THIRTEENTH ANNUAL REPORT

1961

NORTHWESTERN MONTANA BRANCH

MONTANA AGRICULTURAL EXPERIMENT STATION

Route Four

Kalispell, Montana

Research work in 1961 was conducted by C. W. Roath, Superintendent, Vern R. Stewart, Assistant Agronomist, and Donald R. Graham, Assistant in Soils. Mr. Roath's major work was with perennial forages, Mr. Stewart's with cereals and oil crops, and Mr. Graham's with fertilizers.

Mr. Graham's contract was not renewed after July 1 due to insufficient funds. His work in the area was considered to be of such importance to the agriculture of the area that the Kalispell Chamber of Commerce raised funds to pay his July and August salary and permit him to complete the season's work.

In this report, work done by Mr. Roath is reported in Part I, by Mr. Stewart in Part II, and by Mr. Graham in Part III.

PART I

1961

by

C. W. Roath, Superintendent

FISCAL PROJECTS

RESEARCH PROJECTS

GENERAL ADMINISTRATION 1062

Staff:

The Staff at Northwestern Montana Branch was reduced by one man when Donald R. Graham's contract was not renewed because of insufficient funds. This loss, numerically speaking, was partially restored by joint appointment of Mr. Don Merkley, Associate Entomologist, to the Northwestern Staff.

Help:

Budgetary limitations made it necessary to dispense with the services of part-time student help during the summer months and to turn one of the two regular employees out to pasture on September 30. Progress in reverse seems to be the order of the day.

Research Curtailed:

With one Staff man not reappointed and with considerably less seasonal help available, the research work load for the 1961 growing season was drastically reduced. The aim was to attempt as much as could be done well and yet fully utilize all available resources. In this, with a lot of assistance from the weather man, we were quite successful, as I believe this report will indicate.

Local Support Heartwarming:

We, at Northwestern Branch, are very proud of our area support for the research program of the Station. The first evidence of this was the actual amount of the line item appropriation. The second was the loud and long, not yet over, dissent when funds were diverted to less fortunate members of the research system. And finally, whoever heard of a Chamber of Commerce raising nine hundred dollars just to keep a Branch Station man on the job two additional months?

Budget:

The 1961-62 budget for Administration expenditures is $4511.33, which is of necessity increased by the amount of the employer contributions to retirement programs, heretofore appropriated in lump-sum to institutions.

The 1961-62 budget is as follows:

Project Number	Item	Amount	Project Total
1062	Clerk	$1248.00	
	Postage	30.00	
	Station and Office Supplies	70.00	
	Mimeograph and Multigraph	50.00	
	Subscriptions	50.00	
	Travel	450.00	
	Social Security and Retirement	1875.00	
	Office Machine Maintenance	35.00	
	Salary	683.33	
			$4491.33
1063	Hardware, Lumber, Paint, etc.	240.00	
	Electrical Service	325.00	
	Fuel	695.00	
	Labor	340.00	
	Salary	683.33	
	Telephone and Telegraph	150.00	
			$2433.33
1064	Freight and Express	80.00	
	Irrigation Water	120.00	
	Custom Machine Hire	75.00	
	Machine Lease	1750.00	
	Land Rental	1280.00	
	Fuel and Lubricants	1200.00	
	Repairs and Maintenance	365.00	
	Salary	683.33	
	Labor	1602.00	
			$7155.33
5020	Fertilizers	50.00	
	Supplies	50.00	
	Laboratory Analysis	25.00	
	Labor	590.00	
	Salary	3091.66	
			$3806.66
5021	Weedicides	50.00	
	Supplies	50.00	
	Labor	590.00	
	Salary	1150.00	
			$1840.00
5022	Supplies	50.00	
	Laboratory Analysis	25.00	
	Labor	890.00	
	Salary	3416.65	
			$4381.65

Continued ----

1961-62 budget (Continued)

Project Number	Item	Amount	Project Total
5023	Supplies	$ 50.00	
	Laboratory Analysis	25.00	
	Labor	890.00	
	Salary	3450.00	
			$4415.00
5028	Seeds and Plants	45.00	
	Insecticides	25.00	
	Supplies	50.00	
	Labor	590.00	
	Salary	1258.33	
			$1968.33
5029	Feed	50.00	
	Veterinary Supplies and Service	50.00	
	Labor	590.00	
	Salary	683.33	
			$1373.33

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PHYSICAL PLANT 1063

A budget of $2433.33 for heat, light, phone, and minor repairs and maintenance of buildings is approved for the 1961-62 fiscal year. While this makes no provision for major improvements of present facilities or construction of new ones, it should provide for present operations at the present level.

GENERAL FARM 1064

One change in general farm operations has been made as a concession to wind and weather. Wind erosion on the dryland lease has been severe during the past two dry seasons. To partially control soil movement, fields laid out 330 feet wide have been divided into three 110 feet strips and the center strip in each field fall seeded.

One of the most profitable projects on the farm has been the farm flock. Considerable interest has been expressed in the information derived from the project as well. To permit some modest expansion of flock numbers, some additional land has been made available for pasture.

Only essential annual operations are provided for in the current budget, if indeed there is sufficient for vehicle and machine maintenance and repair. The 1961-62 budget is $7155.33.

1961 ACTIVITIES

Because of the necessity for using the Dorset ram early or not all, the year's operations started early in 1961. The sheep were sheared on January 17th. Project planning trips were made to Lake and Lincoln Counties on January 25th and 26th. A brief report was made to Flathead Wool Growers the 7th.

The first lambs arrived February 14. Staff members assisted the Chamber of Commerce Agricultural Committee with plans for a Feeder Tour held February 22 with near 200 participants.

A short talk to Western Montana Seed Growers on March 4 started the March activities. Research was planned in Bozeman March 13-15. The Northwestern Branch Station Advisory Committee met at the Station with full attendance on March 17. Assistance was given with Conservation Days at Eureka, Libby, and Polson on March 22, 23, and 29. The Progress Report was completed. Brownie Scouts from Kalispell saw the lambs.

April and May brought numerous visitors and visiting groups to the Station. Farmers called to ask about production possibilities of standard and new crops. One FFA group judged sheep. Two grade school groups toured the Station. Fertilizer and Chemical companies were well represented. Director Huffman paid us a visit and made a fine talk to the Eastside Grange.

June, July, August, and September were busy ones with research activities almost to the exclusion of other kinds. Gene Sharp, Erhardt Hehn, Jim Drummond, Art Post, Lark Carter, Fred Willson, and Joe Asleson made business calls to the Station as did Jim Hoffmanof the Regional Smut Lab. Wes took time out to judge two County Fairs.

From October 1 on, the main activity was that of preparing reports. The new Flathead County Agent, Allen Nelson, called to become acquainted with our operations. Company representatives interested in promoting new crops in the area talked things over as did Art Shaw. Time out for Conference was considered profitable. Meetings with the Agricultural Committee of the Kalispell Chamber will have been productive if an educational program to replace the seed show, that is helpful to the area, results.

FORAGES 5022

1961-62 Budget -- $4381.65

Introduction

In Northwestern Montana, 1961 has been a good hay year where irrigation water has been available and properly applied. An unusually long growing season, warm temperatures, and favorable harvest weather have contributed to the results reported.

Dryland forages have not fared so well and yields reflect the unusually dry growing season.

Forage Nurseries Harvested in 1961

Description	Location	Seeding Year
Hay Mixtures-irrigated	Ravalli Co.	1958
Hay Mixtures-irrigated	Station	1958
Hay Mixtures-irrigated	Lake Co.	1959
Fescues-irrigated	Station	1958
Bromegrasses-irrigated	Station	1958
Orchardgrasses-irrigated	Station	1959
Bluegrasses-irrigated	Station	1959
Small Seeded Legumes-irrigated	Station	1960
Wheatgrasses-irrigated	Station	1960
Maturity Characteristics-irrigated	Station	1960
Winter Hardiness-irrigated	Station	1960
Grasses-dryland	Lake Co.	1958
Tice Nursery-dryland	Ovando	58, 59, 60
Fescues-dryland	Station	1959
Orchardgrasses-dryland	Station	1960
Wheatgrasses-dryland	Station	1960
Small Seeded Legumes-dryland	Station	1960

Forage Nurseries Seeded in 1961

Description	Location
One Cutting Mixtures-irrigated	Station
Alfalfa Variety Evaluation-irrigated	Station
Orchard Variety Evaluation-irrigated	Station
Sanfoin Pastures-dryland	Station
Alfalfa Variety Evaluation-dryland	Station
Orchard Variety Evaluation-dryland	Station

Hay Mixtures-irrigated in Ravalli County, Lake County, and on the Station in 1961.

Sixteen entries were seeded in irrigated hay mixture trials in Ravalli County in 1958 and in Lake County in 1959. Twelve of the mixtures were seeded on the Station in 1958 in nine replications so management could be varied. The intent was to determine the relationship of growth habit to yield, and the grass varieties were selected as representatives of bunch grasses, and those with moderate and vigorous sod forming tendencies.

Through some strange coincidence, both the Ravalli and Lake County nurseries were harvested by mistake prior to our arrival to harvest the second cuttings, so only one harvest was obtained this season. The Ravalli mixtures were grazed late by horses so harvest was delayed until July 6 at which time mixtures had reached the early bloom stage.

Sites for the three nurseries were selected to represent soils used extensively for hay production. The Ravalli site was deep sandy loam, the Lake site shallow clay loam, and the Station site silty-clay loam of medium depth.

1961 yields are tabulated in tons per acre at twelve percent moisture in Tables I, II, and III. Three locations, one cutting yields, are shown in Table IV. Tables V-VII show seasons' yields for the mixtures when cut one, two, and three times.

Table I. Hay mixtures-irrigated in Ravalli County. One cutting on July 6, 1961. Tons per acre at 12% moisture.

Variety or Mix	Replications I	II	III	IV	Total	Average
Vernal Alfalfa	1.99	1.57	1.29	2.08	6.93	1.73
Rhizoma Alfalfa	1.26	1.54	2.58	1.36	6.74	1.69
Ladak Alfalfa	1.60	1.43	1.14	1.89	6.06	1.52
Whitmar Wheatgrass and Alfalfa	1.23	1.60	1.50	1.43	5.76	1.44
Greenar Wheatgrass and Alfalfa	1.57	1.65	2.19	1.65	7.06	1.77
Ree Wheatgrass and Alfalfa	1.65	2.31	1.97	2.09	8.02	2.00
Mandan 404 Brome and Alfalfa	2.04	1.74	2.00	2.20	7.98	2.00
Manchar Brome and Alfalfa	2.13	2.40	2.31	1.11	7.95	1.99
Lincoln Brome and Alfalfa	2.41	1.61	2.43	1.73	8.18	2.05
Potomac Orchard and Alfalfa	1.90	2.15	2.13	2.38	8.56	2.14
Alta Fescue	1.89	1.46	2.09	1.52	6.96	1.74
Sherman Big Bluegrass and Alfalfa	1.60	1.34	3.07	1.82	7.83	1.96
Reed Canary and Alfalfa	1.60	1.80	2.23	1.71	7.34	1.84
Meadow Foxtail and Alfalfa	1.88	1.39	1.71	2.63	7.61	1.90
Green Stipa and Alfalfa	1.58	3.04	1.62	2.17	8.41	2.10
Tall Oat and Alfalfa	1.14	2.32	1.77	2.31	7.54	1.89

$\bar{x}$	1.86
S.E.$\bar{x}$.	.2233
L.S.D.	NS
C.V.	12.02%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	.222176	—
Mixture	15	2.420736	—
Error	45	8.974076	
Total	63		

Table II. Hay Mixtures-irrigated in Lake County. One cutting on June 19, 1961. Tons per acre at 12% moisture.

Variety or Mix	Replications I	II	III	IV	Total	Average
Vernal Alfalfa	2.97	2.21	2.47	1.85	9.50	2.375
Rhizoma Alfalfa	2.44	1.86	2.18	2.14	8.62	2.155
Ladak Alfalfa	3.80	1.83	1.81	2.24	9.68	2.420
Whitmar Wheatgrass and Alfalfa	2.55	1.99	2.37	1.98	8.89	2.220
Greenar Wheatgrass and Alfalfa	3.51	1.95	1.94	2.72	10.12	2.530
Ree Wheatgrass and Alfalfa	3.12	2.71	1.85	2.30	9.98	2.495
Mandan 404 Brome and Alfalfa	2.35	2.32	2.49	1.92	9.08	2.270
Manchar Brome and Alfalfa	2.21	2.08	1.91	2.28	8.48	2.120
Lincoln Brome and Alfalfa	2.28	1.94	2.84	2.59	9.65	2.410
Potomac Orchard and Alfalfa	2.00	2.56	1.89	1.99	8.44	2.110
Alta Fescue and Alfalfa	2.18	2.18	2.87	2.26	9.49	2.370
Sherman Big Bluegrass and Alfalfa	2.21	1.91	1.94	1.96	8.02	2.005
Reed Canary and Alfalfa	2.06	1.70	2.33	2.77	8.86	2.210
Meadow Foxtail and Alfalfa	2.26	2.45	2.22	2.18	9.11	2.280
Green Stipa and Alfalfa	2.21	2.51	2.86	1.70	9.28	2.320
Tall Oat and Alfalfa	2.67	3.56	2.17	2.18	10.58	2.645

$\bar{x}$ 2.31
S.E.$\bar{x}$. ..... .2242
L.S.D. ..... NS
C.V. 9.71%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	1.288819	—
Mixture	15	1.752644	—
Error	45	9.047481	
Total	63	12.088944	

Table III. Hay mixtures-irrigated on the Station. One cutting on July 12, 1961. Tons per acre at 12% moisture.

Variety or Mix	Replications I	II	III	Total	Average
Ladak Alfalfa	1.70	1.36	2.01	5.07	1.69
Orchard and Alfalfa	1.79	1.89	2.13	5.81	1.94
Alta and Alfalfa	2.19	2.09	1.92	6.20	2.07
Sherman Big Bluegrass and Alfalfa	1.72	1.61	1.86	5.19	1.73
Erect Brome and Alfalfa	2.27	2.83	1.98	7.08	2.36
Meadow Foxtail and Alfalfa	1.72	1.53	1.72	4.97	1.66
Green Stipa and Alfalfa	2.61	1.44	1.56	5.61	1.87
Lincoln Brome and Alfalfa	1.99	2.26	2.15	6.40	2.13
Tall Oat and Alfalfa	2.22	1.90	1.98	6.10	2.03
Ree Wheat and Alfalfa	2.10	2.21	1.64	5.95	1.98
Mandan 404 Brome and Alfalfa	2.29	1.92	1.81	6.02	2.01
Whitmar and Alfalfa	2.38	1.31	1.45	5.14	1.71

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	.202908	1.99
Mixtures	11	.132869	1.31
Error	22	.101796	
Total	35		

$\bar{x}$	1.93
S.E.$\bar{x}$.	.1842
L.S.D.	NS
C.V.	9.54%

Table IV. Hay mixtures-irrigated. Three location summary - twelve mixtures.

Variety or Mix	Location Averages Station	Ravalli Co.	Lake Co.	Total	Ave.
Ladak Alfalfa	1.69	1.52	2.42	5.63	1.88
Orchard and Alfalfa	1.94	2.14	2.11	6.19	2.06
Alta and Alfalfa	2.07	1.74	2.37	6.18	2.06
Sherman Big Bluegrass and Alfalfa	1.73	1.96	2.01	5.70	1.90
Erect Brome and Alfalfa	2.36				
Meadow Foxtail and Alfalfa	1.66	1.90	2.28	5.84	1.95
Green Stipa and Alfalfa	1.87	2.10	2.32	6.29	2.10
Lincoln Brome and Alfalfa	2.13	2.05	2.41	6.59	2.20
Tall Oat and Alfalfa	2.03	1.89	2.65	6.57	2.19
Ree Wheat and Alfalfa	1.98	2.00	2.50	6.48	2.16
Mandan 404 Brome and Alfalfa	2.01	2.00	2.27	6.28	2.09
Whitmar and Alfalfa	1.71	1.44	2.22	5.37	1.79

Table V. Hay mixtures-irrigated on the Station in 1961. Two cuttings harvested - tons per acre at 12% moisture.

Variety or Mix	Cut	Replications I	II	III	Total	Average	Season Total
Ladak Alfalfa	1	1.40	1.51	1.69	4.60	1.53	
	2	.72	.69	.80	2.21	.74	2.27
Orchard and Alfalfa	1	1.86	1.78	2.01	5.65	1.88	
	2	.97	1.02	.72	2.71	.90	2.78
Alta Fescue and Alfalfa	1	2.20	1.63	1.74	5.57	1.86	
	2	.94	1.20	.70	2.84	.95	2.81
Sherman Bluegrass and Alfalfa	1	.88	1.55	1.63	4.06	1.35	
	2	.66	1.07	.66	2.39	.80	2.15
Erect Brome and Alfalfa	1	1.52	1.54	1.36	4.42	1.47	
	2	.81	.80	.63	2.24	.75	2.22
Meadow Foxtail and Alfalfa	1	1.50	1.65	1.73	4.88	1.63	
	2	.84	1.07	.93	2.84	.95	2.58
Green Stipa and Alfalfa	1	1.35	1.50	1.33	4.18	1.39	
	2	.59	1.04	.67	2.30	.77	2.16
Lincoln Brome and Alfalfa	1	1.46	1.30	2.00	4.76	1.59	
	2	.71	.57	.85	2.13	.71	2.30
Tall Oat and Alfalfa	1	1.78	1.65	1.73	5.16	1.72	
	2	.76	1.14	.83	2.73	.91	2.63
Ree Wheatgrass and Alfalfa	1	1.59	1.64	1.59	4.82	1.61	
	2	.71	.61	.61	1.93	.64	2.25
Mandan 404 Brome and Alfalfa	1	1.74	1.15	1.57	4.46	1.49	
	2	.94	.59	.69	2.22	.74	2.23
Whitmar Wheatgrass and Alfalfa	1	1.86	1.49	1.51	4.86	1.62	
	2	1.14	.75	.85	2.74	.91	2.53

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	.000308	
Mixtures	11	.175827	1.46
Error	22	.120253	
Total	35		

$\bar{x}$	2.41
S.E.$\bar{x}$	.2002
L.S.D.	NS
C.V.	8.31%

Table VI. Hay mixtures on the Station in 1961 - irrigated. Harvested in three cuttings. Tons per acre at 12% moisture.

Variety or Mix	Cut	Replications I	II	III	Total	Average	Season Total
Ladak Alfalfa	1	1.27	1.10	1.06	3.43	1.14	
	2	.56	.62	.57	1.75	.58	
	3	.42	.41	.28	1.11	.37	2.09
Orchard & Alf.	1	1.64	1.22	1.22	4.08	1.36	
	2	.61	.63	.50	1.74	.58	
	3	.59	.38	.28	1.25	.42	2.36
Alta Fescue & Alf.	1	1.91	1.59	1.24	4.74	1.58	
	2	.62	.65	.43	1.70	.57	
	3	.48	.43	.26	1.17	.39	2.54
Sherman Bluegrass & Alf.	1	1.24	.72	.82	2.78	.93	
	2	.61	.32	.41	1.34	.45	
	3	.41	.27	.23	.91	.30	1.68
Erect Brome & Alf.	1	1.23	1.17	1.05	3.45	1.15	
	2	.70	.53	.44	1.67	.56	
	3	.42	.43	.27	1.12	.37	2.08
Meadow Foxtail & Alf.	1	1.14	.97	.90	3.01	1.00	
	2	.56	.51	.47	1.54	.51	
	3	.41	.33	.33	1.07	.36	1.87
Green Stipa and Alf.	1	1.23	.76	.91	2.90	.97	
	2	.62	.37	.51	1.50	.50	
	3	.46	.27	.28	1.01	.34	1.81
Lincoln Brome & Alf.	1	1.19	1.60	1.49	4.28	1.43	
	2	.59	.62	.69	1.90	.63	
	3	.44	.43	.38	1.25	.42	2.48
Tall Oat & Alf.	1	1.19	.96	.84	2.99	1.00	
	2	.44	.60	.37	1.41	.47	
	3	.42	.38	.26	1.06	.35	1.82
Ree Wheatgrass & Alf.	1	1.12	1.17	1.21	3.50	1.17	
	2	.54	.43	.39	1.36	.45	
	3	.42	.27	.22	.91	.30	1.92
Mandan 404 Brome & Alf.	1	1.18	1.05	1.12	3.35	1.12	
	2	.56	.61	.38	1.55	.52	
	3	.48	.42	.23	1.13	.38	2.02
Whitmar Wheatgrass & Alf.	1	1.30	.84	.58	2.72	.91	
	2	.66	.47	.36	1.49	.50	
	3	.57	.32	.18	1.07	.36	1.77

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	1.061186	14.40**
Mixtures	11	.245232	3.33**
Error	22	.073680	
Total	35		

$\bar{x}$	2.03
S.E.$\bar{x}$.	.1567
L.S.D.(5%)....	.46
L.S.D.(1%)....	.63
C.V.	7.7%

Table VII. Hay Mixtures on the Station - irrigated 1961. Seasons' Yields in Tons per acre at 12% moisture when cut one, two, and three times based on three replication averages.

Variety or Mix	One Cut	Two Cuts	Three Cuts	Total	Ave.
Ladak Alfalfa	1.69	2.27	2.09	6.05	2.02
Orchard and Alfalfa	1.94	2.78	2.36	7.08	2.36
Alta Fescue and Alfalfa	2.07	2.81	2.54	7.42	2.47
Sherman Bluegrass and Alfalfa	1.73	2.15	1.68	5.56	1.85
Erect Brome and Alfalfa	2.36	2.22	2.08	6.66	2.22
Meadow Foxtail and Alfalfa	1.66	2.58	1.87	6.11	2.04
Green Stipa and Alfalfa	1.87	2.16	1.81	5.84	1.95
Lincoln Brome and Alfalfa	2.13	2.30	2.48	6.91	2.30
Tall Oat and Alfalfa	2.03	2.63	1.82	6.48	2.16
Ree Wheatgrass and Alfalfa	1.98	2.25	1.92	6.15	2.05
Mandan 404 Brome and Alfalfa	2.01	2.23	2.02	6.26	2.09
Whitmar Wheatgrass and Alfalfa	1.71	2.53	1.77	6.01	2.00

Analysis of Variance

Source	D.F.	Mean Square	F
Cuttings	2	.755575	22.93**
Mixtures	11	.099721	3.03**
Error	22	.032945	
Total	35		

The above data when analyzed show that the two cuttings of Orchard and Alfalfa or Alta Fescue and Alfalfa would give the most production of forage.

Hay Mixtures — irrigated

Results and Discussion

While there was some variation in yield between the mixtures harvested in one cutting, Tables I, II, and III, these differences did not achieve statistical significance. Certainly, no strong case could be made with these data for one type or variety of grass over another. Neither is there any great degree of agreement between locations when the three location data is compared in Table IV.

If possible, another year's harvest of the off-station locations and in two or more cuttings will be made. This time lapse from seeding to harvest should be sufficient for sodding effects, if any, to be measurable.

Yields of mixtures harvested in two cuttings on the Station follow usual patterns with Orchard-Alfalfa and Fescue-Alfalfa leading and producing one half ton more than Alfalfa alone. These differences are not statistically significant at the five percent level. Not all bunch grass alfalfa mixtures are above all sod grass alfalfa mixtures in yield, however, three bunch grass alfalfa mixtures lead all sod grass alfalfa mixtures by non-significant amounts.

