alsike	Common	Trifolium Hybridum
17. Alsike	Alon	Trifolium Hybridum
18. Trefoil		Lotus tenuis
19. Trefoil		Lotus uliginosus
20. Yellow trefoil		Medicago lupulina
21. Seradella		Ornithopus sativus
22. Burnett		Sanquisorba minor
23. Crown Vetch		Coronilla varia
24. Kidney Vetch		Anthyllis vulnerraria
25. Sickle Milk Vetch		Astragalas chinensis
26. Sainfoin		Onobrychis vicaefolia
27. Trigonalla corniculata		
28. Sheep's Parsley		
29. Sweet Clover	White	Melilotus alba
30. Sweet Clover	Yellow	Melilotus officinalis
31. Crimson Clover		Trifolium incarnatus
32. Birdsfoot Trefoil		Lotus corniculatus
33. Lespedeza (Korean)		Lespedeza stipulacea
34. Wild Red Clover		Trifolium pratense spontaneum.