Significant differences at both the five percent and one percent levels are found between mixtures harvested three times on the Station (Table VI). The three top producing mixtures with no difference between them are Potomac Orchard, Alta Fescue, and Lincoln Brome with Ladak Alfalfa.

When yields of the same mixtures are compared when grown in the same location but harvested in one, two, or three cuttings, Table VII, it appears that some produce more in two than in three cuttings and others as much in one as in three.

Future Work

These studies agree with previous ones on the Station in pointing to certain mixtures as desirable two cutting mixtures for irrigated lands. Yields of late grasses and legumes harvested in one cutting, Tables XIV and XV, indicate yields comparable to two cutting yields from early grasses and alfalfa. Work in the immediate future probably should explore this possibility.

Tall Fescues - Irrigated

Irrigated tall fescues were harvested in three cuttings in 1961. Yields are reported in tons per acre at twelve percent moisture by cuttings in Table VIII. Seasons' total yields vary from 1.34 to 1.88 tons with Kentucky G1-32 leading in season's yield and also in first and second cutting yields. This variety has been first in season's yield each of the three years harvested.

Four replications, season's yields (total average) for the three years of harvest in tons per acre at twelve percent moisture are as follows:

Variety	1959	1960	1961	Average
Alta	2.65	1.36	1.40	1.80
Kentucky 31	2.74	1.29	1.59	1.87
Goar	1.89	1.24	1.34	1.49
Kentucky G1-32	2.82	1.74	1.88	2.15
Oregon 4-36	2.78	1.45	1.64	1.96

Stand was estimated following harvest in 1961 using the forty unit frame and found to be above 95% for all varieties except Goar which was 83%. The row width was measured three places in each plot and found to vary little, averaging nine inches for all varieties except Goar which was six and a half inches in average row width.

Table VIII. Irrigated Tall Fescue on the Station, 1961. Tons per acre at 12% moisture from three cuttings - 5/22, 7/5, and 8/29.

Variety	Cut	Replications I	II	III	IV	Total	Ave.	Season Total
Alta	1	.508	.419	.470	.330	1.727	.43	
	2	.634	.520	.634	.559	2.347	.59	
	3	M	.570	.530	.480	1.580	.53*	1.55
Kentucky 31	1	.508	.241	.343	.330	1.422	.36	
	2	.825	.533	.762	.584	2.704	.68	
	3	.840	.470	.810	.590	2.710	.68	1.71
Goar	1	.534	.254	.470	.254	1.089	.27	
	2	.598	.394	.496	.356	1.844	.46	
	3	.650	.480	.700	.610	2.440	.61	1.34
Kentucky G1-32	1	.419	.343	.394	.254	1.410	.35	
	2	.878	.825	.748	.725	3.175	.79	
	3	.690	.790	.880	.590	2.950	.74	1.88
Oregon 4-36	1	.330	.292	.432	.356	1.113	.28	
	2	.559	.598	.598	.533	2.288	.57	
	3	.970	.630	.840	.710	3.150	.79	1.64

* Three plot average

$\bar{x}$.	1.670
S.E.$\bar{x}$.	.0827
L.S.D.(5%)..	.257
C.V.	4.95%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	.295449	
Variety	4	.103514	
Error	11	.027343	
Total	18		

Bromegrasses - Irrigated 1961

Ten varieties of Bromegrass, seeded in 1958 for frequent cutting as simulated pasture, have been harvested three times in 1961.

Seasons' yield in tons per acre by cuttings is reported in Table IX. Seasons' yields vary little, ranging from 1.67 to 2.01 tons per acre. This is the history of this trial, there being no particularly outstanding performance by any variety in this location.

Three-year four replication average seasons' yields are as follows in tons per acre:

Variety	1959	1960	1961	Average
Achenback	2.81	1.78	1.76	2.12
Lancaster	2.71	1.94	1.81	2.15
Southland	2.74	1.93	1.82	2.19
Manchar	2.66	1.82	1.93	2.14
Wisconsin 63	2.29	1.86	1.67	1.94
Saratoga	2.60	1.51	1.97	2.03
Montana I	2.33	1.62	1.94	1.96
Montana II	2.45	1.64	1.92	2.00
Lincoln	2.50	1.58	2.01	2.03
Canadian Common	2.51	1.48	2.00	2.00

In three-year four replication averages, Manchar ranks first in early and mid-season growth and sixth in late growth. Southland, which leads in three-year seasons' production, is first in late season growth, second in mid-season growth, and third in early growth. However, with such small differences as are found in this trial, it is doubtful if these mean much. The Analysis show differences to be below statistical significance even with a C.V. of 5.42%. See Table IX.

Table IX. Irrigated Bromegrass Varieties on the Station in 1961. Tons per acre at 12% moisture from three cuttings, 5/22, 7/5, and 8/29.

Variety	Cut	Replications I	II	III	IV	Total	Ave.	Season Total
Achenback	1	.37	.46	.47	.44	1.74	.44	
	2	.42	.48	.51	.61	2.02	.51	
	3	.78	.81	.69	.97	3.25	.81	1.76
Lancaster	1	.46	.55	.48	.36	1.85	.46	
	2	.46	.63	.61	.62	2.32	.58	
	3	.78	1.22	.59	.50	3.09	.77	1.81
Southland	1	.47	.62	.51	.39	1.99	.50	
	2	.44	.52	.65	.52	2.13	.53	
	3	.97	.81	.76	.61	3.15	.79	1.82
Manchar	1	.53	.56	.43	.22	1.74	.44	
	2	.53	.74	.90	.70	2.87	.72	
	3	.74	1.28	.65	.42	3.09	.77	1.93
Wisconsin 63	1	.40	.47	.44	.36	1.67	.42	
	2	.52	.51	.50	.53	2.06	.52	
	3	.71	.93	.76	.52	2.92	.73	1.67
Saratoga	1	.55	.47	.34	.36	1.72	.43	
	2	.66	.66	.59	.59	2.50	.63	
	3	.85	1.18	.99	.60	3.62	.91	1.97
Montana I	1	.46	.51	.33	.27	1.57	.39	
	2	.71	.83	.84	.85	3.23	.81	
	3	.61	1.08	.79	.48	2.96	.74	1.94
Montana II	1	.46	.39	.27	.33	1.45	.36	
	2	.80	.69	.75	.69	2.93	.73	
	3	.71	1.37	.70	.54	3.32	.83	1.92
Lincoln	1	.51	.46	.55	.42	1.94	.49	
	2	.71	.69	.51	.54	2.45	.61	
	3	.93	1.00	.81	.89	3.63	.91	2.01
Canadian Common	1	.36	.42	.30	.38	1.46	.37	
	2	.65	.90	.74	.76	3.05	.76	
	3	.63	1.22	1.02	.61	3.48	.87	2.00

$\bar{X}$. 1.875
S.E.$\bar{X}$. .. .1017
L.S.D. .. NS
C.V. 5.42%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	.66156	15.99**
Variety	9	.050188	1.21
Error	27	.041385	
Total	39		

Orchardgrasses - Irrigated 1961

This nursery with nineteen entries was seeded in 1959. The three cutting yields by cuttings are shown in Table X. Yields for the season run between 3.12 and 3.96 tons per acre, about a ton more than in 1960.

Stands as estimated by use of the forty unit frame are, as of October 1961, from 88 to 100 percent.

Pa. Medium ranks first in season's production this year and first in early, mid-season, and late and in total production for a two year average which is quite a record in a nineteen variety nursery. Penlate and Latar, two varieties farmers are interested in because in maturity characteristics they closely resemble alfalfa, have both produced as well as Potomac, our presently recommended variety, in the two years of this trial. Avon which is first in the dryland nursery for two year production is third in this irrigated trial.

Analysis of the season's production shows differences to be below statistical significance at the five percent level. The C. V. is 5.27%.

One additional year of harvest is planned for this trial. Data are included in the State report on this nursery. See Table X.

Table X. Irrigated Orchardgrass on the Station in 1961. Tons per acre at 12% moisture in three cuttings - 6/8, 7/27, and 8/31.

Variety	Cut	Replications I	II	III	IV	Total	Ave.	Season Total	2 yr. Ave.
Potomac	1	1.68	1.60	2.04	2.13	7.45	1.86		
	2	.89	1.20	1.41	1.49	4.99	1.25		
	3	.29	.30	.30	.52	1.41	.35	3.46	2.95
Akaroa	1	1.20	1.74	1.68	2.08	6.70	1.67		
	2	1.02	1.07	1.46	1.55	5.10	1.28		
	3	.30	.34	.38	.59	1.61	.40	3.35	2.75
Aurora	1	2.04	1.84	1.98	2.63	8.49	2.12		
	2	1.07	1.08	1.44	1.45	5.04	1.26		
	3	.27	.17	.33	.52	1.29	.32	3.70	3.10
Commercial	1	2.13	2.06	2.16	1.95	8.30	2.07		
	2	.94	1.11	1.48	1.11	4.64	1.16		
	3	.33	.34	.34	.44	1.45	.36	3.59	3.06
Iowa I	1	2.19	2.17	2.00	1.95	8.31	2.08		
	2	.88	1.20	1.54	1.27	4.89	1.22		
	3	.27	.33	.33	.38	1.31	.33	3.63	3.12
Pennlate	1	1.35	2.27	1.95	2.37	7.94	1.98		
	2	.98	1.40	1.44	1.12	4.94	1.24		
	3	.30	.43	.38	.46	1.57	.39	3.61	3.08
Avon	1	1.81	2.10	2.20	2.27	8.38	2.09		
	2	1.05	1.09	1.30	1.40	4.84	1.21		
	3	.39	.29	.38	.65	1.71	.43	3.73	3.21
Danish	1	1.72	2.17	1.91	2.19	7.99	2.00		
	2	1.15	1.24	1.36	1.22	4.97	1.24		
	3	.30	.34	.38	.43	1.45	.36	3.60	2.99
Wisconsin 52	1	1.87	2.08	2.31	2.24	8.50	2.12		
	2	1.05	1.04	1.49	1.31	4.89	1.22		
	3	.29	.34	.42	.54	1.59	.40	3.74	3.13
Utah Syn. 2	1	1.71	1.93	1.86	1.78	7.28	1.82		
	2	1.13	1.15	.94	1.40	4.62	1.16		
	3	.30	.33	.29	.54	1.46	.37	3.35	2.94
Iowa 6	1	2.06	1.71	1.83	2.51	8.11	2.03		
	2	1.22	1.30	1.32	1.36	5.20	1.30		
	3	.34	.38	.29	.54	1.55	.39	3.72	3.27
Kentucky Syn.	1	2.18	2.00	1.60	1.93	7.71	1.93		
	2	1.18	1.23	1.40	1.35	5.16	1.29		
	3	.34	.33	.37	.43	1.47	.37	3.59	3.12
Latar	1	2.13	1.54	2.24	1.97	7.88	1.97		
	2	.93	.95	1.20	1.41	4.49	1.12		
	3	.32	.34	.29	.48	1.43	.36	3.45	2.98
Pa. Early	1	2.03	1.53	1.95	1.82	7.33	1.83		
	2	1.33	1.22	1.73	1.31	5.59	1.40		
	3	.36	.26	.38	.47	1.47	.37	3.60	3.18

Continued ---

Table X --- Continued

Variety	Cut	Replications I	II	III	IV	Total	Ave.	Season Total	2 yr. Ave.
Pa. Medium	1	1.92	2.07	2.28	2.08	8.35	2.09		
	2	1.20	1.32	1.70	1.49	5.71	1.43		
	3	.38	.36	.54	.47	1.75	.44	3.96	3.37
S-26	1	1.37	1.54	1.57	2.32	6.80	1.70		
	2	.95	1.15	1.26	1.54	4.90	1.23		
	3	.27	.24	.33	.52	1.36	.34	3.27	2.71
S-37	1	1.13	1.64	2.16	1.78	6.71	1.68		
	2	.90	1.04	1.55	1.35	4.84	1.21		
	3	.28	.39	.43	.52	1.62	.41	3.30	2.68
S-143	1	1.33	1.62	1.71	1.57	6.23	1.56		
	2	.74	1.21	1.55	1.35	4.85	1.21		
	3	.23	.30	.42	.44	1.39	.35	3.12	2.61
Trogdon	1	1.69	2.34	1.93	2.19	8.15	2.04		
	2	.85	1.37	1.58	1.40	5.20	1.30		
	3	.26	.38	.36	.56	1.56	.36	3.70	3.13

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	2.780796	19.90
Variety	18	.168443	1.21
Error	54	.139737	
Total	75		

$\bar{x}$.	3.55
S.E.$\bar{x}$.	.1869
L.S.D.	NS
C.V.	5.27%

Bluegrasses--Irrigated 1961

This is the second year of harvest for bluegrasses selected from an observational introductions study, seeded with alfalfa for hay, and checked against Sherman Big Blue, Troy Blue, and Potomac Orchard.

Volunteer red clover continues to obscure results from the species and varieties seeded.

Yields from two cuttings are shown in Table XI.

There may be a bunchgrass type Blue in this study equal to Sherman Big Blue but in two years, no advantage is indicated for any mixture over the Orchard-alfalfa mixture for hay.

Table XI. Bluegrass Varieties

Variety or Mix	Cut	Replications I	II	III	Total	Ave.	Season Ave.	2 yr. Ave.
P-5731	1	2.30	2.47	2.37	7.14	2.38		
	2	1.63	1.82	1.63	5.08	1.69	4.07	4.04
P-8903	1	2.42	2.06	2.54	7.02	2.34		
	2	1.91	1.54	1.36	4.81	1.60	3.94	3.95
P-846	1	2.62	2.16	2.01	6.79	2.26		
	2	2.00	1.54	1.82	5.36	1.79	4.05	4.21
P-15398	1	2.03	2.47	2.04	6.54	2.18		
	2	2.00	2.00	1.54	5.54	1.85	4.03	4.13
13949-410	1	2.63	2.37	1.91	6.91	2.30		
	2	2.27	1.36	1.36	4.99	1.66	3.96	4.25
13783-33	1	1.94	1.83	2.43	6.20	2.07		
	2	2.00	1.82	1.45	5.27	1.76	3.83	4.25
13703-208	1	2.46	1.89	2.95	7.30	2.43		
	2	1.82	1.72	1.91	5.45	1.82	4.25	4.17
P-13819	1	2.57	1.98	2.11	6.66	2.22		
	2	1.91	1.54	2.09	5.54	1.85	4.07	4.23
14095-803	1	2.07	2.27	2.29	6.63	2.21		
	2	1.82	1.72	1.82	5.36	1.79	4.00	4.18
Sherman	1	2.47	2.08	2.24	6.79	2.26		
	2	1.45	1.36	1.36	4.17	1.39	3.65	3.62
Potomac O.	1	2.29	2.63	2.15	7.07	2.36		
	2	1.63	2.00	1.82	5.45	1.82	4.18	4.30
Troy	1	2.69	2.52	2.48	7.69	2.56		
	2	1.63	1.82	2.00	5.45	1.82	4.38	4.24

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	2	.255040	1.43
Variety	11	.106948	----
Error	22	.178469	
Total	35		

$\bar{x}$.	4.03
S.E.$\bar{x}$.	.2439
L.S.D.	NS
C.V.	6.05%

Small Seeded Legumes--Irrigated 1961

Twenty-one entries, four replications, are included in this nursery seeded in 1960. The 1960 Annual Report shows seedling year harvested yields of 1.21 to 1.85 tons per acre for sixteen entries.

Stands of the sixteen entries harvested this season were estimated by use of the forty unit frame, five measurements per plot, to be from 68 to 100 percent and average from 84 to 99.75 per entry. Montgomery Red Clover, Astragulus Canadensis, Cicer and Sickle Milkvetch, and Astragulus semibilocularis either failed to establish stands or made insufficient growth to be harvested this season.

Seasons yields for one harvest taken at full bloom for Kenland Red Clover plus aftermath cuttings at one month intervals, three harvests in all, vary from a low of 4.06 tons to a high of 6.56 tons per acre at twelve percent moisture. The harvest data are found in Table XII.

Ranking one to five in first cutting yield are: 1. Weibull's Tetra Red Clover, 2. Tomminsto Red Clover, 3. Altaswede Red Clover, 4. Zigzag Red Clover, and 5. Ottio Mammoth Red Clover. One and two are above Kenland at the five percent level.

Ranking one to five in aftermath production are: 1. Vernal Alfalfa, 2. Pennscott Red Clover, 3. Lakeland Red Clover, 4. Kenland Red Clover, and 5. Dollard Red Clover.

Ranking one to five in total production for the season are: 1. Weibull's Tetra Red Clover, 2. Tomminsto Red Clover, 3. Ottio Mammoth Red Clover, 4. Weibull's Resistana Red Clover, and 5. Zigzag Red Clover.

Analysis show significance in this trial. The C.V. is 6.18%. If yields of better entries can be maintained over a reasonable number of years near this year's levels, their use will doubtless expand.

See Table XII.

Table XII. Irrigated Legumes

Variety or Mix	Cut	Ave. Stand	Replications I	II	III	IV	Total	Ave.	Season Total
Zigzag	1		4.02	3.75	3.45	4.35	15.57	3.89	
Red Clover	2	90	.65	.67	.79	.70	2.81	.70	
	3		.79	.95	.85	.79	3.38	.85	5.44
Pennscott	1		2.80	3.33	2.55	3.78	12.46	3.12	
Red Clover	2	98	1.27	1.42	1.22	1.44	5.35	1.34	
	3		.81	.81	.57	.89	3.08	.77	5.23
Kenland	1		3.09	3.72	3.04	3.03	12.88	3.22	
Red Clover	2	87	1.30	1.52	1.26	1.08	5.16	1.29	
	3		.81	.80	.50	.81	2.92	.73	5.24
Lakeland	1		3.45	3.35	3.18	3.57	13.55	3.39	
Red Clover	2	93	1.02	1.30	1.15	1.17	4.64	1.16	
	3		.94	.85	.91	.91	3.61	.90	5.45
Dollard	1		3.04	3.88	2.69	2.00	11.61	2.90	
Red Clover	2	97	1.02	1.14	1.39	1.06	4.61	1.15	
	3		.91	.90	.80	.80	3.41	.85	4.90
Altaswede	1		3.36	5.02	4.27	2.97	15.62	3.91	
Red Clover	2	90	.43	.79	.82	.65	2.69	.67	
	3		.69	.79	.85	.59	2.92	.73	5.31
Ottie Mammoth	1		3.88	4.30	3.76	3.53	15.47	3.87	
Red Clover	2	92	.74	.78	1.08	1.06	3.66	.91	
	3		.97	.79	.88	.74	3.40	.85	5.63
Weibulls Tetra	1		4.37	6.94	3.66	4.37	19.34	4.84	
Red Clover	2	88.5	.78	.81	.84	.82	3.25	.81	
	3		1.00	.85	.81	.97	3.63	.91	6.56
Tomminsto	1		3.91	4.82	4.92	5.34	18.99	4.75	
Red Clover	2	95	.88	.75	.91	.71	3.25	.81	
	3		.91	.84	.81	.72	3.28	.82	6.38
Alaskland	1		2.87	3.46	2.69	2.85	11.87	2.97	
Red Clover	2	86	1.12	1.47	1.21	1.12	4.92	1.23	
	3		.70	.81	.76	.62	2.89	.72	4.92

Continued ——

Table XII. (Continued)

Variety or Mix	Cut	Ave. Stand	Replications I	II	III	IV	Total	Ave.	Season Total
Manhardy	1		4.26	4.56	3.27	3.09	15.18	3.80	
Red Clover	2	88.5	.45	.61	.69	1.10	2.85	.71	
	3		.75	.71	.59	.66	2.71	.68	5.19
Weibulls Resistenta	1		3.91	3.73	3.49	3.41	14.54	3.64	
Red Clover	2	93.5	.89	.91	1.00	.82	3.62	.90	
	3		1.04	.88	.89	.84	3.65	.91	5.45
Comm. Alsike	1		3.17	4.11	3.02	2.53	12.83	3.21	
	2	99.7	.07	.38	.50	.37	1.32	.33	
	3		.52	.42	.54	.59	2.07	.52	4.06
Tetra Alsike	1		3.55	4.24	2.52	2.78	13.09	3.27	
	2	95	.18	.35	.43	.48	1.44	.36	
	3		.47	.61	.43	.41	1.92	.48	4.11
Vernal Alfalfa	1		3.33	1.99	3.03	3.33	11.68	2.92	
	2	84	1.42	1.02	1.50	1.47	5.41	1.35	
	3		.95	.70	.94	.99	3.58	.90	5.17
Sanfoin	1		3.11	3.26	2.33	2.95	11.65	2.91	
	2	87	.85	.81	.65	1.05	3.36	.84	
	3		.48	.48	.37	.56	1.89	.47	4.22

Analysis of Variance (First Cutting)

Source	D.F.	Mean Square	F
Replications	3	1.912085	5.75**
Varieties	15	1.486499	4.47**
Error	45	.332762	
Total	63		

Analysis of Variance (Aftermath)

Source	D.F.	Mean Square	F
Replications	3	.019654	.46
Varieties	15	.716321	16.92
Error	45	.042328	
Total	63		

	One Cut	Aftermath
$\bar{x}$.	3.54	1.67
S.E.$\bar{x}$.	.2884	.1029
L.S.D.(5%)...	.82	.29
L.S.D.(1%)...	1.10	.39
C.V.	8.16%	6.18%

Table 12A. Occupancy - Irrigated Legumes. April 20, 1961.
Based on five samples per plot - 40 unit frame.
% = 2½ times average occupancy.

Variety	Replications I	II	III	IV	Mean Ave.	Percent Stand
Zigzag R. C.	32.0	38.8	38.4	35.6	36.2	90.50
Pennscott R. C.	37.7	40.0	39.2	40.0	39.1	97.75
Kenland R. C.	34.0	40.0	32.8	32.4	34.8	87.00
Lakeland R. C.	34.8	37.6	38.4	38.8	37.4	93.50
Dollard R. C.	36.0	40.0	40.0	39.6	38.9	97.25
Altaswede R. C.	32.0	39.2	38.8	34.0	36.0	90.00
Ottio Mammoth R. C.	36.8	36.0	39.2	35.2	36.8	92.00
Weibull's Tetra R. C.	34.0	37.6	38.4	31.6	35.4	88.50
Tomminsto R. C.	39.2	36.8	36.0	40.0	38.0	95.00
Alaskland R. C.	31.6	37.6	36.8	34.0	35.0	87.50
Manhardy R. C.	37.6	36.4	36.4	31.6	35.5	88.75
Weibull's Resistana	38.8	32.8	39.6	38.4	37.4	93.50
Common Alsike	40.0	39.6	40.0	40.0	39.9	99.75
Tetra Alsike	36.8	38.8	37.6	38.4	37.9	94.75
Vernal Alfalfa	27.2	32.4	38.0	36.8	33.6	84.00
Sanfoin	35.6	34.4	34.4	34.8	34.8	87.00

$\bar{x}$. 36.7
S.E.$\bar{x}$. 1.2191
L.S.D. 3.5
C.V. 3.86%

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	20.165166	
Variety	15	13.108493	
Error	45	5.944811	
Total	63		

Wheatgrasses - Irrigated 1961

Eighteen wheatgrasses seeded in 1960 were harvested once on June 22. It would have been cut the second time had growth justified.

Stand estimates were taken by use of the forty unit frame. They varied based on five measurements averages from nine to ninety-three percent in the spring and was not greatly different in the fall in many cases. Standard Crested and Whitmar Beardless were notably poor in stand with 13.25%.

Table XIII shows the one cutting yields and aftermath rank with yields in tons per acre at twelve percent moisture. These vary from .84 to 3.59 tons per acre. Ranking one to five in yield are: 1.-S.D. 20, 3.59 2.-Greenar, 3.17 3.-Ree, 3.16 4.-Neb. 50, 2.93 5.-Amur, 2.64. All of these are intermediates. S64 Tall is first among the Tall varieties with 2.25 tons, but it should be pointed out that the harvest was scheduled by Intermediate maturity and was somewhat early for the Talls.

In regrowth after cutting based on four replication average estimates, the top ranking varieties are:

1. Ree Intermediate
2. Greenar Intermediate
3. Amur, Ida. 3, Neb. 50, S.D. 20 Intermediate, and Mandan 759 Pubescent
4. S64, Alkar, A12465 Tall, Utah 109 Pubescent, and Sodar Streambank
5. Neb. P.I. 985263 Tall.

Statistically, different yields were obtained in this trial at the one percent level. The C.V. was 7.46%.

See Table XIII for yield, XIIIA for stand data, and XIV for maturity characteristics.

Table XIII. Irrigated Wheatgrass. One cutting yield in tons per acre at 12% moisture and aftermath rank. Cut: June 22, 1961 Aftermath rank: September 7, 1961

Variety or Mix		Replications I	II	III	IV	Total	Ave.	Am. Rank
Beardless Whitmar		.97	.84	.93	1.07	3.81	.95	
	Aftermath rank	10	10	7	5	32	8.00	9
Siberian P27		1.35	1.37	1.71	1.85	6.28	1.57	
	Aftermath rank	8	4	4	6	22	5.50	6
Crested Standard		.70	1.09	.91	.76	3.46	.87	
	Aftermath rank	9	10	10	10	39	9.75	10
Tall Wheatgrass Mandan 1422		1.57	1.76	3.07	1.86	8.26	2.07	
	Aftermath rank	6	6	5	7	24	6.00	7
Tall Wheatgrass Nebr. P.I. 985263		1.00	1.51	1.36	1.42	5.29	1.32	
	Aftermath Rank	7	6	3	5	21	5.25	5
Tall Wheatgrass S64		1.93	2.26	2.26	2.54	8.99	2.25	
	Aftermath rank	5	5	4	5	19	4.75	4
Tall Wheatgrass Alkar		1.73	2.39	2.92	1.78	8.82	2.21	
	Aftermath rank	4	4	5	5	18	4.50	4
Tall Wheatgrass A 12465		1.71	2.18	2.55	2.04	8.48	2.12	
	Aftermath rank	5	5	5	4	19	4.75	4
Intermediate Amur		1.97	2.64	2.86	3.07	10.54	2.64	
	Aftermath rank	4	3	3	5	15	3.75	3
Intermediate Greenar		2.23	2.92	3.14	3.02	11.31	2.83	
	Aftermath rank	3	3	2	3	11	2.75	2
Intermediate Idaho 3		1.98	2.19	2.08	2.71	8.96	2.24	
	Aftermath rank	3	5	2	4	14	3.50	3
Intermediate Nebr. 50		2.13	2.89	3.72	2.97	11.71	2.93	
	Aftermath rank	3	2	4	4	13	3.25	3

Continued ——

Table XIII (Continued)

Variety or Mix		Replications I	II	III	IV	Total	Ave.	Am. Rank
Intermediate Ree		2.88	3.15	3.01	3.61	12.65	3.16	
	Aftermath rank	2	1	1	2	6	1.50	1
Intermediate S. Dak. 20		3.31	3.80	4.27	2.98	14.36	3.59	
	Aftermath rank	3	4	2	4	13	3.25	3
Pubescent Mandan 759		1.93	2.75	2.49	2.26	9.43	2.36	
	Aftermath rank	4	5	2	5	16	4.00	3
Pubescent Topar		1.42	1.90	3.08	2.13	8.53	2.13	
	Aftermath rank	8	5	6	6	25	6.25	8
Pubescent Utah 109		1.67	2.40	2.51	2.39	8.97	2.24	
	Aftermath rank	5	4	3	6	18	4.50	4
Streambank Sodar		.60	1.07	1.12	.56	3.35	.84	
	Aftermath rank	4	4	4	6	18	4.50	4

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	1.586648	15.71**
Species	17	2.423135	24.00**
Error	51	5.149405	
Total	71		

$\bar{x}$.	2.13
S.E.$\bar{x}$.	.1589
L.S.D. (5%).....	.45
L.S.D. (1%).....	.60
C.V.	7.46%

Table XIIIA. Occupancy - Irrigated Wheatgrass April 20, 1961
Based on five samples per plot with a forty unit frame.

Entry		Replications I	II	III	IV	Mean	Percent Stand
Whitmar	Beardless	6.4	3.6	4.8	6.4	5.3	13.25
Siberian	P27	32.0	32.8	23.2	25.6	28.4	71.00
Standard	Crested	6.0	4.0	7.2	4.0	5.3	13.25
Mandan 1422	Tall	34.4	28.4	36.8	30.0	32.4	81.00
Nebr. P. I. 985263	Tall	22.0	15.2	14.4	20.0	17.9	44.75
S64	Tall	34.4	35.6	36.4	34.8	35.3	88.25
Alkar	Tall	37.2	38.0	35.6	34.8	36.4	91.00
A 12465	Tall	36.4	38.0	34.8	36.0	36.3	90.75
Amur	Intermediate	33.2	34.0	32.0	28.0	31.8	79.50
Greenar	Intermediate	35.6	36.4	37.6	33.2	35.7	89.25
Idaho 3	Intermediate	33.2	22.4	16.8	28.8	25.3	63.25
Neb. 50	Intermediate	28.0	27.2	31.6	18.8	26.4	66.00
Ree	Intermediate	33.6	30.0	28.4	32.8	31.2	78.00
S. Dak. 20	Intermediate	36.8	34.8	33.2	36.8	35.4	88.50
Mandan 759	Pubescent	28.8	25.6	34.0	28.8	29.3	73.25
Topar	Pubescent	28.8	25.6	30.4	23.2	27.0	67.50
Utah 109	Pubescent	32.8	28.8	24.4	31.6	29.4	73.50
Sodar	Streambank	29.2	29.2	24.0	28.4	27.7	69.25

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	26.295566	2.53
Species	17	351.775294	33.79
Error	51	10.408496	
Total	71		

$\bar{x}$.	27.58
S.E.$\bar{x}$.	1.6131
L.S.D.	4.59
L.S.D.	6.11
C.V.	5.85%

Maturity Characteristics of Wheatgrasses and Legumes

A fifth replication of the wheatgrass and small seeded legume nurseries-irrigated was seeded for observation of maturity characteristics. Attempt was made to note bloom dates and harvest by varieties or maturity groups when ready.

Data for wheatgrasses is shownin Table XIV. Yields are merely indicative since single plots were used. However, they suggest the possibility that the Tall wheatgrasses were harvested too early in the eighteen variety yield nursery. None of the wheatgrasses reached bloom stage a second time.

Data for the legumes is shown in Table XV. Only in the case of Dollard red clover do these single plot samples indicate that the management of the irrigated yield nursery was unsuited to the variety. It will be noted that eight of the legumes in the nursery, even though they produced considerable regrouth in the yield nursery, failed to reach bloom stage for a second harvest, or in other words, might be classed as one cutting varieties.

Date of bloom in 1961 indicates that certain of the wheatgrasses could be put with certain of the legumes in mixtures for irrigated hay production that could be harvested as good quality hay in July when favorable harvest weather is expected.

The indicated yield in one cutting, if maintained during the next two years, would be strong competition for two cutting mixtures.

See Tables XIV and XV.

Table XIV. Wheatgrass Maturity Characteristics. Harvest yield indicated by 12 ft. of inside row.

Variety			Panicles Emerge	Headed	Bloom	Cut	Tons/ Acre
Whitmar	Beardless	34084	6- 5	6-10	6-16	6-16	.54
Siberian	P27	34619	6- 7	6-10	7- 5	7- 5	1.90
Mandan 1422	Tall	34616	6-16	7- 5	7-10	7-10	3.30
Neb. P.I. 1985263	Tall	34527	6-26	7- 5	7-10	7-10	1.46
S 64	Tall	35099	6-26	7- 5	7-12	7-10	3.56
Alkar	Tall	35261	6-26	7- 5	7-12	7-10	3.43
A 12465	Tall	35262	6-26	7- 5	7-10	7-10	3.17
Amur	Interm.	35306	6-12	6-18	6-27	7- 5	2.41
Greenar	Interm.	35248	6-14	6-22	6-27	7- 5	2.48
Idaho 3	Interm.	34224	6-16	6-24	7- 5	7- 5	3.05
Nehr. 50	Interm.	34528	6-12	6-18	7- 5	7- 5	3.36
Ree	Interm.	35110	6-16	6-20	6-27	7- 5	2.86
S. Dak. 20	Interm.	35927	6-12	6-19	6-30	7- 5	3.81
Man. 759	Pubesc.	34617	6-16	6-22	6-30	7- 5	3.81
Topar	Pubesc.	34620	6- 9	6-15	6-27	7- 5	2.79
Utah 109	Pubesc.	33961	6-12	6-16	6-27	7- 5	2.67
Sodar	Strbk.	34618	6- 5	6-12	6-16	6-16	.67

Table XV. Legume Maturity in 1961. Yields in tons per acre at 12% moisture from 12 feet of center row.

Variety	Date Buds	Date 1st Bloom	Date ½ Bloom	Cutting 1st Date	Cutting 2nd Date	Tons Per Acre 1st	2nd	Total
Zigzag		6-15	6-27	7- 5		3.43		
Pennscott		6-13	6-24	7- 5	8-13	2.92	1.30	4.22
Kenland		6-12	6-22	7- 5	8-13	3.37	1.36	4.73
Lakeland		6-12	6-22	7- 5	8-28	3.68	1.90	5.58
Dollard		6-12	6-22	7- 5	8-28	3.68	1.78	5.46
Altaswede	6-12	6-27		7-10		3.56		
Ottio Mammoth	6-12	6-16	6-28	7-10		3.78		
Weibulls Tetra		6-12	6-28	7-10	8-28	4.14	1.14	5.28
Tomminsto	6-12	6-16	6-30	7-10		3.66		
Alaskland		6-10	6-16	6-16	8- 7	1.95	1.71	3.66
Manhardy		6-12	6-26	7- 5		3.78		
Weibulls Resistance	6-12	6-27		7-10		4.28		
Common Alsike		6-14	6-24	7- 5		2.72		
Tetra Alsike	6-16	6-22	6-26	7- 5		3.54		
Vernal Alfalfa	6-12	6-20	6-26	7- 5	8-13	2.96	1.46	4.42
Sanfoin		6- 9	6-16	6-16	8-10	2.82	1.24	4.06

Maturity of Grasses — 1961

The height of grasses in several Station grass nurseries was determined on May 12, 1961 as an indication of the relative earliness of the species and varieties grown.

Height in Inches	Varieties
	Orchardgrasses
12	Potomac
9	Danish
8	Commercial, Iowa I, Kentucky Syn., Pa. Early, Pa. Medium, Avon, and Wisc. 52
6	Akaroa, Aurora, Iowa 6, Latar, Pennlate, Utah Syn.
5	S-26, S-37, Trogdon
4	S-143
	Fescues
12	Alta
11	Goar
10	Ky. 31
8	Ky. 61-32, Oregon 4-36
	Legumes
8	Pennscott, Lakeland, Tetra Alsike, Vernal Alfalfa, Sanfoin
7	Kenland, Dollard, common Alsike
6	Zigzag
	Wheatgrasses
12	S. Dak. 20 Intermediate
10	Greenar, Neb. 50, Ree, (Intermediates) Mandan 759 Pubescent
9	Idaho 3 Intermediate
8	Whitmar Beardless, Siberian P27, A 12465 Tall, Amur Intermediate, Utah 109 Pubescent
7	Alkar Tall
6	Std. Crested, Man. 1422 Tall, Neb. P.I. 985 263 Tall, S 64 Tall, Topar Pubescent, Sodar Streambank
	Bluegrasses
12	P-13819, Troy
8	P-5731, 13949-410
7	13703-208
6	P-8903, P-846, P-15398, 13783-33, 14095-803, Sherman Big Blue, Potomac Orchard

Height in Inches	Varieties
	Bromegrasses
8	Montana 1
7	Achenbach, Southland, Wis. 63, Saratoga, Montana 11, Lincoln
6	Lancaster, Manchar, Can. Common
	Miscellaneous in Mixtures
12	Potomac Orchard, Meadow Foxtail (Headed)
8	Alta Fescue
7	Sherman Big Blue, Green Stipa, Lincoln Brome
6	Erect Brome, Tall Oat, Ree Intermediate
5	Ladak Alfalfa, Man. 404 Brome, Whitmar Beardless Wheatgrass

Winter Hardiness of Alfalfa

Five alfalfa varieties were seeded under irrigation for observation of winter hardiness. This season all that was done was to determine stands by use of the forty unit frame. Stand percentages vary from 80.5 to 94.25 in 1961.

Table XVA. Occupancy - Winter Hardiness Alfalfas at Creston, Montana April 20, 1961

Alfalfa	Reps.	A	B	C	D	E	Total	Ave.	Mean	%
Lahontan	1	30	24	28	20	40	142	28.4		
	2	40	40	40	40	34	194	38.8		
	3	36	40	40	40	40	196	39.2		
	4	40	40	40	40	40	200	40.0	36.6	91.5
Vernal	1	30	24	28	28	40	150	30.0		
	2	24	32	40	40	40	176	35.2		
	3	40	38	40	38	40	196	39.2		
	4	40	32	38	40	28	178	35.6	35.0	87.5
Zia	1	20	24	28	28	34	134	26.8		
	2	40	12	38	32	28	150	30.0		
	3	38	30	40	32	40	180	36.0		
	4	40	38	34	40	28	180	36.0	32.2	80.5

Continued ——

Table XVA. (Continued)

Alfalfa	Reps.	A	B	C	D	E	Total	Ave.	Mean	%
New Mexico 11-1	1	40	38	36	36	32	182	36.4		
	2	38	40	32	40	40	190	38.0		
	3	34	40	40	40	40	194	38.8		
	4	34	36	38	40	40	188	37.6	37.7	94.25
New Mexico 22-2	1	32	12	32	40	40	156	31.2		
	2	24	34	40	34	36	168	33.6		
	3	32	40	40	40	40	192	38.4		
	4	40	40	36	40	40	196	39.2	35.6	89.00

$\bar{x}$..... 35.42
L.S.D.(5%).. 3.5

Analysis of Variance

Source	D.F.	Mean Square	F
Total	99	---	---
Replications	3	310.2267	10.33**
Varieties	4	85.84	2.86*
Var x Reps	12	23.8933	
Error	80	30.02	

Grasses — Dryland 1961

Grasses seeded on a dry hilltop near Polson in 1958 were harvested in one cutting on June 27. A shortage of June precipitation was noticeable in yields of the least drought tolerant species.

Yields in 1961 in tons per acre at twelve percent moisture varied from .48 for Meadow Foxtail to 1.21 for Intermediate Wheatgrass. Russian Wild Rye, while doubtless drought tolerant, produced .35 tons per acre. Grasses producing .90 tons and upward were Standard Crested, Pubescent Wheatgrass, Tall Wheatgrass, and Sherman Big Bluegrass.

In a three year average production, Intermediate Wheatgrass leads with 1.64 tons followed by Pubescent and Tall Wheatgrass with 1.28 and 1.27 tons. In the 1.05 to 1.19 ton range are Standard and Nordan Crested, Slender Wheatgrass, Manchar and Lincoln Brome, Sherman Big Blue, Alta Fescue, and Hopkins Timothy. 1961 yields and three year average yields are reported in Table XVI.

Statistical significance at the one percent level is found between yields of entries in this nursery when compared to Russian Wild Rye. The coefficient of variability is rather high, 16.49%.

Table XVI. Grasses - Dryland in Lake County in 1961. Yields in tons per acre from one cutting on June 27, 1961.

Variety or Mix	Cut	Replications I	II	III	IV	Total	Ave.	3 yr. Ave.
Intermediate Wheat	1	1.92	1.02	.79	1.09	4.82	1.21	1.64
Nordan Crested	1	1.22	.41	.64	.70	2.97	.74	1.05
Standard Crested	1	1.42	.64	.94	.79	3.79	.95	1.19
Pubescent Wheat	1	1.19	1.13	.48	.89	3.69	.92	1.28
Tall Wheat	1	1.05	.99	1.25	.79	4.08	1.02	1.27
Manchar Brome	1	.67	1.09	.78	.60	3.14	.79	1.05
Slender Wheat	1	.60	.56	.83	.95	2.94	.74	1.13
R.W. Rye - Polson	1	.33	.37	.19	.50	1.39	.35	.42 [1]
Potomac Orchard	1	.60	.53	.32	.65	2.10	.53	.77
Sherman Big Blue	1	.93	1.44	1.07	.56	4.00	1.00	1.07
Meadow Foxtail	1	.51	.46	.53	.43	1.93	.48	.57
Alta Fescue	1	.71	.97	.36	.84	2.88	.72	1.16
Lincoln Brome	1	.78	.95	.51	.91	3.15	.79	1.12
Hopkins Timothy	1	.67	.74	.43	.48	2.32	.58	1.15

[1] two year average

$\bar{x}$.	.77
S.E.$\bar{x}$.	.127
L.S.D.(5%).....	.36
L.S.D.(1%).....	.49
C.V.	16.49%

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	.159447	2.47
Species	13	.222048	3.44**
Error	39	.064525	
Total	55		

Tice Nursery — Dryland 1961

The Tice grass nursery near Ovando was observed on July 21 by C. W. Roath and Donald R. Graham. Production was ranked from one to ten for yield, and samples of grasses harvested indicate that yields per acre vary from 1.5 tons for plots ranked one to as low as .15 tons for plots ranked ten. Stand and maturity estimates were also made.

Mr. Graham made some soil observations and described the soil as follows:

Color: Darker than a brown soil except for the surface four inches
Phase: Very gravelly
Texture: Silty-clay loam surface grading to sand at twenty inches
No clay bulge and only one gradual horizon boundary at four inches.

Plots were in excellent weed-free condition. Growth was good for drought tolerant species. Yield of Orchardgrass indicated more favorable moisture than at Polson. Grasses were closer in maturity than expected and about two weeks later than at Creston.

Observations are shown in Table XVII.

Table XVII. Tice grass plot at Ovando, Montana - 3 miles south. * 2/3 seeds are set - rest in bloom.
Clovers and grasses ranked separately, each one to ten with ten the least.
Four samples of Rank 1 taken from three feet of row to establish yield level.

Plot No.	Name	Identification	Stand	Maturity	Rank
1	Irish Grade A Italian Rye Grass		Failed		
2	British Perennial Rye Grass #23		Poor	In bloom	9
3	Kenty Rye Grass (Pasture)		Poor	Bloom	8
4	British Rye Grass #24		Fair	Dough	6
5	Wild Russian Rye Grass		Fair	Dough	7
6	Imported Meadow Fescue (Pasture)		Good	Ripe	5
7	#215 Meadow Fescue (Hay)		Good	Ripe	6
8	Pasture Rye Grass #101		Poor	Bloom	10
9	Timothy British #48 (Hay)		Good	Bloom	5
10	British Pasture Timothy #50		Good	Bloom	7
11	#21 Timothy British Hay Strain		Good	Bloom	4
12	Italian #22 Rye Grass		Very Poor	Bloom	10
13	Orchardgrass #20 (Pasture)		Good	Ripe	6
14	Orchardgrass #143 (Pasture)		Good	Dough	5
15	Orchardgrass #37 (Hay)		Good	Dough	5
16	Kersey White Clover		Fair	Ripe	9
17	#100 British White Clover		Good	Ripe	9
18	British Late Flowering Red Clover		Good	Seed 2/3 *	4
19	#184 Wild White Clover		Fair	Mostly ripe	9
20	Dorset Marl Grass Broad Red Clover		Good	3/4 *	5
21	English Trefoil	Black Medic	Good	1/2 *	7
22	Meadow Foxtail	North Dakota	Good	Ripe	7
23	Creeping Meadow Foxtail	Washington	Good Creeping	Ripe	6
24	Meadow Foxtail	Oregon	Fair	Ripe	7
25	Greenar Intermediate		Good	Bloom	2
26	Creeping Red Fescue		Good	Ripe	5
27	Topar Pubescent Wheat		Good	Bloom	3
28	Siberian Wheatgrass		Good	Bloom	3
29	Smutless Crested Wheat	Standard Crested	Good	Bloom	2

Continued ——

Table XVII. (Continued)

Plot No.	Name	Identification	Stand	Maturity	Rank
30	Latar Orchardgrass		Good	Dough	3
31	Russian Wild Rye		Good	Ripe	6
32	Ladak Alfalfa		Good	½ varies with plant	1
33	Alta Fescue		Good	Dough	5
34	Tall Wheatgrass		Good	Bloom	1
35	Norden Crested Wheat		Good	Bloom	2
36	Sodar Streambank Wheatgrass		Good	Ripe	7
37	Whitmar Beardless Wheat		Good	Dough	4
38	Strawberry Clover		Fair	3/4*	9
39	Alsike Clover		Good	Ripe seed & blossoms 3/4*	4
40	Poa Lengifolia (Armenian Blue Grass)		Good	Ripe	3
41	Big Blue Grass		Good	Ripe	2
42	Canada Blue Grass		Good	Dough	5
43	Kenland Red Clover		Good	Ripe 7/8 *	2
44	Lethridge Orchardgrass		Good	Ripe	5
45	Avon Orchard		Good	Ripe	4
46	Buffalo Grass		None		
47	Creeping Red Rescue		Good	Ripe	5
48	Mandan Rice (a failure) Fall Seeded 1959		None		
49	Mandan Rice (a fair stand)		Good	Ripe	6
50	Belgian Alfalfa-Triumph DuNord		Good	3/4	1
51	Belgian Rye Grass-hay type		Fair	Ripe	8
52	Engels Rye Grass-Pasture		Good	Bloom	7
53	MerKense Red Clover		Good	3/4	2
54	Violetta Red Clover		Good	7/8	3
55	Kroper Hay and Pasture	Orchardgrass	Good	Ripe	5
56	Dactylis Glomerata Deendiang Bloom		Good	Ripe	5
57	Engels Rye Grass-Hay type		Good	Ripe	5
58	English Meadow Fescue	Meadow Fescue	Poor	Ripe	7
59	English Smooth Stalk Meadow Grass		Very Poor	Ripe	8
60	Crested Dog Tail		None		
61	Kent Wild White Clover		Good	Ripe	9
62	Perennial Rye Grass		Good	Bloom	7

Tall Fescue — Dryland 1961

Five varieties of tall fescue seeded in 1959 were harvested in one cutting June 1 and aftermath rank estimated September 7. Growth did not justify a second harvest.

1961 yield data and two year average yields are shown in Table XVIII.

Alta was first in yield this season and for the two year average followed by Kentucky 31 and Kentucky G1-32. Kentucky G1-32 led in production in the irrigated trial.

The mean yield for the nursery of 2.33 tons is double that of the adjoining orchardgrass nursery indicating greater drought tolerance for Fescue than for Orchard.

Data from this nursery is included in the Montana report on Fescue varieties. Analysis of one cutting yields indicates significance at the one percent level and a C.V. of 5.53%.

See Table XVIII.

Table XVIII. Fescue - Dryland at Northwestern Montana Branch Station in 1961. Tons per acre at 12% moisture, one cutting - June 1, aftermath rank - September 7.

Variety	Cutting	Replications I	II	III	IV	Total	Ave.	2 year Ave.
Alta	1	3.52	2.61	3.11	2.37	11.61	2.90	3.04
	Am rank	2	2	2	1		2	
Kentucky 31	1	3.15	2.24	2.93	2.26	10.58	2.65	2.88
	Am rank	1	1	1	3		1	
Goar	1	2.43	2.39	2.14	1.73	8.69	2.17	2.13
	Am rank	4	5	4	4		4	
Kentucky G1-32	1	2.00	1.67	2.29	1.75	7.71	1.93	2.48
	Am rank	3	3	3	2		3	
Oregon 4-36	1	1.94	1.82	2.33	1.93	8.02	2.00	2.22
	Am rank	5	4	5	5		5	

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	.446205	6.71**
Variety	4	.719417	10.82**
Error	12	.0665	
Total	19		

$\bar{x}$.	2.33
S.E.$\bar{x}$.	.1289
L.S.D.(5%).....	.40
L.S.D.(1%).....	.56
C.V.	5.53%

Table XVIIIA. Occupancy - Dry Fescue at Creston, Montana - April 20, 1961

Variety	Rep.	A	B	C	D	E	Total	Ave.	Mean	%
Alta	1	40	40	36	40	38	194	38.8		
	2	40	40	40	40	40	200	40.0		
	3	40	40	40	40	40	200	40.0		
	4	40	40	40	40	40	200	40.0	39.7	99.25
Kentucky 31	1	36	36	40	40	40	192	38.4		
	2	40	36	36	40	40	192	38.4		
	3	40	40	40	34	30	194	38.8		
	4	40	40	40	40	40	200	40.0	38.9	97.25
Goar	1	40	24	28	32	40	164	32.8		
	2	32	32	40	40	34	178	35.6		
	3	40	40	40	36	36	192	38.4		
	4	32	36	40	40	28	176	35.2	35.5	88.75
Kentucky G1-32	1	40	40	40	40	32	192	38.4		
	2	40	40	40	40	36	196	39.2		
	3	40	40	40	40	40	200	40.0		
	4	40	40	40	40	40	200	40.0	39.4	98.50
Oregon 4-36	1	40	40	40	38	40	198	39.6		
	2	40	40	28	36	36	180	36.0		
	3	36	40	40	40	40	196	39.2		
	4	40	32	34	40	36	182	36.4	37.8	94.50

$\bar{x}$.	38.26
L.S.D. (5%)..	1.9
L.S.D. (1%)..	2.5

Analysis of Variance

Source	D.F.	Mean Square	F
Total	99	---	---
Replications	3	13.803333	1.56
Variety	4	58.06	6.57**
Var x Rep	12	9.36667	
Error	80	8.84	

Orchardgrasses — Dryland 1961

Nineteen orchardgrass varieties seeded in 1959 were harvested in one cutting on June 1 and height of aftermath in inches measured September 7. The mean yield from one cutting was 1.1 tons.

Yields in tons per acre at twelve percent moisture are tabulated in Table XIX. Also shown are two year average yields and height of regrowth.

Ranking one to five in yield this season are: 1. Avon 2. Wisconsin 52 3. Iowa 6 4. Commercial 5. Pa. Medium. Avon, Iowa 6, and Wisconsin 52 rank one to three in two year average production.

In height of aftermath Latar and Iowa 1 lead, closely followed by Akaroa, Iowa 6, and Utah Syn. 2.

1961 was a poor year in which to demonstrate yield ability in Orchard varieties on dryland, but a very good one to show ability under difficult conditions.

Avon came close to being significantly higher in yield than Potomac under these conditions, three were lower.

Data from this nursery are included in the State report on Orchardgrass varieties.

See Table XIX for yield and Table XIXA for stand data.

Table XIX. Orchardgrass - Dryland at Northwestern Montana Branch Station in 1961. One cutting and aftermath, tons per acre at 12% moisture.

Variety	Cut	Replications I	II	III	IV	Total	Ave.	2 year Ave.
Potomac	1	1.83	1.22	1.14	.76	4.95	1.24	1.84
	Am	8	6	6	6		6.50	
Akarca	1	1.01	1.15	1.39	1.44	4.99	1.25	1.76
	Am	7	6	7	7		6.75	
Aurora	1	.87	.67	.89	.72	3.15	.79	1.40
	Am	6	5	5	6		5.50	
Commercial	1	1.36	1.65	1.11	1.22	5.34	1.34	1.84
	Am	6	6	5	6		5.75	
Iowa I	1	1.34	1.20	1.55	.79	4.88	1.22	1.92
	Am	7	7	7	7		7.00	
Iowa 6	1	.99	1.98	.84	2.01	5.82	1.46	2.14
	Am	6	7	6	8		6.75	
Kentucky Syn.	1	1.17	.72	1.05	.76	3.70	.93	1.79
	Am	7	5	6	6		6.00	
Latar	1	.96	.52	.91	1.06	3.45	.86	1.68
	Am	6	5	5	7		5.75	
Pa. Early	1	1.46	1.52	.54	1.56	5.08	1.27	2.02
	Am	6	7	5	6		6.00	
Pa. Medium	1	1.23	.76	1.65	.76	4.40	1.10	1.95
	Am	7	6	6	6		6.25	
Pennlate	1	1.09	1.07	1.04	1.29	4.49	1.12	1.88
	Am	7	8	7	6		7.00	
Avon	1	1.70	1.38	1.19	2.51	6.78	1.70	2.20
	Am	5	6	6	6		5.75	
Danish	1	1.68	.76	1.23	1.25	4.92	1.23	1.81
	Am	6	5	6	6		5.75	
Wisconsin 52	1	1.79	.86	1.78	1.62	6.05	1.51	2.07
	Am	6	7	6	6		6.25	
Utah Syn. 2	1	.96	1.17	1.22	1.35	4.70	1.18	1.86
	Am	6	8	6	7		6.75	
S-26	1	.63	.59	.73	.59	2.54	.64	1.40
	Am	5	5	6	5		5.25	
S-37	1	.52	.70	.74	.96	2.92	.73	1.40
	Am	6	6	5	5		5.50	
S-143	1	.34	.61	.57	.34	1.86	.47	1.29
	Am	4	5	5	5		4.75	
Trogdon	1	.84	2.03	.73	.95	4.55	1.14	1.85
	Am	4	7	5	5		5.25	

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	.036473	
Varieties	18	.389283	2.89**
Error	54	.134711	
Total	75		

$\bar{x}$.	1.11
S.E.$\bar{x}$.	.1835
L.S.D.(5%)...	.52
L.S.D.(1%)...	.70
C.V.	16.49%

Table XIXA. Occupancy - Dryland Orchard at Creston, Montana
April 20, 1961

Variety	Reps.	A	B	C	D	E	Total	Ave.	Mean	%
Potomac	1	40	40	40	40	40	200	40.0		
	2	40	40	36	38	36	190	38.0		
	3	34	40	38	40	38	190	38.0		
	4	40	36	36	40	40	192	38.4	38.6	86.50
Akarca	1	40	40	40	40	40	200	40.0		
	2	40	40	40	40	40	200	40.0		
	3	36	40	40	40	40	196	39.2		
	4	40	36	38	34	40	188	37.6	39.2	98.00
Aurora	1	38	40	40	40	32	190	38.0		
	2	40	40	40	36	38	194	38.8		
	3	40	38	40	40	40	198	39.6		
	4	40	40	40	38	36	194	38.8	38.8	97.00
Commercial	1	38	36	38	40	36	188	37.6		
	2	40	36	36	40	40	192	38.4		
	3	40	40	40	32	36	188	37.6		
	4	40	40	40	36	40	196	39.2	38.2	95.50
Iowa I	1	40	40	40	40	36	196	39.2		
	2	40	40	40	40	40	200	40.0		
	3	40	40	36	38	40	194	38.8		
	4	40	40	40	36	36	192	38.4	39.1	97.75
Iowa 6	1	36	40	40	40	40	196	39.2		
	2	38	36	40	36	40	190	38.0		
	3	40	40	40	36	34	190	38.0		
	4	40	40	36	40	40	196	39.2	38.6	86.50
Kentucky Syn.	1	40	40	40	36	40	196	39.2		
	2	40	40	34	38	40	192	38.4		
	3	40	40	36	30	30	196	39.2		
	4	40	40	40	40	40	200	40.0	39.2	98.00
Latar	1	40	40	40	40	40	200	40.0		
	2	40	40	40	40	40	200	40.0		
	3	40	38	34	36	40	188	37.6		
	4	40	40	40	40	40	200	40.0	39.4	98.50
Pa. Early	1	40	40	40	36	40	196	39.2		
	2	40	40	40	36	38	194	38.8		
	3	40	40	36	40	40	196	39.2		
	4	40	40	38	36	40	194	38.8	39.0	97.50

Continued ——

Table XIXA. (Continued)

Variety	Reps.	A	B	C	D	E	Total	Ave.	Mean	%
Pa. Medium	1	40	40	40	40	40	200	40.0		
	2	40	36	40	40	34	190	38.0		
	3	40	40	40	40	40	200	40.0		
	4	38	38	40	40	40	196	39.2	39.3	98.25
Pennlate	1	40	40	40	40	40	200	40.0		
	2	40	40	40	38	40	198	39.6		
	3	40	40	40	40	40	200	40.0		
	4	40	38	40	36	40	194	38.8	39.6	99.00
Avon	1	40	40	36	40	32	188	37.6		
	2	36	40	38	38	40	192	38.4		
	3	34	36	38	40	38	186	37.2		
	4	40	40	40	40	40	200	40.0	38.3	95.75
Danish	1	36	36	40	32	36	180	36.0		
	2	36	36	40	36	40	188	37.6		
	3	40	40	34	36	36	186	37.2		
	4	40	34	32	34	38	178	35.6	36.6	86.50
Wisconsin 52	1	36	40	36	40	30	182	36.4		
	2	36	36	40	40	40	192	38.4		
	3	40	40	40	36	40	196	39.2		
	4	40	34	38	38	40	190	38.0	38.0	95.00
Utah Syn. 2	1	40	40	40	40	40	200	40.0		
	2	40	38	36	40	36	190	38.0		
	3	38	38	40	40	32	188	37.6		
	4	40	40	40	36	34	190	38.0	38.4	96.00
S-26	1	36	40	40	34	38	188	37.6		
	2	36	40	36	36	40	188	37.6		
	3	36	40	36	40	40	192	38.4		
	4	40	34	38	34	38	184	36.8	37.6	94.00
S-37	1	34	40	38	40	32	184	36.8		
	2	40	40	40	40	40	200	40.0		
	3	40	40	40	40	40	200	40.0		
	4	40	36	38	40	40	194	38.8	38.9	97.25
S-143	1	30	40	40	40	36	186	37.2		
	2	34	40	40	38	40	192	38.4		
	3	38	36	34	36	36	180	36.0		
	4	40	40	38	34	40	192	38.4	37.5	93.75

Continued ——

Table XIXA. (Continued)

Variety	Reps.	A	B	C	D	E	Total	Ave.	Mean	%
Trogdon	1	36	36	40	28	36	176	35.2		
	2	40	40	40	40	34	194	38.8		
	3	38	36	40	36	40	190	38.0		
	4	36	32	40	38	36	182	36.4	37.1	92.75

$\bar{x}$. 38.49
L.S.D.(5%)..... 1.4
L.S.D.(1%)..... 1.8

Analysis of Variance

Source	D.F.	Mean Square	F
Total	379	---	---
Replication	3	1.81	---
Variety	18	13.655	2.86**
Var x Rep	54	5.151666	1.08
Error	304	4.768355	

Wheatgrasses -- Dryland 1961

Eighteen Wheatgrasses seeded in 1960 were harvested in one cutting on June 30 and aftermath ranked one to ten on September 7. Yields in tons per acre at twelve percent are shown in Table XX.

As a group, the Intermediate Wheatgrasses were the most productive this first season of harvest and of these, S. Dak. 20 was leading with 2.37 tons followed by Greenar with 1.73 tons.

In growth of aftermath, S. Dak. 20 was first, followed by Greenar and Ree, all Intermediates.

Data were found to be highly significant. Real differences in yield this first harvest season exist between species and between varieties within species.

See Table XX for yield and Table XXA for stand.

Table XX. Wheatgrass - Dryland

Variety or Mix	Cut	Replications I	II	III	IV	Total	Ave.	Rank
Beardless Whitmar	1	.48	.65	.61	.46	2.20	.55	10
	Am	10	9	9	9			
Siberian F27	1	1.48	.80	1.33	1.00	4.61	1.15	6
	Am	5	5	5	5			
Crested Standard	1	.66	.65	.76	.74	2.81	.70	10
	Am	9	9	9	6			
Tall Wheatgrass - Mandan 1422	1	1.14	.75	.88	.59	3.36	.84	7
	Am	5	7	8	4			
Tall Wheatgrass - Neb. P.I. 985263	1	.62	.42	.76	.67	2.47	.62	10
	Am	9	8	9	8			
Tall Wheatgrass S64	1	1.30	.84	.84	1.04	4.02	1.00	8
	Am	6	6	7	7			
Tall Wheatgrass-Alkar	1	.96	.87	.95	1.14	3.92	.98	9
	Am	6	8	7	7			
Tall Wheatgrass - A 12465	1	1.09	1.01	1.32	.70	4.12	1.03	8
	Am	6	6	7	7			
Intermediate Amur	1	1.65	1.41	1.03	1.25	5.34	1.34	7
	Am	5	5	6	8			
Intermediate Greenar	1	1.81	1.40	1.85	1.87	6.93	1.73	2
	Am	3	3	3	4			
Intermediate Idaho 3	1	1.24	1.24	1.45	1.42	5.35	1.34	6
	Am	6	5	3	6			
Intermediate Neb. 50	1	1.54	1.26	1.80	1.07	5.67	1.42	5
	Am	3	4	3	8			
Intermediate Ree	1	1.54	1.36	1.41	1.66	5.97	1.49	3
	Am	2	4	3	5			
Intermediate S.Dak. 20	1	2.36	2.31	2.39	2.42	9.48	2.37	1
	Am	2	4	3	3			
Pubescent Mandan 759	1	1.34	1.03	1.38	1.40	5.15	1.29	4
	Am	3	5	4	5			
Pubescent Topar - Wheatgrass	1	.83	.81	1.43	.93	4.00	1.00	8
	Am	7	7	7	6			
Pubescent Utah 109	1	1.02	.81	1.07	1.44	4.34	1.08	7
	Am	4	5	5	6			
Streambank Sodar	1	.42	.57	.59	.52	2.10	.53	9
	Am	6	7	8	7			

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	.150833	4.27
Variety	17	.829	23.46**
Error	51	.035335	
Total	71		

$\bar{X}$.	1.14
S.E.$\bar{X}$.	.094
L.S.D.(5%)....	.27
L.S.D.(1%)....	.37
C.V.	8.25%

Table XXA. Occupancy - Dryland Wheatgrasses April 20, 1961 Based on a five sample average, 2½ times occupancy equals percent stand.

Variety or Mix	Replications I	II	III	IV	Total	Average	% Stand
Beardless Whitmar	12.0	18.0	16.4	8.8	55.2	13.8	34.50
Siberian P27	32.6	35.2	37.6	32.4	137.8	34.5	86.10
Crested Standard	4.4	13.2	6.4	9.2	33.2	8.3	20.75
Tall Wheatgrass Mandan 1422	28.0	34.8	29.2	30.2	122.2	30.7	76.75
Tall Wheatgrass Nebr. P.I. 985263	12.0	14.8	8.8	16.0	51.6	12.9	32.25
Tall Wheatgrass S64	30.4	37.2	36.0	34.0	137.6	34.4	86.00
Tall Wheatgrass Alkar	33.2	30.0	30.4	32.8	126.4	31.6	79.00
Tall Wheatgrass A12465	30.4	34.4	31.6	31.2	127.6	31.9	79.75
Intermediate Amur	30.0	31.2	32.4	30.8	124.4	31.1	77.75
Intermediate Greenar	33.6	38.4	36.0	38.0	146.0	36.5	91.25
Intermediate Idaho 3	30.4	31.6	32.0	30.4	124.4	31.1	77.75
Intermediate Nebr. 50	31.1	32.8	31.1	25.6	120.6	30.1	75.25
Intermediate Ree	30.0	32.8	33.6	35.2	131.6	32.9	82.25
Intermediate S. Dak. 20	32.8	36.8	35.6	33.6	138.8	34.7	86.75
Pubescent Mandan 759	32.8	27.6	36.4	33.6	130.4	32.6	81.50
Pubescent Topar Wheatgrass	32.8	24.8	32.8	31.6	122.0	30.5	76.25
Pubescent Utah 109	29.6	22.4	31.2	32.4	115.6	28.9	72.25
Streambank Sodar	26.8	12.0	35.2	35.2	109.2	27.3	68.25

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	16.373567	1.12
Variety	17	264.369453	18.13**
Error	51	14.5841	
Total	71		

$\bar{x}$.	28.5
S.E.$\bar{x}$.	1.9095
L.S.D.(5%).....	5.4
L.S.D.(1%).....	7.2
C.V.	6.69%

Small Seeded Legumes — Dryland 1961

Thirteen small seeded legumes seeded in 1960 were harvested in one cutting and the aftermath or regrowth estimated at monthly intervals.

Surprising amounts of forage were produced in the one cutting, above four tons per acre at twelve percent moisture, from three of the thirteen entries. Two entries failed of establishment and Milk Vetches were customarily slow of development and low in production.

Sanfoin and Alsike clover ranked ahead of alfalfa in first cutting production in this trial. Alsike produced little regrowth while Sanfoin was ranked second to alfalfa in this respect.

First cutting yield and aftermath rankings are shown in Table XXI.

These same legumes were included in an irrigated trial and reported in Table XII. Red Clovers exceed in season's yield in the irrigated trial.

Analysis indicate significance in the data. Data from this nursery is to be included in the Montana summary of work with legumes.

See Table XXI for yield and Table XXIA for stand.

Table XXI. Dryland Legumes - Creston, Montana Am = Aftermath

Variety or Mix	Cut	Date	I	II	III	IV	Total	Ave.	Am. Rank
Zigzag	1		3.22	4.16	3.38	4.25	15.01	3.75	
	Am rank	8-1	6	5	6	5	22		
		9-7	6	7	6	7	26		6
Pennscott	1		1.94	4.61	3.52	3.75	13.82	3.46	
	Am rank	8-1	4	3	3	2	12		
		9-7	7	4	4	5	20		4
Kenland	1		2.51	4.61	3.81	3.64	14.57	3.64	
	Am rank		3	2	4	2	11		
			5	3	5	3	16		3
Lakeland	1		3.52	4.32	4.16	4.51	16.51	4.13	
	Am rank		3	4	4	3	14		
			4	5	4	1	14		3
Dollard	1		4.13	4.27	3.51	3.28	15.19	3.80	
	Am rank		4	4	4	4	16		
			3	6	3	6	18		5
Common Alsike	1		3.76	4.57	3.44	6.22	17.99	4.50	
	Am rank		10	10	9	10	39		
			9	10	10	10	39		9
Tetra Alsike	1		4.04	4.84	3.31	4.33	16.52	4.13	
	Am rank		8	8	8	8	32		
			8	8	9	8	33		7
Vernal Alfalfa	1		3.33	3.22	3.49	3.36	13.40	3.35	
	Am rank		1	1	1	1	4		
			1	1	1	2	5		1
Cicer Vetch	1		.68	1.61	1.91	2.92	7.12	1.78	
	Am rank		10	9	9	9	37		
			10	10	9	9	38		8
Sickle Vetch	1		.59	1.47	2.32	1.88	6.26	1.57	
	Am rank		10	10	10	10	40		
			10	10	10	10	40		10

Continued ——

Table XXI . (Continued)

Variety or Mix	Cut	Date	I	II	III	IV	Total	Ave.	Am. Rank
Sanfoin	1		4.58	4.35	4.49	4.72	18.14	4.54	
	Am rank		2	3	3	3	11		
			2	2	2	2	8		2

$\bar{x}$	3.51
S.E.$\bar{x}$.	.3125
L.S.D.(5%).....	.90
L.S.D.(1%).....	1.22
C.V.	8.90%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	2.157148	5.52**
Varieties	10	3.902004	9.99**
Error	30	.390741	
Total	43		

Table XXIA. Occupancy - Dryland Legumes. April 20, 1961
Based on five samples per plot with forty unit frame.

Variety or Mix	Replications I	II	III	IV	Mean	Percent Stand
Zigzag Red Clover	34.0	39.2	40.0	37.2	37.6	94.00
Pennscott Red Clover	27.2	39.6	38.0	37.2	35.5	88.75
Kenland Red Clover	35.2	40.0	39.6	32.8	36.9	92.25
Lakeland Red Clover	34.4	40.0	38.0	38.0	37.6	94.00
Dollard Red Clover	37.6	40.0	39.2	38.4	38.8	97.00
Common Alsike	40.0	40.0	40.0	38.8	39.7	99.25
Tetra Alsike	39.2	40.0	40.0	39.2	39.6	99.00
Vernal Alfalfa	35.6	28.4	35.6	34.0	33.4	83.50
Sanfoin	35.6	37.2	36.0	35.2	36.0	90.00

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	18.457766	2.84
Varieties	8	16.87	2.60
Error	24	6.501112	
Total	35		

$\bar{x}$	37.23
S.E.$\bar{x}$	1.2749
L.S.D.(5%).....	3.7
C.V.	3.42%

Forage Nurseries Seeded in 1961

One Cutting Mixtures — Irrigated

Seeded May 11, 1961 in fourteen feet strips the length of the field in Y-5 were nine mixtures for one cutting harvest and fall pasture. Three grasses were seeded in forty-two feet strips north to south and Birdsfoot Trefoil, Mammoth Red Clover, and Sanfoin seeded in fourteen feet strips in each grass.

Already it is realised that mistakes have been made. Sanfoin, for example, is an early legume. Tall Wheatgrass is somewhat later than is Intermediate as indicated by maturity studies this season. Excellent stands of Reed Canary that was drilled were secured while Brome that was broadcast may possibly not be uniformly good in all strips. However, a year or two of harvest of one or more of the nine mixtures may indicate possibilities. And maturity studies may provide varietal information which will lead to improvement of the mixtures.

North to south in Y-5 in fourteen feet strips, the mixtures and seeding rates are as follows: (Grasses and legumes in alternate rows)

1. Reed Canary 4 pounds, Birdsfoot Trefoil four pounds
2. Reed Canary 4 pounds, Mammoth Red Clover 6 pounds
3. Reed Canary 4 pounds, Sanfoin 16 pounds
4. Intermediate Wheatgrass 8 pounds, Mammoth Red Clover 6 pounds
5. Intermediate Wheatgrass 8 pounds, Sanfoin 16 pounds
6. Intermediate Wheatgrass 8 pounds, Trefoil 4 pounds
7. Bromegrass 8 pounds, Trefoil 4 pounds
8. Bromegrass 8 pounds, Sanfoin 16 pounds
9. Bromegrass 8 pounds, Mammoth Red Clover 6 pounds.

Alfalfa Variety Evaluation — Irrigated and Dryland

Five varieties of alfalfa were seeded in single row plots twenty feet long, rows two feet apart, and four replications on May 4 in Y-5. The dry section west of the irrigated section is sufficiently so, so that one can be irrigated without getting water on the other.

Four readings, using the forty unit frame in each plot, indicate very good stands on October 2, from 86 to 100 percent.

Orchardgrass Variety Evaluation — Irrigted and Dryland

Two varieties of Orchardgrass were seeded adjacent to and in a similar manner to the alfalfa above. Stands run from 93 to 100 percent.

Sanfoin Pastures — Dryland

Seven entries in dryland pasture studies were seeded May 4 in four row plots twenty feet long, two feet between plots, rows one foot apart, and four replications. Sanfoin was the only legume. This was seeded alone and with Green Stipa, Nordan Crested, and Neb. 50 Intermediate. Occupancy data is tabulated below. Four plot average stand percentages October 5 were Sanfoin 73.25, Stipa 34.1, Nordan 76.25, Nebraska 50 69, Sanfoin and Stipa 82.9, Sanfoin and Nordan 89.1, Sanfoin and Nebraska 50 80.6. Stands may be expected to improve and be quite good except possible those of Stipa.

Table XXII. Occupancy - Sanfoin Pastures October 5, 1961
Five readings with a forty unit frame.

Variety or Mix	Replications I	II	III	IV	Mean	Percent Stand
Sanfoin	30.4	31.6	28.8	26.8	29.4	73.50
Sanfoin & Neb. 50	33.2	36.0	32.0	28.0	32.2	80.75
Sanfoin & Stipa	34.0	36.4	33.6	29.2	33.3	83.25
Stipa	14.8	10.4	18.0	9.6	13.2	33.00
Sanfoin & Nordan	36.0	34.0	35.6	32.8	34.6	86.50
Nordan	32.4	30.4	33.2	27.2	30.8	77.00
Neb. 50	30.0	33.2	22.8	25.6	27.9	69.75

L.S.D.(5%) 2.8
L.S.D.(1%) 3.9

Analysis of Variance

Source	D.F.	Mean Square	F
Total	139		
Block	3	166.733333	8.37**
Variety	6	1048.895250	52.63**
B x Var	18	30.888888	1.55
Error	112	19.928571	

PRELIMINARY INVESTIGATIONS 5028

1961-62 Budget — $1968.33

Introduction

Work done under this project in 1961 has been limited to evaluation of potato crosses made at Montana State College so far as Part I of this report is concerned. Other work may be reported in Parts II and III.

Evaluation of Potato Crosses, Primarily for Scab Resistance

Eighty-three of the successful crosses made at Montana State College were grown in single row plots for the purpose of determining their resistance to scab under the conditions found on the Northwestern Montana Branch Station. These may be described as being conducive of scab development on all but the most resistant tubers. The number of hills was dictated by the size and number of seed tubers received for planting, seven being the maximum number.

The potatoes were planted May 24 in a portion of a field prepared for commercial potato production by plowing down red clover the fall before and use of 300 pounds of 11-48-0 fertilizer per acre in bands at seeding. The trial was cultivated and irrigated with the remainder of the field. The plots were dug by hand on September 18 following a vine killing frost on September 13. Maturity as indicated by the vines on August 28 was noted.

In preliminary observations at digging time, forty-seven were said to have no scab, seven to have deep scab, and the remaining twenty-nine to have light surface scab. However, the official scab readings will be made at M.S.C.

Other observations included the weight and number per hill, the color of the skin and meat, the type of tuber, the kind of skin surface, the maturity, and faults such as hollow-heart, air-checks, unusual roughness, and obvious scab. These characteristics are tabulated and included in this report.

A few of the crosses with apparent desirability and sufficient production were selected for furthur evaluation. It will be obvious in the tabulated characteristics that the sorted numbers of tubers and weight per hill, as indicated by the few hills grown, indicate very high yield. For example, Number 72 with no serious defects, early maturity, and white meat set seven tubers per hill and produced 4.9 pounds per hill. This times 13,200, the number of hills spaced one foot in forty inch rows, indicates a potential production of thirty-two tons per acre.

Table XXIII. Evaluation of Potato Crosses 1961

No.	M.S.C. No.	No. Hills	Per Hill Sorted Lbs.	Per Hill Sorted Pounds	Per Hill Sorted No.	Color	Type [1]	Color Meat	Skin	Maturity [2]	Faults [3]
1	5943- 6	6	1.1	1.1	4-	Russet	L-R-F	Cream White	Heavy Net	M	
2	5978- 1	3	1.2	1.2	4/	Red Russet	R-F	White	Heavy Net	L	
3	5969- 3	6	3.1	1.5	6	Russet	R-F	Cream White	Heavy Net	M	H
4	5969- 4	1	1.9	1.7	4/	Russet	R-F	Cream White	Heavy Net	M	H
5	5969- 2	7								M	
6	5969- 1	3	3.2	3.2	10	Russet	L-R	Cream White	Heavy Net	M	
7	6962- 5	3	5	3.7	7/	Russet	L-R-F	Cream	Very Heavy Net	M	MH
8	5978- 3	6	3.3	3.1	11/	Russet		Cream White	Heavy Net	E	
9	5979- 1	6	2.7	2.6	7	Russet	R-F	Cream White	Heavy Net	E	H
10	5934- 4	6	5.8	5.7	9/	White	R-F	White	Smooth	E	H
11	5960	5	2.9	2.6	8	Russet	R-F	White	Heavy Net	M	
12	5959- 4	5	4.3	4.3	20/	Russet		Yellow	Netted	M	
13	5962- 2	5	4	3.3	9-	Russet		White	Heavy Net	M	R
14	5979- 2	4	5.5	5.4	13/	Russet	L-R-F	Cream White	Netted	M	
15	5962- 6	6	2.7	2.5	6-	Russet	L-R-F	Cream White	Heavy Net	E	H
16	5959- 6	5	5.3	4.5	11/	Red	R-F	White	Light Net	M	MH
17	5962- 1	3	4.2	4.2	8-	White		Cream White	Light Net	E	
18	5959- 5	6	5.7	4.3	11-	Russet		Cream	Heavy Net	M	MH
19	5904-A1	3	14.3	11.0	32	Red	L-R	White	R. Sm.	E	MH-S
20	5945- 2	6	5.9	4.5	11/	White	R-F	Cream White	R. Sm.	E	MH-S
21	5980	3	1.7	1.5	6-	Russet	R-F	Cream White	Heavy Net	M	
22	5962- 7	6	4.6	4.1	10/	Red	L-R-F	Cream White	Light Net	M	R
23	5943- 5	5	2.5	2.0	4-	Russet	R-F	Cream White	Heavy Net	EM	C
24	5978- 2	4	3.3	2.9	11/	Russet	R-F	Cream White	Netted	L	H
25	5935- 1	4	3.8	3.0	4/	Russet		Cream White	Netted	EM	R
26	5959- 3	5	4.1	4.1	6-	Russet		Cream	Light Net	M	
27	5913- 1	7	3.7	2.1	6/	Russet	L-R	Cream White	Netted	EM	C

Continued ---

Table XXIII. (Continued)

No.	M.S.C. No.	No. Hills	Per Hill Lbs.	Per Hill Sorted Pounds	No.	Color	Type [1]	Color Meat	Skin	Maturity [2]	Faults [3]
28	5927- 6	2	2.5	---	10/	Russet	L-R	Cream White	Netted	M	R
29	5904-A2	6	5.4	2.1	19	Red	L-R-F	White	N. Sm.	E	R-C-S
30	5945- 1	6	3.0	2.9	8	White	L-R-F	White	N. Sm.	EM	H
31	5925- 2	4	4.3	4.0	5	Russet	L-R-F	Cream White		M	H
32	5943- 8	5	4.2	3.8	6/	Russet		Cream White	Netted	EM	H
33	5925- 1	4	3.0	2.0	9-	Russet	R-F	White	Heavy Net	ML	R
34	5913- 2	3	3.7	2.7	7	Red	L-R-F	Yellow	N. Sm.	EM	R
35	5969- 5	6	2.3	2.0	4	Russet		Cream White	M. H. Net	M	H
36	5343- 7	4	3.3	2.9	5-	Red Russet		White	Heavy Net	E	H
37	5902-A	4	3.8	3.1	11	Russet	L-R-F	Cream	Light Net	M	R
38	5903- 6	7	4.1	3.9	13-	Red	R-F		Light Net	EM	
39	5937- 2	5	4.1	3.2	6	Red Russet		Cream White	Netted	E	MH
40	5962- 3	5	4.8	4.2	10	Red Russet	L-R-F	White	Light Net	E	R
41	5973	4	2.5	1.5	5/	White	R-F	Yellow	Light Net	M	C
42	5948- 1	7	3.1	2.4	5-	Russet	R-F	Cream	Heavy Net	ML	MH
43	5903- 2	6	3.7	3.5	6/	Red	R-F	Cream White	N. Sm.	EM	H
44	5927- 5	5	2.6	2.4	5/	Red Russet	R-F	White	Light Net	L	
45	5948- 4	5	2.5	2.0	7-	Russet		Cream White	Heavy Net	L	CH
46	5962- 4	7	4.7	4.6	16/	Red	L-R-F	Cream White		E	
47	5915- 1	6	4.5	4.3	12-	Red		Cream	N. Sm.	E	R
48	5947	7	3.6	3.3	5/	White	L- F	Cream White	Sm.	E	RS
49	5937- 1	6	3.7	2.9	8	White	R-F	Cream	N. Sm.	E	MHS
50	5913- 2	5	4.0	4.0	8-	Pink	L-R	Cream White	Light Net	E	
51	5948- 3	6	2.3	.4	4	Russet	R-F	Cream	Heavy Net	E	MHC
52	5903- 5	6	4.2	4.2	12-	White	R-F	White	Smooth	E	

Continued ---

Table XXIII. (Continued)

No.	M.S.C. No.	No. Hills	Per Hill Lbs.	Per Hill Sorted Pounds	Per Hill No.	Color	Type [1]	Color Meat	Skin	Maturity [2]	Faults [3]
53	5904	5	5.0	3.6	9/	White	R	Cream	Smooth	M	RS
54	5901- 4	4	4.8	4.5	9/	White	F	Cream	Smooth	L	
55	5943- 3	4	2.5	1.3	4-	Russet	L-R-F	Cream	Heavy Net	L	MHC
56	5912-A	4	2.8	2.0	8/	Russet	R-F	Cream	Heavy Net	E	MHC
57	5901- 1	4	.3	All rough and scabby						M	RS
58	5901- 3	4	5.4	4.4	9	White	R-F	Cream	M. Sm.	M	MI
59	5903- 1	4	3.9	3.5	11/	Red	R-F	White	Smooth	E	S
60	5903- 4	7	4.1	4.1	10/	Red	R	White	Light Net	E	
61	5902- 1	6	2.7	2.2	9/	Cream		Yellow	Smooth	E	R
62	5904-A3	8	3.7	3.4	9/	Red	R-F	Cream	Smooth	M	S
63	5917	4	2.4	2.3	8-	Russet	R-F	White	Heavy Net	E	H
64	5958- 9	4	1.3	1.0	3	Russet		Cream White	Netted	E	H
65	5908- 1	4	3.4	3.1	8/	White	R-F	Cream	Light Net	E	
66	5948- 6	7	2.5	2.3	5-	Russet		Cream White	Med. Net	M	H
67	5952- 2	3	2.5	2.5	8-	Russet	L-R-F	Cream White	Light Net	E	
68	5908- 2	6	2.9	2.8	11	Russet	L- F	White	Heavy Net	E	
69	5903- 3	8	4.7	4.3	7	Red	R-F	Cream	Smooth	M	MHS
70	5901- 2	5	4.4	3.6	6/	White		Cream	Sm. Or V.L.Net	L	R
71	5848-10	5	3.9	2.6	6/	White	R	Cream	Smooth	M	MH
72	5916-	4	5.1	4.9	7	Russet	L-R	White	Light Net	E	
73	5959- 1	6	2.8	2.3	5	Russet	R-F	Cream	Heavy Net	M	MI
74	5948-11	5	3.2	3.0	7-	Red	R-F		Med. Rough	M	H
75	5922	4	5.0	3.6	10/	Russet		White	Heavy Netted	L	MH

Continued ---

Table XXIII. (Continued)

No.	M.S.C. No.	No. Hills	Per Hill Lbs.	Per Hill Sorted Pounds	Per Hill No.	Color	Type [1]	Color Meat	Skin	Maturity [2]	Faults [3]
76	5948- 5	6	1.5	1.5	3	White		White	Light Net	L	
77	5913- 3	6	3.2	1.3	3/	Russet		White	Light Net	M	R
78	5948- 2	5	6.5	6.4	8/	Red	L- F	White	Light Net	L	
79	5954	3	4.2	3.8	7	Russet	R	White	Heavy Net	L	H
80	5971	6	4.8	4.7	14	White	R-F	White	Light Net	E	
81	5961- 1	5	5.3	5.3	10	White	R-F	Yellow	N. Sm.	L	
82	5961- 2	5	4.4	3.5	9/	White	R-F	Cream	N. Sm.	E	MH
83	5978- 4	6	3.1	2.8	5-	Russet	L-R	White	Med. Net	M	

[1] L = Long R = Round F = Flat

[2] Maturity indicated by vines August 28

[3] Faults: S = Deep Scab H = Hollow Heart C = Air Checks R = Rough MH = Many Hollow

FARM FLOCK 5029

1961-62 Budget -- $1373.33

The gross return from the farm flock in 1961, consisting of forty-five ewes over one year and twelve ewe lambs (January 1, 1961), was $1087.12. This is an average of $24.17 per ewe of producing age.

Seventy lambs were born to forty-three ewes with sixty-two weaned or 138 percent.

Valuable assistance was secured from the Montana Wool Laboratory again this year. By their examination of fleeces shorn and of lamb fleece characteristics, we are advised of need for culling and selection, and know which of the ewe lambs have desirable fleece characteristics for replacements. Of our 1961 clip 79.7% was staple length and 59.4% 3/8 staple. Six fleeces were finer than 3/8, thirteen too short for staple grade in eleven months of growth. Lamb fleeces varied from 4.1 to 11.0 m.m. in length at weaning with an average length of 6.7. Spinning count estimates on lamb fleeces ranged from 48's to 62's but with 43 of the 62 having 58's or 60's.

Two lots of fifteen Columbia ewes were carefully selected so as to be of equal age and to have records of equal wool and lamb production. One of these lots was bred to a Columbia ram and the other to a Polled Dorset ram. Since only eleven ewes were settled by the Dorset in the twenty-eight days this ram was available, the lots were adjusted as equally as possible to eleven ewes. Eighteen lambs were born to each lot. Fourteen Columbia lambs were weaned and eighteen cross-bred lambs. The lambs were creep fed until turnout, May 8, then pastured together until weaned. Comparative data is shown in Table XXIV.

After weaning, wether lambs from both lots were fed silage, grain, and a little hay in the feed lot until sold on September 22. The average gain, i.e., difference between weaning weights and weights the day before the sale, was fifteen pounds for both lots.

This Columbia-Crossbred comparison is being continued with twenty ewes in each lot and with the Dorset ram available over a long period. Also eight of the crossbred ewe lambs were held over to determine what, if any, difference there might be in off-season breeding habit of these as yearlings when compared to Columbia's.

Four Columbia rams were sold to two men, one a purebred breeder at Simms, Montana.

Number 95, a Columbia ewe, secured from Ernest White as a yearling with a lamb at side in 1951, went blind this summer just prior to weaning her sixteenth and seventeenth lambs and after shearing 136 pounds of 3/8 blood wool. She has been given a decent burial.

Sorry I can't give you the precise total weight of her lambs weaned, but at the average weight of the last eight, the total would be 1190 pounds.

On hand January 1, 1962 there are fifty-four ewes one year and over, eighteen ewe lambs, and five ram lambs. Records for those kept based on total pounds of production divided by age average are as follows:

Number	Age	Ave. Lbs. Wool	Ave. Lbs. Lamb Weaned
8	6	12.1	100.2
5	5	11.4	87.6
8	4	11.2	78.5
8	3	10.0	64.5
13	2	9.8	57.4
12	1	7.5	00.0

Table XXIV. Columbia, Dorset-Columbia Cross Comparison 1961

		Columbia		Dorset-Columbia
Number born		18		18
Lost first week		4		0
Weaned		14		18
Birth weight-singles (ave.)	(4)	11.25	(4)	11.69
Birth weight-twins (ave.)	(14)	8.91	(14)	9.28
Weaning weight of twins	(6)	68.83	(14)	75.20
Weaning weight of singles	(8) *	86.1	(4)	91.25
Total weight of lambs weaned (lbs.)		1102		1418

* Includes lambs raised as singles because of loss of one twin.

Condition Scores

4	1	0
3-	2	2
3	5	6
3+	2	5
2-	3	3
2	0	1
2+	1	1
	14	18

Lamb Fleece Characteristics

Length in M.M. (ave.)		6.4	6.3
Spin Count Estimates:	54's	0	1
	56's	0	2
	58's	5	2
	60's	8	12
	62's	1	1
		14	18

Plans for the flock in 1962 include a continuation of the Columbia, Columbia-Dorset comparison; off-season breeding of the crossbred yearling ewes kept for this purpose; and quite possibly the self-feeding of wether lambs when they reach 65 to 70 pounds in weight.

Another way of comparing crossbred with straightbred lambs is to compare weights of lambs from the same ewes.

		Columbia Lambs				Crossbred Lambs in 1961			
Ewe	Year		Birth Wt.	Weaning Wt.	Condition		Birth Wt.	Weaning Wt.	Condition
59	1960	367	9.5	62	3-	423	10.0	75	3-
		368	9.0	65	3-	425	9.5	79	3/
J-9328	1960	322	9.0	64	3/	389	8.5	70	3
		323	7.5	64	3/	390	9.3	65	3
127	1959	270	10.5	89	2-	391	11.0	90	2-
J-9441	1960	351	11.0	72	3/	402	11.0	92	3
		352	9.0	65	3/	403	10.5	82	2-
J-9438	1960	355	9.0	63	3	457	8.5	74	3/
		382							
		356	7.5	71	4/	458	8.5	67	3-
L-1412	1960	342	9.0	72	3	392	9.0	80	3
		343	6.0	58	3	393	9.3	77	3
198	1960	369	12.0	76	3/	401	15.0	101	2
251	1960	378	7.0	56	3-	397	12.5	92	2-
L-1406	1960	376	8.0	64	3	388	8.3	70	3
Total weight-14				941		Total weight-14			1114
Average weight				67.2		Average weight			79.6

Difference - an average of 12.4 pounds

Table XXV. Detailed ewe production - 38 ewes with three year records

Year Born	Flock No.	Fleece Weights: First Year	Second Year	Third Year	Total	Three Year Ave.	Pounds Lamb Weaned: First Year	Second Year	Third Year	Pounds Total	Three Year Ave.
1954	28	9.5	14.5	15.0	39.0	13.0	0	1- 99	2-142	241	80.3
	38	7.5	14.0	12.0	33.5	11.2	0	0	1- 80	80	26.6
	27	10.0	15.0	13.0	38.0	12.7	0	2-168	1- 73	241	80.3
	56	8.5	13.0	13.5	35.0	11.7	0	0	2-140	140	46.6
	43	12.5	17.0	15.0	44.5	14.8	0	2-178	1- 73	251	83.7
	51	11.0	15.5	14.0	40.5	13.5	0	0	2-126	126	42.0
	53	10.5	14.0	15.0	39.5	13.2	1-65	2-190	2-129	384	128.0
	48	7.5	13.0	12.5	33.0	11.0	0	0	1- 85	85	28.3
	57	9.0	14.5	15.0	38.5	12.8	0	0	1- 95	95	31.7
1955	58	11.5	14.0	15.0	40.5	13.5	0	1- 71	2-125	196	65.3
	76	10.0	13.0	13.5	36.5	12.2	0	2-121	1- 84	205	68.3
	80	10.0	12.5	17.0	39.5	13.2	0	0	0	0	000.0
	81	12.0	13.5	11.0	36.5	12.2	0	2-123	1- 85	208	69.3
	82	10.0	13.5	11.5	35.0	11.7	0	2-127	1- 66	193	64.3
	87	11.5	14.5	12.5	38.5	12.8	0	2-149	2-139	388	129.3
	88	12.0	13.5	14.0	39.5	13.2	0	2-149	2-131	280	93.3
	59	10.5	12.5	12.0	35.0	11.7	0	2-136	1- 96	232	77.3
	61	12.0	13.0	16.0	41.0	13.7	0	0	0	0	000.0
	69	12.0	14.5	17.0	43.5	14.5	1-99	1- 76	2-144	319	106.3
	72	9.0	14.0	18.0	41.0	13.7	0	0	1- 81	81	27.0
	83	11.5	13.5	12.5	37.5	12.5	0	1- 97	0	97	32.3
	85	12.0	16.0	17.0	45.0	15.0	0	2-118	1- 47	165	55.0

Continued ——

Table XXV. (Continued)

Year Born	Flock No.	Fleece Weights: First Year	Second Year	Third Year	Total	Three Year Ave.	Pounds Lamb Weaned: First Year	Second Year	Third Year	Pounds Total	Three Year Ave.
1956	128	9.0	13.0	8.5	30.5	10.2	0	2-115	2-148	263	87.7
	108	9.0	15.0	11.0	35.0	11.7	0	1- 58	1- 90	148	49.3
	110	13.0	15.0	11.0	39.0	13.0	1-66	1- 73	1- 81	220	73.3
	133	13.0	16.0	13.5	42.5	14.2	1-58	1- 53	1- 87	198	66.0
	105	13.0	16.5	13.5	43.0	14.3	1-58	2- 87	1- 75	220	73.3
	127	9.5	14.5	9.5	33.5	11.2	0	1- 83	1- 89	172	57.3
	137	11.5	14.0	11.0	36.5	12.2	0	2-105	0	105	35.0
	103	10.0	15.0	10.5	35.5	11.8	0	2- 97	2-149	246	82.0
1957	152	14.5	12.5	12.5	39.5	13.2	0	1- 66	2-103	169	56.3
	154	10.5	12.0	11.0	33.5	11.2	0	2-104	1- 88	192	64.0
	169	14.0	13.5	14.0	41.5	13.8	1-64	1- 89	2-137	290	96.7
	171	8.0	10.5	10.5	29.0	9.7	1-50	1- 69	2-127	246	82.0
	178	9.0	10.0	9.5	28.5	9.5	0	0-dogs	1- 71	71	23.7
	180	10.0	11.0	11.0	32.0	10.7	1-39	1- 71	2-113	248	82.7
	189	9.0	10.5	11.0	30.5	10.2	1-42	1- 96	2-138	276	92.0
	192	12.0	13.5	11.5	37.0	12.3	1-59	1- 80	2-132	271	90.3
				Total ——		473.0			Total——		2446.8
				Average—		12.4			Average—		64.4

Possible use of Table XXV or similar data in flock improvement is suggested by making certain assumptions.

The three year average production for the thirty-eight ewes in Table XXV is 12.4 pounds wool and 64.4 pounds weaned lamb.

Remove four yearlings with under nine pound yearling fleeces and the three year average of the thirty-four remaining is 12.6 pounds wool and 66.6 pounds weaned lamb.

Remove six two year ewes weaning no lambs as two's and the three year average for the remaining twenty-eight becomes 12.6 pounds wool and 76.4 pounds weaned lamb.

Remove three two year ewes raising light (under 70 pounds) single lambs and the average becomes 12.6 pounds wool and 78.7 pounds weaned lamb for twenty-five.

Remove six two year ewes weaning under 60 pounds twins and the average of the nineteen remaining increases to 12.6 pounds wool and 82.6 pounds weaned lamb.

While this line of investigation will doubtless be continued at Northwestern Branch, it may be possible to secure records from other sources and thus confirm or disprove the value of yearling or two year traits for predicting mature performance.

PART II

1961

ANNUAL RESEARCH REPORT

Northwestern Montana Branch

of the

Montana Agricultural Experiment Station

Kalispell, Montana

by

Vern R. Stewart, B.S., M.S.
Assistant Agronomist

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENT

Without the cooperation of other Staff Members on the Station, at Bozeman, and other Branch Stations, our research program would not be effective or productive. Dr. E. R. Hehn, winter wheat Coordinator, spent several days with the author in the winter wheat research on the Station. The Western Wheat Smut Control Lab in Pullman, Washington (Federal) has worked with us in our dwarf smut control program. Dr. J. R. Hoffmann, Dr. E. L. Kendrick, and R. L. H. Purdy were the personnel from the Smut Laboratory.

The farmer cooperators throughout Western Montana have aided materially in our over all program of research.

To Mr. C. W. Roath, Superintendent, and Mr. Paul Ross go much thanks for their help during the research year. Mr. Don Graham gave much assistance until leaving the Station the last of August.

The author wishes to express his appreciation to Mrs. Audrey Holman, Clerk, for her careful preparation and typing of this report and her help during the research year.

INTRODUCTION

This report will be concerned with research on cereals, weeds, annual forages, and new crops.

The cereals program has been reduced somewhat because of budget limitations. The winter wheat program was enlarged to include a breeding program.

The control of weeds using chemicals was the basis of research in this project. Several crops and weed species were studied.

The work on new crops was concerned with oil crops and the annual forage study was corn for silage production.

A statement of climatic and growing conditions is made a part of this report.

During the 1961 calendar year, the author took part in the following activities:

Date	Meeting	Place
January 5	Agricultural Council	Kalispell
January 10	Western Mont. District C. Agents	Missoula
January 11	Western Mont. District C. Agents	Missoula
February 22	Feeder Tour	Flathead County
March 12-16	Planning Conference	Bozeman
March 17	Advisory Council	Kalispell
March 22	Conservation Day	Eureka
March 23	Conservation Day	Libby
April 4	Russell School Children toured Station	Kalispell
October 16	Edmingston Bull Sale	Kalispell
November 28-30	Annual Conference	Bozeman

CLIMATE

Table I gives a brief summary of weather data. The growing season total for precipitation was 18.15 inches, .78 inches below normal. Again this season as during the 1960 season, spring grain yields were poor. Winter wheat yields were poor to good. May moisture was above the average for the 1949 to 1961 period, however, June, July, and August were considerably below normal. High humid conditions in May and early June contributed to a severe epidemic of stripe rust, (Puccinia glumarum). This disease had a very depressing effect on yield of Westmont, particularly in the lower valley area of Flathead County.

The last killing frost occurred May 6 and the first killing frost in the fall was September 12, 1961. This gave a growing season (frost free) of 129 days. This is twenty-two days longer than the average frost free period.

Little or no winter killing of winter grains was noted. Winter temperatures were mild with a low of 0° F on January 2, 1961 being recorded. The highest temperature recorded was August 4, 1961. The temperature was 100°, the highest ever recorded at the Northwestern Montana Branch Station.

A hail storm at noon September 1 did considerable damage on the Station to crops that had not been harvested. Corn plants were severly damaged by the hail. A fifty percent loss of wheat was caused by the hail and a total loss of mustard varieties was sustained.

Irrigation water was adequate during the growing season.

Table I. Summary of climatic data by months for the 1960-1961 crop year (September to August) and averages for the period, 1949-1961, at the Agricultural Experiment Station, Creston, Montana.

	Month and Year												Total-Ave.
	Sept. 1960	Oct. 1960	Nov. 1960	Dec. 1960	Jan. 1961	Feb. 1961	Mar. 1961	Apr. 1961	May 1961	June 1961	July 1961	Aug. 1961	Growing Season
Precipitation (inches)													
Current Year	.55	1.44	1.72	1.24	.65	1.46	1.96	2.26	4.02	1.45	.76	.64	18.15
Ave. 1949 to 1960-61	1.22	1.68	1.56	1.57	1.60	1.32	1.03	1.36	2.20	2.62	1.26	1.51	18.93
Mean temperature (°F)													
Current Year	55.0	45.2	34.4	24.9	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	46.3
Ave. 1949 to 1960-61	54.2	43.8	32.5	26.9	21.7	27.2	31.8	42.8	51.9	58.4	64.6	63.6	43.3

Last killing frost in spring*		
1961	May 6	(32°)
Ave. 1949-1961	May 30	(30.6°)
First killing frost in fall*		
1961	Sept. 12	(29°)
Ave. 1949-1961	Sept. 12	(30.1°)
Frost free period		
1961	129 days	
Ave. 1949-1961	107 days	
Maximum summer temperature	100° on August 4, 1961	
Minimum winter temperature	0° below zero on Jan. 2, 1961	

* In this summary 32° is considered a killing frost.

TITLE: Small Grain Investigations

PROJECT NUMBER: 5023

PERSONNEL: Leader - Vern R. Stewart
Coordinators -
1. Winter Wheat - E. R. Hehn
2. Spring Wheat - F. H. McNeal
3. Spring Barley - E. A. Hockett and R. F. Eslick
4. Winter Barley - R. F. Eslick
5. Oats - R. F. Eslick

FUNDS: State - $4415.00

LOCATION: Northwestern Montana Branch Station and off-station locations in several Northwestern Montana counties.

PROBABLE DURATION: Indefinite

EXPERIMENTAL DATA:

INTRODUCTION

The small grain investigations project includes winter wheat, spring wheat, winter barley, spring barley, and oats. The trials are conducted in cooperation with personnel at the Main Station in Bozeman. Plans for work on these projects are formulated and designed in a Planning Conference at the Main Station in Bozeman early in the spring.

Handling of line row and foundation seed is included in the project, however, it is not a research problem.

MATERIALS AND METHODS

Station nurseries are grown in four row plots, ten feet long in general, within a randomized or triple lattice design. Off-station plots were generally grown in a randomized block, single row plots, and four replications. All trials are analyzed using the variance analysis.

Planting was done with the Station's four row belt seeder mounted on a Farmall Cub tractor. Seeding depth depended on moisture and soil conditions, usually one to two inches.

Weeds were controlled when necessary. Cultivation was done with a garden tractor and 2,4-D was applied with a nursery type sprayer on a garden tractor. The irrigated nurseries were irrigated once during the growing season. Two inches of water were applied on June 26, 1961.

Plots were harvested by hand using a small hand scythe. Threshing was done in the field or at the plot immediately following harvest, except oats which were bound and allowed to dry. A portable Vogel threshing machine was used in threshing the plots.

All harvested samples are cleaned and weighed and yields of each plot are calculated from the weights. All weights per plots are given in grams except in larger plots (field size) where pounds per plot are used.

Foundations seeds were harvested with commercial machinery. Line row seed was harvested by hand, that is, in the same manner as the nursery material.

RESULTS AND DISCUSSION

The results and discussion of this project will be considered individually for each crop listed in the introduction.

Winter Wheat

Nurseries grown this year were (1) Western Regional Hard Red Winter, (2) Interstate Hard Red Winter, (3) Dwarf Bunt lines, (4) Short Straw and (5) five off-station nurseries.

Tillage methods for the control of dwarf bunt, production of winter wheat on fallow versus winter wheat on corn land, Westmont versus Wasatch in adjacent plantings, and breeding material from various sources were evaluated and studied. Some 650 rows were planted for observation and study.

The Federal Smut Control Laboratory personnel continued their studies on dwarf bunt in Western Montana.

Western Regional Hard Red Winter

This nursery is grown at many Stations throughout the western region of the United States. The nursery this year was grown on the Lance Claridge farm in an area known to be infected with dwarf bunt (Race D-3). It contained sixteen entries which were grown in four row plots eighteen feet long in four replications. Thirty-two square feet were harvested for yield.

This nursery was seeded September 13, 1960. The soil was very dry at the time of seeding. Seeding depth was shallow to encourage bunt infection. Emergence of this nursery was slow and not until the first of November was there a stand of wheat. Snow cover was light through most of the season. There was no winter killing in the nursery that was evident.

Columbia and Westmont has light bunt infection rate. C.I. 13442 was the only entry found to be bunt free. For the first time in seven years, Westmont was significantly less in yield than other standard entries. This can be accounted for by the high rate of dwarf bunt in Westmont.

Table II gives the results of this study. In studying this table, it shows a high level of bunt in many entries. Yields are about normal for the area.

Interstate Hard Red Winter

Material in this nursery is grown throughout the State of Montana in cooperation with other Agronomists in the Experiment Station system. Sixteen entries were grown in this nursery in 1961. Location of this nursery was in field E-4.

Table III (Part I) shows agronomic data for this nursery. Cheyenne was the most resistant to stripe rust, (Puccinia glumarum). Some entries were very susceptible to this disease. Columbia had a fairly high level of dwarf bunt, (Tilletia contraversa). In general, bunt was quite light in this nursery. Lodging was severe throughout this nursery. Yields were about normal for this rotation. No significant differences were found when analyzed with the variance analysis. Table III (Part II) gives yield data for this nursery.

Dwarf Bunt Lines

This nursery is made up of lines in advance generations where enough seed is available for yield testing. This material was supplied by Dr. E. R. Hehn, winter wheat coordinator.

There were some stripe rust resistant lines in this material and not a high level of bunt, however, bunt was found in all but six lines. There is a wide range of lodging in this material. Westmont has the best straw strength in this nursery. There was no line which was significantly higher in yield than Westmont. See Table IV.

Short Straw

The material for this nursery came from many sources and was given to the author by Dr. E. R. Hehn. All entries with the exception of the checks are semi-dwarfs. Yogo, Westmont, Itana, Burt, and Cheyenne are included as checks.

Dwarf bunt was found in most lines and all were, more or less, susceptible to stripe rust. Height variations were of considerable range from forty-eight inches for Cheyenne down to twenty-four inches for (W/B-17-4 x K-16)-F6-1-2-6. Burt was the highest yielding line. None of the semi-dwarfs were significantly higher than any of the other checks in the nursery. See Table V.

Differences were found in total bundle weights between varieties, but little difference was found in grain straw ratios. Table VI shows bundle weights and other grain-straw comparative data.

Off-station

These nurseries are grown in Western Montana counties and contain entries from the Station nurseries which have ayield potential or other factors which warrant testing off-station.

Five nurseries were seeded in the fall of 1960. Conditions during the growing season, yields, and other factors about these nurseries will be discussed under a county heading.

Missoula County — The nursery in Missoula County was grown near Huson, Montana in a dryland area. There was considerable variation in soil and slope of the land. Moisture conditions were quite poor at time of seeding. Yields were fair for this area, however, there were no significant difference between varieties in this trial. The mean was 28.3 bushels per acre. Table VII.

Ravalli County — The nursery in Ravalli County was grown on the L. B. McFadgen farm near Stevensville. Yields are very low in this nursery. A very dry fall and dry growing season, no doubt, account for these low yields. Table VIII gives the data for these trials.

Lake County — Table IX shows the yield data obtained from the Lake County winter wheat nursery grown on the Curtis Van Voast farm near Polson, Montana. Yields are fair for the area, however, the variance analysis shows no significant differences between varieties.

Mineral County — The Charles Frey farm was the sight of the winter wheat nursery grown in Mineral County. Yields were considerably higher than normal for this area with a mean yield of 33.5 bushels per acre. Cheyenne was the highest yielding entry in the nursery this year. Stripe rust was found on all entries. Readings of rust are found in Table X which also gives complete agronomic data for this trial.

Lincoln County — The nursery in Lincoln County was grown on the Dick Britten farm near Eureka, Montana. Moisture conditions were quite good for winter wheat production. Lodging was quite severe throughout the nursery. Tendoy was the highest yielding line, being significantly higher in yield than Westmont, i.e., Tendoy 56.5, Westmont 30.1. However, the high coefficient of variability would cause some scepticism on the reliability of these data. Table XI shows data for this trial.

Production Methods - I

Dwarf Bunt, (Tilletia contraversa), in an area Northwest of Kalispell has presented quite a problem to some operators in that area. A search for a new variety is being made. However, some observations have been made which indicate cultural techniques may be in part responsible for a high infection rate. One factor noted in particular is the depth of seeding. Deeper seeding tends to reduce the infection rate. Compaction of soil is also found to increase the rate of dwarf bunt infection.

With these observations in mind, a study was designed to try to measure some of the factors under field conditions. The following conditions or techniques were used in this study.

A. Fallow only - this being the check and the type of treatment given the soil by the operator.

B. Compacted soil - the fallow soil was compacted by running a tractor wheel over the area several times until the soil was fairly firm.

C. Disked with a disk harrow - the fallowed area was loosened up with a standarddisk harrow.

D. Worked with a field cultivator - the soil was worked with a field cultivator and then seeded with no more tillage operations.

E. Deep plowing - this area was plowed eight to ten inches with a "wheatland plow". This made the soil quite loose as contrasted with the check or standard fallowed area.

Three seeding depths were used on each tillage method, namely, ½"-shallow, 2"-medium, and 4"-deep. All seeding was done with an International Harvester Grassland drill. Rows were spaced twelve inches apart. The tillage method and seeding depth extend across the field or about 800 feet long. The plots were sprayed for weed control once during the growing season.

Harvesting was done with a field combine. The plots were 630 square feet in area. Samples were taken at random throughout each strip. Considerable dwarf bunt was found throughout all treatments. However, no random counts or estimates of the dwarf bunt infection rate was made in this material.

Yields were obtained and are recorded in Tables XII and XIIa. In analyzing these data, no difference of significance was found between tillage methods. However, Table XIIa shows that methods C, D, and E gave higher yields than A or B. The statistical analysis do show a significant difference for seeding depth. The 2 and 4 inch depths gave better yields than the ½ inch or shallow seeding depth.

Production Methods - II

Westmont and Wasatch wheat were planted in alternate strips in a bunt infested soil. This was done by putting Westmont in one side of an Allis Chalmers drill and Wasatch in the other side. These strips were seeded across a field so as to get a uniform area of the entire field.

Table XIII gives the yields of this production study. It will be noted that Wasatch has a yield advantage of .6 bushel per acre which may be or may not be a real significant difference.

Production Method - III

A study to measure the difference between total production in a wheat-fallow rotation and corn silage-wheat was started in 1956. 1961 is the sixth year of this study. The 1960 Annual Report of the Northwestern Montana Branch Station shows economic data for five years' work. (Page 40, 1960 Annual Report).

Table XIV gives the data for the 1961 crop. There was no significant differences between the fallow yields and the corn-fallow yields this year.

Production Method - IV

Since some farmers have been seeding in the latter part of August in the area, a study under field conditions was designed to measure the effect of this early date of seeding on yields of winter wheat. Previous work done at the Station indicates that September 15 is the most ideal planting date for winter wheat.

The study designed was for three dates of planting, namely, August 29, September 6, and September 14. Table XV shows the results of this study. The best yields were obtained with either the September 6 or September 14 planting. The early seeding tended to tiller more than the later seeding. This may have been in part responsible for the lower yield in the early seeding because there was not sufficient moisture for a high head or tiller population at heading time. This may have caused some reduction in yield.

Breeding Material

The breeding material this past season was grown on the Lance Claridge farm where a known source of inoculum is present. Breeding material was supplied by Dr. Paul Fitzgerald, Dr. Konzak, Dr. E. R. Hehn, and Dr. O. A. Vogel.

The material was screened for stripe rust and dwarf smut. All plants which had stripe rust were discarded. Readings for bunt were made at harvest time. Those lines free of bunt were selected if other agronomic factors were acceptable. The following shows the selections made from each source of material.

Vogel's material —

Twenty-six bulks were selected from this material.
Two hundred and ninety-three plant selections were made from Vogel's material. These selections came from twenty-eight 1961 rows.

Konzak's material —

Cross		1961 Row No.	No. Selected
Im 462-N#10 x Itana 684)	(15)	6	3
P.I. 178383 #9 x OAV 25)			
" "		8	5
Im 462-N#10 x Itana 684)	(16)	19	3
P.I. 178383 #5 x OAV 25)			
" "		20	4
" "		24	2
" "		26	6
" "		30	4
" "		36	5
" "		37	5
" "		38	5
" "		45	3
Im 462-N#10 x Itana 684)	(19)	74	4
Im 462-N#10#3 x P.I. 178383)			
" "	(20)	90	3
" "	(21)	97	4
" "	(21)	100	5
" "	(21)	101	3
Im 462-N#10 x P.I. 178383)	(31)	107	3
?)			
" "		108	4
" "		111	3
" "		117	3
" "		119	3
Im 462-N#10 x P.I. 178383)	(32)	124	3
4890)			
" "	(33)	143	3
Im 462-N#10 x P.I. 178383)	(34)	152	4
B/K 4890-2)			
Im 462-N#10 x P.I. 178383)	(36d)	185	4
R 101 SM-N#10 #4 x C.I. 13273)			
" "		187	3
" "	(37)	197	4
C.I. 13273 x B/K 70038 #1)	(74)	262	2
70060 A-#12 x P.I. 178383)			
" "		267	3
" "		268	4
" "	(77)	280	3
" "		283	3
" "		285	4
P.I. 178383 x OAV 25)	(82)	350	4
Dewey 225A x Itana/2423#1)			
" "	(83d)	369	3
" "	(84)	372	3
" "	(84)	380	5
" "	(84)	383	3

Continued —

Fitzgerald's material * —

Cross	1961 Row No.	No. Selected
5722 x Wilhelmina	1	9
5686 x 5722	2	8
Carsten IV x P.I. 178383	3	6
Erotica x P.I. 178383	5	7
White Winter x 5722	6	4
5770 x 5722	7	2
5781 x 5722	9	4
5780 x 5772	10	3
Carsten V x 5722	11	8
5775 x 5783	12	8
5775 x 5772	13	3
563 BC_4 x 5789		
55108 BC_4 x 5772	14 & 15	6
5772 x 5778	16	5
P.I. 178383 x Cheyenne	Pope	13

* Pedigree of code numbers:

5686	- (Itana x Utah 1754-53) x Itana
5772	- P.I. 178383 x (Norin 10 x Brevor)
5770	- P.I. 178383 x Lemhi
5772	- 5686 x 5722
5781	- Wilhelmina x 5686
5780	- White Winter x 5686
5775	- Gabo x Rio
5783	- Carsten V x 5686
5778	- $(Rio\text{-}Rex \times Cheyenne^{2}) \times Turkey^{3})_4 \times 5722$
563 BC_4	- $(Rio\text{-}Rex \times Cheyenne^{2}) \times Comanche^{4}$
55108 BC_4	- $(Rio\text{-}Rex \times Cheyenne^{2}) \times Turkey^{4}$

To determine the survival ability of some spring wheat and their reaction to dwarf bunt, twenty-eight varieties plus Dakold Rye were seeded in the fall of 1960 in dwarf bunt infected soil. Table XVI shows the percent survival and the absence or presence of bunt.

Federal Project

The cooperative work with the Montana Agricultural Experiment Station and the Federal Smut Control Laboratory at Pullman, Washington was carried again this season. Their material consisted of testing varieties to establish races of dwarf bunt, date of seeding, and chemical control of this disease. Report of their work is found in the 1960 Annual Report of the Regional Smut Research Laboratory by C. S. Holton, et al. This report is on file in the Station's library.

Table II. Agronomic data from the Western Regional hard red winter wheat nursery at Kalispell, Montana in 1961.
Grown on the Lance Claridge farm, four row plots, four replications.
Date Planted: September 13, 1960 Date Harvested: July 31, 1961 Size of Plot: 32 square feet

Variety	C. I. Number	Heading Date	Dwarf Bunt %	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield Bu./ Acre	Bu. Wt.
Columbia	12928	6-14	35.0	25	220	290	230	260	1000	12.5	55.4
Westmont	12930	6-13	30.0	28	285	315	305	275	1180	14.8	55.3
Itana	12933	6-17	27.5	28	305	335	300	245	1185	14.8	57.5
Kharkof	1442	6-15	17.5	30	370	405	355	355	1485	18.6*	58.4
Rio	10061	6-15	35.0	30	345	325	265	280	1215	15.2	56.6
Burt	12696	6-16	15.0	27	445	485	320	340	1590	19.9*	56.5
Wasatch	11925	6-15	5.0	31	415	405	375	330	1525	19.1*	59.5
Tendoy (Cheyenne 57)	13426	6-15	20.0	29	475	480	331	445	1731	21.6*	58.5
Yogo x 112a-520-6-1	13441	6-19	2.5	30	390	360	345	255	1350	16.9	58.3
Brevor x Utah Kanred	13442	6-20	0.0	27	332	350	254	250	1186	14.8	56.9
Rego	13181	6-17	1.5	30	370	350	370	340	1430	17.9*	54.5
Yogo x (Turkey x Cro-221)-117	13542	6-16	10.0	35	350	415	285	305	1355	16.9	56.0
(Yogo x Wasatch-3) x Cheyenne-56-10-1	13633	6-15	5.0	29	326	402	370	330	1428	17.9*	59.0
Cheyenne	8885	6-15	12.5	28	410	385	340	340	1475	18.4*	59.8
(Yogo x Wasatch-3) x Cheyenne-56-6-5		6-15	3.0	29	381	370	368	375	1494	18.7*	59.0
(Yogo x Wasatch-3) x Cheyenne-56-5-3		6-14	9.0	32	400	324	295	315	1334	16.7	58.5

Note: Westmont is the check in this nursery.
* Varieties yielding significantly more than the check (5%)

Mean Yield.....	17.1
S.E.X.	.8373
L.S.D. (5%).....	2.4
L.S.D. (1%).....	5.6
C.V.	4.87%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	14,847.890	13.24
Varieties	15	8,604.124	7.67
Error	45	1,121.724	
Total	63		

Table III. Agronomic data from the Interstate hard red winter wheat nursery at Creston, Montana in 1961. Four row plots, four replications. (Part I).
Date Planted: September 21, 1960 Date Harvested: July 26, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Heading Date	Ht. in In.	Stripe Rust 1 - 4	Stripe Rust %	Septoria 1 - 4	Dwarf Bunt %	Lodging %
Cheyenne	8885	6-12	48	1	x	4	4.0	90.0
Karmont	6700	6-11	48	1	x	4	5.3	97.5
Rego	13181	6-10	46	1	x	4	0.0	95.0
Newturk	6935	6-11	46	1	x	4	5.3	95.0
Yogo	8033	6-12	53	3	30.0	4	1.3	90.0
Itana	12933	6-11	52	4	70.0	3	1.2	77.5
Westmont	12930	6- 7	46	4	70.0	4	5.7	87.5
Westmont (Short Straw)		6- 4	44	4	70.0	4	1.7	95.0
Tendoy (Cheyenne 57)	13426	6-11	47	1	x	3	5.0	77.5
Triplet	5408	6-10	48	3	5.0	2	5.7	45.0
Rodco		6- 5	52	3	10.0	4	8.0	35.0
Columbia	12928	6- 8	51	4	70.0	3	23.7	77.5
Omar	13072	6-15	54	4	60.0	4	1.3	15.0
Wasatch	11025	6- 9	51	3	10.0	4	1.7	30.0
Yogo x (Turkey x Cro-221)-117	13542	6-11	48	1	x	4	4.0	85.0
(Yogo x Wasatch-3) x Cheyenne 56-10-1	13633	6- 9	54	2	5.0	3	1.3	55.0

Table III. Agronomic data from the Interstate hard red winter wheat nursery at Creston, Montana in 1961. Four row plots, four replications. (Part II).

Variety	C. I. Number	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu./Acre	Bu. Wt.
Cheyenne	8885	485	490	440	565	1980	49.5	61.3
Karmont	6700	300	490	355	630	1775	44.4	60.5
Rego	13181	475	405	515	471	1866	46.7	60.0
Newturk	6935	440	500	510	562	2012	50.3	59.5
Yogo	8033	300	470	410	335	1515	37.9	58.0
Itana	12933	360	545	505	510	1920	48.0	61.6
Westmont	12930	335	480	615	615	2045	51.1	60.6
Westmont (Short Straw)		390	500	488	464	1842	46.1	60.8
Tenday (Cheyenne 57)	13426	430	490	555	435	1910	47.8	61.5
Triplet	5408	473	415	490	460	1838	46.0	61.7
Rodeo		460	515	555	529	2059	51.5	61.6
Columbia	12928	490	426	505	516	1937	48.4	61.6
Omar	13072	575	490	458	565	2088	52.2	58.5
Wasatch	11025	345	515	455	426	1741	43.5	62.0
Yogo x (Turkey x Cro-221)-117	13542	380	537	544	477	1938	48.5	62.3
(Yogo x Wasatch-3) x Cheyenne 56-10-1	13633	440	556	475	465	1936	48.4	61.4

Mean Yield..... 47.5
S.E.X. 3.2137
L.S.D. ..... NS
C.V. 6.76%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	24,093.937	5.83
Varieties	15	5,044.963	1.22
Error	45	4,131.238	
Total	63		

Table IV. Agronomic data from Dwarf Bunt Lines grown at Creston, Montana in 1961. Single row plots, four replications.

Date Planted: September 21, 1960 Date Harvested: July 26, 1961 Size of Plot: 16 square feet

Variety	Heading Date	Bunt %	Stripe Rust	Ht. in In.	Lodging %	Grams Plot Yield I	II	III	IV	Total Grams	Yield in bu./Acre	Bu. Wt. in Pounds
Itana #1	6-11	3.0	4.0	53	70.0	473	504	398	450	1825	45.6	61.0
(YxR-56-30 x Was-2)-1-1-1	6-11	1.0	1.0	52	100.0	180	435	495	545	1655	41.6	61.0
" -2	6-11	2.5	1.0	52	100.0	265	331	405	480	1481	37.0	60.0
" -3	6-10	0.0	1.0	52	67.5	605	545	485	405	2040	51.0	61.5
" -4	6-10	.5	1.0	52	97.5	578	465	541	565	2149	53.7	61.4
Wasatch #2	6- 9	0.0	1.0	54	72.5	320	470	490	470	1750	43.8	60.6
Tendoy	6-11	3.0	1.0	53	87.5	481	482	510	582	2055	51.4	61.5
(YxR-56-30 x Was-2)-2-10-1	6-12	0.0	4.0	50	92.5	476	235	375	395	1481	37.1	61.9
" -3	6-11	4.0	2.0	48	87.5	428	450	375	496	1749	43.7	54.9
" -4	6-11	0.0	4.0	50	47.5	490	485	405	525	1905	47.6	61.8
Itana #6 x K-17-7-3)-1-11-1	6-10	1.5	2.0	52	.5	540	545	585	545	2215	55.4	61.0
" -5	6-10	6.5	1.0	51	0.0	567	525	552	565	2209	55.2	60.9
Itana #6 x K-17-7-3)-1-26-1	6-10	.5	2.5	49	5.0	659	455	490	435	2039	51.0	61.3
" -2	6-11	4.0	2.5	54	12.0	492	540	501	515	2048	51.2	61.9
" -3	6-11	5.0	2.5	55	20.0	415	540	515	503	1973	49.3	62.0
" -4	6-11	3.5	2.5	55	20.0	500	465	670	560	2195	54.9	61.9
" -5	6-11	4.0	1.0	54	27.5	450	395	470	475	1790	44.8	61.9
(17-7-4 x Was-6)-1-10-1	6-12	4.0	1.0	58	40.0	465	445	540	415	1865	46.6	61.5
" -2	6-11	0.0	1.0	53	60.0	355	370	510	510	1745	43.6	61.0
" -5	6-12	0.0	1.0	57	42.5	501	440	401	526	1868	46.7	62.4
(Was-2 x 17-7-2)-1-8-5	6-13	1.0	1.0	49	82.5	400	325	390	430	1545	38.6	61.2
(Was-3 x Itana 6)-2-10-4	6-12	0.0	2.0	54	30.0	560	475	501	465	2001	50.0	60.4
" -5	6-12	2.0	2.5	56	25.0	470	410	474	565	1919	48.0	60.0
" -6	6-12	2.5	2.0	51	50.0	475	465	305	510	1755	43.9	62.0
Westmont	6- 8	2.5	4.0	54	30.0	445	560	390	465	1860	46.5	61.8

1/ Calculated missing plot

Mean Yield..... 47.1
S.E.$\bar{x}$. 3.5761
L.S.D. (5%)..... 10.1
C.V. 7.59%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	7,943.53	1.55
Varieties	24	11,330.494	2.22
Error	72	5,115.2628	
Total	99		

Table V. Agronomic data for the short straw nursery grown at Creston, Montana in 1961. Single row plots, four replications.
Date Planted: September 21, 1960 Date Harvested: July 26, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Heading Date	Bunt %	Stripe Rust	Ht. in In.	Plot Yield in Grams I	II	III	IV	Total Grams	Yield in Bu/Acre	Bu. Wt.
(H/B-17-4 x Y-16)-F6-1-2-6		6-10	1.5	1.0	24	269	395	430	400	1494	37.4	58.5
Yogo	8033	6-12	22.5	2.0	49	685	675	479	445	2284	57.1	61.2
(H/B-17-6 x Y-18)-F6-18-1		6-11	10.0	4.0	26	376	565	460	490	1891	47.3	56.0
Westmont	12930	6- 7	5.0	4.0	44	700	585	450	690	2425	60.6	61.5
(Y-2 x H/B-17-2)-F6-7-4		6- 9	2.5	4.0	40	510	585	439	555	2089	52.2	61.7
(Y-2 x H/B-17-2)-F6-10-3		6-12	0.0	4.0	29	515	540	465	580	2100	52.5	59.2
Itana	12933	6-11	9.0	4.0	46	810	605	492	800	2707	67.8	60.0
(Y-8 x H/B-17-8)-F6-16-2		6-10	1.0	1.0	39	520	484	470	495	1969	49.2	59.0
(Y-4 x H/B-17-4)-F6-1-4-2		6-12	4.5	4.0	35	674	590	700	630	2594	64.9	55.9
" -3		6-10	1.5	1.0	38	765	725	580	710	2780	69.5	59.0
(Y-8 x H/B-17-8)-F6-1-6-4		6-13	0.0	2.0	27	615	580	485	628	2308	57.7	56.1
" 11-4		6-13	3.5	3.5	29	675	670	820	620	2785	69.6	57.0
(Huntley 54 x 130A)-57-74		6- 9	2.0	1.5	36	600	660	609	484	2353	58.8	50.5
" -57-224		6- 8	2.0	4.0	41	490	380	463	415	1748	43.7	59.5
Cheyenne	8885	6-12	0.0	1.0	48	825	650	655	675	2805	70.1	61.2
Sel. No. 56751 (1959-60)		6- 4	7.0	1.5	34	530	575	515	535	2155	53.9	59.2
59590		6- 4	11.5	4.0	34	560	625	582	550	2317	57.9	59.8
59394		6- 4	2.5	3.5	36	565	675	465	500	2205	55.1	59.5
59396		6- 5	1.5	1.5	30	495	490	544	540	2069	51.7	58.3
59407		6- 4	22.5	3.0	35	535	555	515	390	1995	49.9	60.0
59420		6- 3	4.0	2.0	35	455	525	505	535	2020	50.5	61.2
59433		6- 3	6.0	2.5	36	585	495	605	560	2245	56.1	59.3
59435		6- 3	25.0	2.0	38	560	633	404	350	1947	48.7	58.6
59438		6- 2	6.0	4.0	32	540	380	605	500	2025	50.6	58.5
59464		6- 4	5.0	3.5	33	500	544	514	455	2013	50.3	60.9
59494		6- 3	4.0	4.0	39	595	515	520	450	2080	52.0	61.2
59503		6- 3	20.0	1.0	34	609	465	615	545	2234	55.9	59.0
59506		6- 5	11.5	1.5	35	425	351	442	465	1683	42.1	59.0

Continued ——

Table V. (Continued)

Variety	C. I. Number	Heading Date	Bunt %	Stripe Rust	Ht. in In.	Plot Yield in Grams I	II	III	IV	Total Grams	Yield in Bu/Acre	Bu. Wt.
Sel. No. 391-56-D4		6- 5	17.5	1.0	34	635	665	730	560	2590	64.8	59.1
391-56-D8		6- 5	17.5	1.0	35	520	580	590	401	2091	52.3	60.0
551556		6- 5	12.5	2.5	36	545	450	579	625	2199	55.0	59.5
Orievira Hybrid	13285	6- 4	17.5	1.5	39	596	450	584	595	2225	55.6	61.0
533211		6- 5	6.5	4.0	35	499	450	521	565	2035	50.9	51.5
551147		6- 5	15.0	3.0	39	480	450	510	565	2005	50.1	60.0
533532		6- 4	7.0	4.0	37	510	375	557	575	2017	50.4	58.5
Burt	12696	6-10	5.5	1.0	43	730	820	708	890	3148	78.7	59.9

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	4,454.627	---
Varieties	35	29,302.171	5.02
Error	105	5,835.220	
Total	143		

Mean Yield.....55.3
S.E.M. 3.8194
L.S.D. (5%)....10.7
L.S.D. (1%)....14.2
C.V. 6.91%

Table VI. Bundle weight data from short straw nursery grown at Creston, Montana in 1960-61. Single row plots, four replications.
Date Planted: September 21, 1960 Date Harvested: July 26, 1961 Size of Plot: 16 square feet

Variety or Selection	C. I. No.	Bundle Weights in Ounces I	II	III	IV	Total Ounces	Pounds Per Acre	Grain Yield #/Acre	Grain Straw Ratio
(N/B-17-4 x Y-16)-F6-1-2-6		29.0	44.0	41.0	41.0	155.0	6,594	2242	1:2.94
Yogo	8033	76.0	76.0	52.0	53.0	257.0	10,932	3427	1:3.19
(N/B-17-6 x Y-18)-F6-18-1		48.0	54.0	48.0	48.5	198.5	8,444	2837	1:2.98
Westmont	12930	72.0	60.5	52.0	71.0	255.5	10,869	3639	1:2.99
(Y-2 x N/B-17-2)-F6-7-4		63.0	72.0	54.0	74.0	263.0	11,188	3135	1:3.57
10-3		59.0	63.0	57.0	65.0	244.0	10,380	3151	1:3.29
Itana	12933	96.5	81.0	61.0	92.0	330.5	14,059	4062	1:3.46
(Y-8 x N/B-17-8)-F6-16-2		58.0	60.0	52.0	63.0	233.0	9,912	2955	1:3.35
(Y-4 x N/B-17-4)-F6-1-4-2		65.0	61.0	66.0	57.5	249.5	10,613	3893	1:2.72
-3		81.5	88.0	75.0	79.0	323.5	13,761	4172	1:3.30
(Y-8 x N/B-17-8)-F6-1-6-4		73.0	57.0	51.0	76.5	257.5	10,954	3463	1:3.16
11-4		72.0	83.0	86.0	67.5	308.5	13,123	4179	1:3.14
(Huntley 54 x 130A)-57-74		66.0	62.0	61.0	54.0	243.0	10,337	3531	1:2.93
57-224		55.0	39.5	50.0	47.0	191.5	8,146	2623	1:3.10
Cheyenne	8885	89.0	75.0	76.0	82.0	322.0	13,698	4209	1:3.25
Sel. No. 56751 (1959-60)		60.0	63.0	59.0	76.0	258.0	10,975	3234	1:3.39
59590		76.0	71.5	68.0	70.0	285.5	12,145	3477	1:3.49
59394		64.0	70.0	55.0	53.0	242.0	10,295	3309	1:3.11
59396		63.0	69.0	70.0	57.0	259.0	11,018	3105	1:3.55
59407		56.0	64.0	55.0	43.5	218.5	9,295	2994	1:3.68
59420		49.0	61.5	52.0	58.0	220.5	9,380	3031	1:3.09
59435		70.0	70.0	62.5	51.0	253.5	10,784	2922	1:3.69
59433		74.0	65.0	76.0	62.0	277.0	11,783	3369	1:3.50

Continued ——

Table VI. (Continued)

Variety or Selection		C.I. No.	Bundle Weights in Ounces I	II	III	IV	Total Ounces	Pounds Per Acre	Grain Yield #/Acre	Grain Straw Ratio
Sel. No.	59438		72.0	64.0	75.0	47.0	258.0	10,975	3039	1:3.61
	59464		64.0	72.0	61.0	50.0	247.0	10,507	3021	1:3.48
	59494		67.0	60.0	66.0	54.0	247.0	10,507	3121	1:3.37
	59503		74.0	46.0	62.0	56.0	238.0	10,124	3352	1:3.02
	59506		42.0	41.0	48.0	47.0	178.0	7,572	2526	1:3.00
	391-56-D4		76.0	61.5	84.0	65.0	286.5	12,187	3886	1:3.13
	391-56-D8		76.0	69.5	69.0	48.0	262.5	11,167	3138	1:3.56
	551556		62.0	54.0	63.5	56.0	235.5	10,018	3300	1:3.04
	Crievira Hybrid	13285	86.0	56.0	72.0	75.0	289.0	12,294	3339	1:3.68
	533211		70.5	55.0	70.0	80.0	275.5	11,720	3054	1:3.84
	551147		64.0	55.0	62.0	64.0	245.0	10,422	3009	1:3.46
	533532		72.0	44.0	67.0	71.5	254.5	10,825	3027	1:3.58
Burt			83.0	95.0	79.0	93.0	350.0	14,889	4724	1:3.15

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	184.909	2.58
Varieties	35	417.220771	5.81
Error	105	71.787724	
Total	143		

Mean Yield.....	10,885
S.E.x.	720.805
L.S.D.(5%).....	2,017
L.S.D.(1%).....	2,671
C.V.	6.62%

Table VII. Agronomic data from off-station winter wheat nursery grown on the Henry LaVoie farm in Missoula County, Huson, Montana in 1961. Single row plots, four replications.
Date Planted: September 19, 1960 Date Harvested: August 3, 1961 Size of Plot: 16 square feet

Variety	C.I. No.	Stripe Rust 1 - 4	% Stripe Rust	Ht. in In.	Bunt	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu/A.	Bu. Wt.
Westmont	12930	4	45	32	x	355	170	110	372	1007	25.1	62.3
Itana	12933	4	65	33	x	170	204	350	195	919	22.9	61.0
Columbia	12928	4	45	37	x	242	260	230	130	862	21.6	——
Cheyenne	8885	2	5	37	4	250	205	254	360	1069	26.7	62.6
Yogo-Turkey-Oro 117	13542	3	5	42	x	242	480	260	200	1182	29.6	62.5
Omar	13072	4	17.5	40	x	110	425	250	200	985	24.6	58.0
(Y x W)-3 x Cheyenne 56-10-1	13633	2.5	3	41	x	340	345	235	350	1270	31.8	62.1
Triplet	5408	1	T	36	10	225	325	285	376	1211	30.3	61.4
Rego	13161	1	T	40	x	276	360	360	468	1464	36.6	60.5
Tendoy	13426	1	0	33	10	130	349	437	455	1371	34.3	62.5

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	13,516.866	1.40
Varieties	9	9,848.944	1.01
Error	27	9,668.848	
Total	39		

Mean Yield..... 28.3
S.E.$\bar{x}$ 4.9165
L.S.D. (5%)..... NS
C.V. 17.34%

Table VIII. Agronomic data from off-station winter wheat nursery grown on the L. B. McFadgen farm at Stevensville, Montana in 1961. Single row plots, four replications.
Date Planted: September 19, 1960 Date Harvested: July 20, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu/Acre
Westmont	12930	20.5	175	102	130	175	582	14.6
Itana	12933	22.5	145	100	230	205	680	17.0
Columbia	12928	17.0	130	105	135	270	640	16.0
Cheyenne	8885	18.5	85	105	145	180	515	12.9
Yogo-Turkey-Oro 117	13542	21.5	60	45	95	150	350	8.8
Omar	13072	19.5	55	140	145	145	485	12.1
(Y x W)-3 x Cheyenne 56-10-1	13633	24.0	100	115	135	195	545	13.6
Triplet	5408	18.0	65	115	152	155	487	12.2
Rego	13181	22.0	55	195	101	210	561	14.0
Tendoy	13526	21.0	120	89	155	160	524	13.1

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	14,561.166	11.10**
Varieties	9	2,070.800	1.58
Error	27	1,312.233	
Total	39		

Mean Yield..... 13.4
S.E.$\bar{x}$. 1.8112
L.S.D. (5%)..... NS
C.V. 13.50%

Table IX. Agronomic data from off-station winter wheat nursery grown on the Curtis VanVoast farm in Polson, Montana in 1961. Single row plots, four replications.
Date Planted: September 24, 1960 Date Harvested: July 20, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu/A	Bu. Wt.
Westmont	12930	34	250	260	210	180	900	22.5	58.9
Itana	12933	37	200	270	280	200	950	23.8	59.9
Columbia	12928	33	200	230	205	160	795	19.9	———
Cheyenne	8885	34	290	245	154	270	959	24.0	61.5
Yogo-Turkey-Oro 117	13542	39	205	235	245	230	915	22.9	60.6
Omar	13072	30	275	245	295	200	1015	25.4	58.0
(Y x W)-3 x Cheyenne 56-10-1	13633	35	175	251	290	185	901	22.5	60.1
Triplet	5408	39	325	275	310	315	1225	30.6	60.5
Rego	13181	40	261	255	270	250	1036	25.9	58.0
Tendoy	13426	35	200	240	320	310	1070	26.8	61.9

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	1,558.3	
Varieties	9	3,466.733	2.08
Error	27	1,664.5777	
Total	39		

Mean Yield.....	24.4
S.E.$\bar{x}$.	2.0399
L.S.D. (5%).....	NS
C.V.	8.36%

Table X. Agronomic data from off-station winter wheat nursery grown on the Charles Frey farm at Tarkio, Montana in 1961. Single row plots, four replications.
Date Planted: September 19, 1960 Date Harvested: August 3, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Stripe Rust 1 - 4	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu/A.	Bu. Wt.
Westmont	12930	4	43	290	250	485	295	1320	33.0	58.7
Itana	12933	4	44	225	390	390	315	1320	33.0	57.0
Columbia	12928	4	44	210	220	255	305	990	24.8	57.6
Cheyenne	8885	1	45	435	438	455	430	1758	44.0	60.5
Yogo-Turkey-Oro 117	13542	3	46	250	310	294	225	1079	27.0	59.0
Omar	13072	3.5	43	245	290	280	375	1190	29.8	57.1
(Y x W)-3 x Cheyenne 56-10-1	13633	3	50	290	350	395	235	1270	31.8	59.6
Triplet	5408	3	48	255	326	530	630	1741	43.5	59.4
Rego	13181	1.5	52	360	260	280	310	1210	30.3	56.4
Tendoy	13426	2	48	525	270	350	386	1531	38.3	61.2

Note: Westmont is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	9,585.1	1.38
Varieties	9	16,881.0	2.42
Error	27	6,970.766	
Total	39		

Mean Yield..... 33.5
S.E.$\bar{x}$. 4.1745
L.S.D. (5%)..... 12.1
C.V. 12.45%

Table XI. Agronomic data from off-station winter wheat nursery grown on the Dick Britten farm in Eureka, Montana in 1961. Single row plots, four replications.
Date Planted: September 23, 1960 Date Harvested: July 28, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield in Bu/A	Bu. Wt.
Westmont	12930	45	235	285	500	185	1205	30.1	54.5
Itana	12933	40	160	449	465	354	1428	35.7	58.5
Columbia	12928	38	220	145	265	155	785	19.6	52.1
Cheyenne	8885	47	348	440	415	535	1738	43.5	58.1
Yogo-Turkey-Oro 117	13542	45	315	320	365	315	1315	32.9	56.5
Omar	13072	43	360	285	98	474	1217	30.4	50.5
(Y x W)-3 x Cheyenne 56-10-1	13633	50	190	210	410	340	1150	28.8	57.9
Triplet	5408	46	585	340	440	445	1810	45.3	60.0
Rego	13181	49	185	504	350	330	1369	34.2	55.4
Tendoy	13426	45	435	440	438	945	2258	56.5*	60.5

Note: Westmont is the check in this nursery.
* Varieties yielding significantly more than the check (5%).

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	20,016.9	1.15
Varieties	9	42,559.85	2.45*
Error	27	17,356.703	
Total	39		

Mean Yield.....	35.7
S.E.$\bar{x}$.	6.5872
L.S.D. (5%).....	19.1
C.V.	18.45%

Table XII. Data from tillage method study for control of Dwarf Bunt. Grown on the Lance Claridge farm northwest of Kalispell in 1960-61.

Date Planted: September 13, 1960 Date Harvested: August 2, 1961
Size of Plot: 630 square feet

Method	Depth in Inches	Plot Yield in Ounces I	II	III	Total Ounces
A	½	11.50	13.00	13.00	37.50
	2	10.25	17.00	12.00	39.25
	4	14.00	13.50	15.00	42.50
		35.75	43.50	40.00	119.25
B	½	7.50	8.00	11.00	26.50
	2	17.00	13.50	9.00	39.50
	4	9.50	14.50	16.50	40.50
		34.00	36.00	36.50	106.50
C	½	16.00	9.50	16.00	41.50
	2	17.50	13.00	17.50	48.00
	4	20.00	15.25	17.50	52.75
		53.50	37.75	51.00	142.25
D	½	19.50	10.75	15.75	46.00
	2	18.00	14.00	18.50	50.50
	4	20.00	11.00	17.00	48.00
		57.50	35.75	51.25	144.50
E	½	16.00	12.50	19.00	47.50
	2	21.00	13.50	16.00	50.50
	4	19.00	17.00	20.00	56.00
		56.00	43.00	55.00	154.00
Total		236.75	196.00	233.75	666.50

Table XIIa.

Method	Depth of Seeding ½	2	4		Average Ounces	Yield Bu/A
A	37.50	39.25	42.50	119.25	13.25	15.3
B	26.50	39.50	40.50	106.50	11.83	13.6
C	41.50	48.00	52.75	142.25	15.81	18.2
D	46.00	50.50	48.00	144.50	16.06	18.5
E	47.50	50.50	56.00	154.00	17.11	19.7
Total	199.00	227.75	239.75	666.50		
Average	13.27	15.18	15.98	14.81	14.81	
Yield in Bu/A	15.3	17.5 ≠	18.4 ≠			

Analysis of Variance

Source	D.F.	Mean Square	F
Blocks	2	34.3847	2.54
Method	4	43.21315	3.20
Error a	8	13.5028	
Main Plots	14	———	
Depth of Seeding	2	29.2347	5.01*
Depth x Method	8	2.85862	
Error b	20	5.82558	
Total	44		

x̄.	17.07
Method L.S.D.....	NS
Depth L.S.D.(1%).	2.1

Table XIII. Yield data from strips of Westmont and Wasatch winter wheat grown in alternate strips on the Lance Claridge farm, Kalispell, Montana in 1961.

Date Planted: September 13, 1960 Date Harvested: August 2, 1961

	Bushels per acre	Average
Westmont	22.1	
	22.6	
	25.6	
	19.0	
	18.6	21.6
Wasatch	21.4	
	22.1	
	22.1	
	22.6	
	22.8	22.2

Table XIV. Agronomic yield data from Westmont winter wheat grown on summer fallow and land in cultivated corn crop the previous year.

Date Planted: Sept. 21, 1960 Date Harvested: July 27, 1961
Size of Plot: 360 square feet

	Plot Yield in Pounds I	II	III	IV	Total Pounds	Yield Bu/A
Fallow F-4b	21.5	19.0	14.5	20.5	75.5	36.1
Corn land F-4c	17.5	16.5	19.5	18.5	72.0	36.3

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	3.198	—
Treatment	1	1.531	—
Error	3	8.0313	
Total	7		

Mean Yield.....37.1
S.E.X..... 2.8576
L.S.D. (5%).....NS
C.V. 7.70%

Table XV. Yield data from winter wheat date of planting study, Creston, Montana - 1960-61. Location R-6
Date Harvested: July 19, 1961

Date Planted	Total Bushels	Number of Acres	Bushels Per Acre
August 29, 1960	105	2.85	36.8
September 6, 1960	120	2.82	42.5
September 14, 1960	105	2.47	42.5

Table XVI. Spring wheats seeded in the fall to measure survival and amount of dwarf bunt, (Tilletia controversa),. Grown on the Lance Claridge farm northwest of Kalispell in 1960-61.
Single row plots, 18 feet long.
Planted: September 13, 1960

Variety	C. I. Number	% Stand	Bunt
Lee	12488	0	
Thatcher x Lee	B55-5	0	
II-44-29 x Lee^3, II-53-562	13458	0	
Thatcher^2 x Rescue	B57-191	60	x
Selkirk	13100	70	x
Pembina, C.T. 229	13332	60	
Rescue-N1315 x G.B.	B57-92	50	
Conley	13157	40	
Rescue	12435	20	
Thatcher^3 x Rescue	B57-196	40	x
Lake	13413	95	
Rescue-N1315 x G.B.	B57-173	0	
Minn. Sel. II-53-404	13465	0	
Chinook	13220	30	
Canthatch, C.T. 233	13345	70	x
Rescue x 1831, B51-9	13304	60	x
Minn. Sel. II-53-525	13466	60	
II-44-29 x Lee^3, II-53-567	13416	0	
1953 x Lee, B52-91	13242	20	
Thatcher	10003	90	x
Newthatch	12318	75	x
Cadet	12053	60	x
Weibulls		95	x
Rival	11708	90	x
Canus	11637	90	x
Reliance		95	
Sevenne		30	
Centana	12947	25	x
Dakold Rye (two row rye)			

Spring Wheat

The spring wheat work was reduced this season because of budget limitations. The reduction was made in the off-station work. In the main, spring wheat work consisted of yield nurseries and one milling and baking nursery.

The yield nurseries were as follows: (1) dryland advanced yield, (2) irrigated advanced yield, (3) uniform Western Regional white wheat, and (4) the milling and baking plots.

Dryland Advanced Yield

The entries in this nursery consist of breeding material and standard varieties. The promising lines from other breeding programs are also included in this nursery.

There were twenty-eight entries in the 1961 nursery planted in four row plots and four replications. It was located in field number A-1b.

Yields were below normal for this location. Stripe rust was found on some lines, however, the majority of the hard red lines were quite resistant. There were no significant differences in this nursery and the C.V. is a little high. There was considerable difference due to replications in this test. See Table XVII.

Irrigated Advanced Yield

This nursery has the same entries as in the dryland nursery.

This nursery was located in field number Y-8. Stripe rust was found on some lines in this nursery. The mean yield for this nursery was 42.2 bushels per acre or somewhat less than expected under these conditions. A hail storm on September 1, 1961 did considerable damage to this nursery and thus accounts in part for the reduction in yield. Table XVIII shows yield and agronomic data for this nursery.

Uniform Western Regional White Wheat

This nursery is grown throughout the western states of the United States. Entries are supplied by many breeders and workers throughout the western states.

Stripe rust was quite severe in this nursery and many lines were found to be susceptible. Also there are many lines quite superior in yield, in disease resistance, and lodging resistance to Lemhi, which is the currently recommended variety. C.I. No. 13641 is the highest yielding line in this nursery. Table XIX gives the agronomic data for this trial.

Milling and Baking Plots

These plots are grown to secure sufficient seed for milling and baking tests. The material is planted with a field drill in strips, one drill width. The strips are harvested with a field combine.

The only data secured from this material this year was heading dates. The hail storm plus wet weather reduced the quality of the plots. The hail knocked out about fifty percent of the grain. Quality data is not available at this writing. See Table XX.

Table XVII. Agronomic data from dryland advanced yield spring wheat nursery at Creston, Montana in 1961. Four row plots, four replications, field number A-1b.
Date Planted: April 24, 1961 Date Harvested: August 18, 1961 Size of Plot: 16 square feet

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
Minn II-53-404	13465	6-23	2.5	29	140	245	270	255	910	22.8	59.2
Nrn 10-Bvr 14 x Cnt	B59-17	6-26	4.0	21	165	310	295	320	1090	27.3	60.0
Canthatch	13345	6-25	1.0	26	140	215	340	280	975	24.4	58.5
Thatcher x Lee	B55-5	6-25	1.0	27	200	265	265	365	1095	27.4	58.6
Chinook	13220	6-26	1.0	28	195	260	290	280	1025	25.6	58.0
Centana x Rescue	B61-31	6-29	1.0	31	165	275	235	250	925	23.1	60.0
Lee^2 x Kenya Farmer	13463	6-23	2.5	29	175	315	325	300	1115	27.9	58.0
II-50-17 x Pilot	B61-95	6-26	1.0	28	180	750	265	345	1540	38.5	59.0
N.D. 81 x Lee, N.D. 137	13349	6-25	1.5	30	150	230	255	265	900	22.5	57.0
Lee	12488	6-23	1.0	29	195	245	245	255	940	23.5	56.5
K. 338 x Lee	B61-88	6-26	1.0	30	205	300	330	325	1160	29.0	59.0
Centana	12974	6-28	2.0	30	210	255	295	370	1130	28.3	59.4
Sawtana	13304	6-28	1.0	29	230	300	250	275	1055	26.4	59.0
Nrn 10-Bvr 14 x Cnt	B59-1	6-27	4.0	26	265	280	260	355	1160	29.0	58.5
Pembina	13332	6-25	2.0	27	225	235	270	290	1020	25.5	57.5
Thatcher	10003	6-26	1.5	24	225	235	295	340	1095	27.4	57.6
Ceres	6900	6-27	2.0	28	195	250	310	285	1040	26.0	60.0
K.F. x Centana	B61-107	6-28	2.5	30	209	285	305	335	1134	28.4	58.0
B49-102 x K. 338	B61-18	6-26	1.0	31	215	315	305	375	1210	30.3	61.5
Rescue	12435	6-26	1.0	31	170	230	275	270	945	23.6	59.0
Selkirk	13100	6-27	1.0	28	145	265	305	305	1020	25.5	57.4
Conley x N.D. 40-2, ND 102	13462	6-27	1.0	28	155	240	275	320	990	24.8	57.3

Continued ——

Table XVII. (Continued)

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Grams Per Plot I	II	III	IV	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
1953 x Lee	13242	6-24	1.0	27	180	250	270	320	1020	25.5	58.3
P.I. 56219-7 x Rescue	B60-41	6-26	2.0	28	190	190	275	285	940	23.5	59.5
K. 338 x Lee	B61-91	6-23	3.0	30	205	240	315	320	1080	27.0	57.2
Hrn 10-Bvr 14 x Cnt	B59-3	6-27	4.0	26	265	275	295	360	1195	29.9	59.0

1 Calculated missing plot

Mean Yield..... 26.6
S.E.$\bar{x}$. 2.7946
L.S.D. ..... NS
C.V. 10.51%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	68,360.860	21.88**
Varieties	25	4,343.464	1.39
Error	74	3,124.032	
Total	102		

Table XVIII. Agronomic data from irrigated advanced yield nursery at Creston, Montana in 1961. Four row plots, four replications, field number Y-8.
Date Planted: May 12, 1961 Date Harvested: September 8, 1961 Size of Plot: 16 square feet

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Lodging %	Grams Per Plot I	II	III	IV	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
Minn II-53-404	13465	7- 3	2.0	44	60	190	535	375	440	1540	38.5	56.2
Nrn 10-Bvr 14 x Cnt	B59-17	7- 8	4.0	33	45	345	570	380	390	1685	42.1	56.5
Canthatch	13345	7- 6	1.5	40	78	386	530	550	365	1831	45.8	57.0
Thatcher x Lee	B55-5	7- 5	1.0	38	73	454	520	520	525	2019	50.5	56.5
Chinook	13220	7- 6	1.5	48	80	405	490	405	455	1755	43.9	59.0
Centana x Rescue	B61-31		1.0	50	52	345	470	435	410	1660	41.5	59.0
Lee^2 x Kenya Farmer	13463	7- 3	1.0	44	60	480	525	460	530	1995	49.9	57.0
II-50-17 x Pilot	B61-95	7- 6	1.0	46	40	290	465	410	255	1420	35.5*	59.0
N.D. 81 x Lee, N.D. 137	13349	7- 6	1.5	37	15	270	360	440	350	1420	35.5	55.5
Lee	12488	7- 3	1.0	40	53	355	360	490	490	1695	42.4	55.4
K. 338 x Lee	B61-88	7- 4	1.5	48	37	375	350	365	455	1545	38.6	58.0
Centana	12974	7- 9	2.5	46	45	440	430	395	390	1655	41.4	57.0
Sawtana	13304	7-10	1.0	48	88	475	525	520	510	2030	50.8	58.0
Nrn 10-Bvr 14 x Cnt	B59-1	7- 9	4.0	37	80	315	355	325	320	1315	32.9**	55.4
Pembina	13332	7- 5	1.0	40	98	434	350	480	360	1624	40.6	56.5
Thatcher	10003	7- 6	1.0	40	100	515	415	420	470	1820	45.5	56.5
Ceres	6900	7- 8	2.5	44	72	445	300	335	340	1420	35.5*	58.0
K.F. x Centana	B61-107	7- 8	3.0	47	70	460	455	420	450	1785	44.6	57.0
B49-102 x K. 338	B61-18	7- 8	1.0	50	72	555	505	550	515	2125	53.1	58.5
Rescue	12435	7- 7	1.0	46	98	375	460	290	370	1495	37.4	55.5
Selkirk	13100	7- 6	1.0	45	42	415	380	435	320	1550	38.8	55.1
Conley x N.D. 40-2, ND 102	13462	7- 7	1.0	46	37	405	355	451	365	1576	39.4	57.0

Continued ——

Table XVIII. (Continued)

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Lodging %	Grams Per Plot I	II	III	IV	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
1953 x Lee	13242	7- 4	1.0	46	30	475	475	555	470	1975	49.4	57.4
P.I. 56219-7 x Rescue	B60-41	7- 7	2.0	43	98	420	385	440	390	1635	40.9	58.5
K. 338 x Lee	B61-91	7- 2	3.0	44	45	495	535	425	435	1890	47.3	56.9
Nrn 10-Bvr 14 x Cnt	B59-3	7- 8	4.0	36	100	375	420	330	330	1455	36.4*	54.5

Hailstorm: September 1, 1961
Note: Thatcher is used as a check in this nursery
* Varieties yielding significantly less than the check (5%)
** Varieties yielding significantly less than the check (1%)

Mean Yield..... 42.2
S.E.x. 3.0039
L.S.D. (5%)..... 8.5
L.S.D. (1%)..... 11.2
C.V. 7.12%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	8,397.667	2.33
Varieties	25	12,155.720	3.37**
Error	75	3,609.360	
Total	103		

Table XIX. Agronomic data from dryland uniform western regional spring wheat nursery at Creston, Montana in 1961.
Four row plots, three replications, field number A-1b.
Date Planted: April 24, 1961 Date Harvested: August 18, 1961 Size of Plot: 16 square feet

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Grams Per Plot I	II	III	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
Baart	1697	6-27	4.00	28	245	240	280	765	25.5**	61.0
Gabo x Idaed^3	13637	6-22	1.00	26	350	271	324	945	31.5**	59.5
Federation	4734	6-28	4.00	26	275	238	235	748	24.9*	57.0
Onas 52 x Idaed^2	13635	6-24	1.33	26	360	300	231	891	29.7**	59.6
Kenya x Lemhi^6	13630	6-28	4.00	28	205	190	205	600	20.0	55.9
Onas	6221	6-28	4.00	27	260	215	175	650	21.7	56.5
Thatcher	10003	6-26	1.00	29	340	255	305	900	30.0**	58.0
Kenya x Lemhi^6	13435	6-28	4.00	30	269	260	202	731	24.4*	57.4
Idaed 590	13634	6-22	2.33	25	340	340	270	950	31.7**	60.5
Onas 53	13257	6-27	4.00	27	270	190	200	660	22.0	57.0
Burt x K.F., 58-2479	13640	6-26	1.66	29	355	310	265	930	31.0**	59.5
Kenhi	13268	6-25	4.00	26	245	235	220	700	23.3	58.0
Idaed x Burt-42-5	Pendleton	6-25	1.66	25	325	215	305	845	28.2**	60.1

Continued ——

Table XIX. (Continued)

Variety	C.I. No.	Heading Date	Stripe Rust 1 - 4	Ht. in In.	Grams Per Plot I	II	III	Total Grams	Yield Bu./ Acre	Bu. Wt. in Pounds
Lemhi	11415	6-28	4.00	27	180	200	170	550	18.3	----
Idaed	11706	6-23	2.33	28	280	270	270	820	27.3**	59.0
Eureka-Lemhi x Idaed[2]	13636	6-23	1.00	26	350	335	285	970	32.3**	59.0
Lemhi 53	13258	6-28	4.00	28	170	205	168[1]	543	18.1	----
Burt x K.F., 57-70136	13641	7- 2	1.33	34	340	355	370	1065	35.5**	60.9
Pullman 59B-3-36-107*	13638	6-26	2.66	30	285	270	250	805	26.8**	60.0
Idaed 59B	13632	6-22	1.66	22	295	305	365	965	32.2**	59.6
Pullman 59K-33-40-5-5*	13639	6-26	2.66	27	270	285	235	790	26.3**	59.6

Note: Lemhi is used as a check in this nursery
1 Calculated missing plot
* Varieties yielding significantly more than the check (5%)
** Varieties yielding significantly more than the check (1%)

Mean Yield.....	26.7
S.E.$\bar{x}$.	1.821
L.S.D. (5%).....	5.2
L.S.D. (1%).....	7.0
C.V.	6.82%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	6,035.1500	6.07**
Varieties	20	7,282.0350	7.32**
Error	39	994.2487	
Total	61		

Table XX. Heading data from dryland milling and baking plots at Creston, Montana in 1961. Drill width - seven feet wide and 250 feet long.
Date Planted: May 11, 1961
Date Harvested: September 15, 1961

Variety	C.I. No.	Heading Date
Minn II-53-404	13465	6-30
Selkirk	13100	7- 3
Centana	12974	7- 5
Thatcher	10003	7- 2
Lee	12488	6-30
Rescue	12435	7- 6
Ceres	6900	7- 4
Sawtana	13304	7- 7
1953 x Lee	13242	6-30

Winter Barley

Winter barley in western Montana has become of vital interest to farmers. Normally, winter barley will out-yield spring barley. However, there is a chance of loss due to winter killing. Data gathered by the author since 1953 has indicated that winter barley can produce a respectable crop and in another location, the crop will winter kill one hundred percent. Much work remains to be done on this crop to make it a reliable crop such as found in winter wheat.

Winter barley work in 1960-61 consisted of a Station nursery and five off-station nurseries. The off-station nurseries will be listed by counties and all discussion of each will be under the heading of each individual county.

In the Station nursery, Svalof 42-7 was the highest yielding line but not significantly higher than Olympia, which is the variety used as the check. Kearney and Dicktoo are the earliest maturing varieties and Alpine is the latest. Alpine was quite susceptible to barley scald this season. Table XXI shows agronomic data for the twelve entries in the nursery.

Off-station

Five off-station winter barley nurseries were seeded in the fall of 1960. These were all seeded on dryland soils. None of the plots received any irrigation. Discussion of each follows below.

Missoula County - This nursery was seeded in a rather dry area in Missoula County. An observation made on April 19 found stands very poor. This nursery was later abandoned because of the poor and uneven stands.

Ravalli County - This nursery was grown in the winter wheat region of Ravalli County. This nursery all winter killed during the season and no results are available.

Lake County - Yields from the nursery on the Van Vost farm were quite low and stands were light. No differences were found when analyzed statistically between varieties. Table XXII gives data from this trial.

Mineral County - Yields were fair in the nursery on the Charles Frey farm in Mineral County. Because of the error in planting and stand differences, this trial had a high coefficient of variability. It is doubtful that these data could be considered as real reliable data. Table XXIII gives the results of this test.

Lincoln County - Stands in the nursery on the Britten farm were uneven. Lodging was quite severe in all varieties. When the data were analyzed statistically, there was not any significant difference between varieties. Examination of Table XIV shows that Boz cc x 242 was the highest yielding line in the nursery.

Table XXI. Agronomic data from dryland winter barley grown at Creston, Montana in 1960-61. Four row plots, three replications.
Date Planted: September 21, 1960 Date Harvested: July 14, 1961 Size of Plot: 32 sq. ft.

Variety	C.I. No.	Heading Date	Date Ripe	Lodging %	Height in Inches	Plot Yield in Grams I	II	III	IV	Total Grams	Pounds Per Acre	Bu. Wt. in Pounds
Svalof 42-7	7187	6- 3	7-10	5	44	1295	1320	1340	1175	5130	3849	42.0
Kearney	7530	5-31	7- 3	82.5	42	875	1005	960	850	3690	2768**	47.0
Boz cc x 242	9176	6- 2	7- 9	48.8	42.5	1370	1355	1235	950	4910	3683	49.0
Boz cc x 349-9		6- 4	7- 7	38.8	44.3	1460	1335	1120	1110	5025	3770	48.5
Ellis	9529	6- 4	7- 9	77.5	43.8	1310	870	880	1180	4240	3181	48.5
Boz cc x 54-3		6- 1	7- 7	61.3	45.3	1355	950	1030	1220	4555	3417	48.3
Alpine	9578	6-13	7-14	---	45.8	1025	1035	1035	950	4045	3035	50.0
Ohio Winter	7072	6- 2	7- 7	78.8	48.3	1365	985	920	1160	4430	3323	47.1
Olympia	6107	6- 2	7- 9	5	45.5	1245	1385	1055	1100	4785	3590	49.0
Kty. 56-74	10542	5-28	7- 2	5	41.3	1300	1225	1140	1220	4885	3665	49.3
Dicktoo		5-31	7- 3	91.3	40.5	1075	655	940	800	3470	2603**	49.4
Winter Club	592	6- 3	7- 8		42.3	1045	1035	1050	950	4080	3061	45.0

Note: Olympia is used as a check in this nursery
* Varieties yielding significantly less than the check (5%)
** Varieties yielding significantly less than the check (1%)

Mean Yield..... 3351
S.E.X. 196.03
L.S.D. (5%)..... 565
L.S.D. (1%)..... 761
C.V. 5.85%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	77,615.8033	4.61**
Varieties	11	72,693.7000	4.32**
Error	33	16,843.0724	
Total	47		

Table XXII. Agronomic data from off-station winter barley nursery grown in Lake County on the Curtis Van Vost farm at Polson, Montana in 1961. Single row plots, four replications.
Date Planted: Sept. 24, 1960 Date Harvested: July 20, 1961 Size of Plot: 16 sq. ft.

Variety	C.I. No.	Lodging %	Height in Inches	Grams Per Plot I	II	III	IV	Total Grams	Lbs. Per Acre	Yield in Bu/A
Svalof	7187	5	32	55	175	180	150	560	840	17.5
Kearney	7580	10	36	125	110	115	50	400	600	12.5
Boz cc x 242	9176	5	30	125	155	120	145	545	818	17.0
Boz cc x 349-9		10	33	70	155	195	265	685	1028	21.4
Ellis	9529	15	25	80	190	125	65	460	690	14.4
Boz cc x 54-3		—	27	130	83	115	245	573	860	17.9
Alpine	9578	—	30	40	120	180	90	430	645	13.4
Ohio Winter	7072	10	25	185	189	175	235	784	1176	24.5
Olympia	6107	—	26	170	135	130	180	615	923	19.2
Kty. 56-74	10542	5	26	155	120	40	120	435	653	13.6

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	2,990.233	1.14
Varieties	9	3,779.667	1.43
Error	27	2,634.004	
Total	39		

Mean Yield..... 823. #/A
S.E.x. 154.6612
L.S.D. (5%).... NS
C.V. 18.71%

Table XXIII. Agronomic data from off-station winter barley nursery grown in Mineral County on the Charles Frey farm at Tarkio, Montana in 1961. Single row plots, three replications. Date Planted: Sept. 19, 1960 Date Harvested: August 3, 1961 Size of Plot: 16 sq. ft.

Variety	C.I. No.	Height in Inches	Plot Yield in Grams I	II	III	Total Grams	Yield Pounds /Acre	Yield in Bu/Acre	Bu. Wt. in Pounds
Svalof	7187	36	480	175	235	890	1781	37.1	42.4
Kearney	7580	41	225	175	80	480	960	20.0	
Boz cc x 242	9176	43	235	215[1]	243	693	1386	28.9	43.8
Boz cc x 349-9		44	140	206[1]	285	631	1262	26.3	
Ellis	9529	42	224	360	55	639	1278	26.6	
Boz cc x 54-3		46	305	115	312	732	1465	30.5	44.4
Alpine	9578	48	220	140	50	410	820	17.1	
Ohio Winter	7072	44	350	260	330	940	1881	39.2	43.4
Olympia	6107	39	235	355[1]	260	850	1701	35.4	45.1
Ky. 56-74	10542	39	430	284[1]	240	954	1909	39.8	44.5

[1] Calculated missing plot

Mean Yield..... 1444.0 #/A
S.E.$\bar{x}$. 301.7825
L.S.D. (5%)..... NS
C.V. 20.89%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	15;317.0335	1.50
Varieties	9	11;776.8481	1.16
Error	16	10,112.70418	
Total	27		

Table XXIV. Agronomic data from off-station winter barley nursery grown in Lincoln County on the Richard Britten farm at Eureka, Montana in 1961. Single row plots, four replications. Date Planted: Sept. 23, 1960 Date Harvested: July 28, 1961 Size of Plot: 16 sq. ft.

Variety	C.I. No.	Plot Yield in Grams I	II	III	IV	Total Grams	Yield Pounds /Acre	Yield in Bu/Acre	Bu. Wt. in Pounds
Svalof	7187	350	500	40	590	1480	2220	50.3	44.1
Kearney	7580	10	435	305	545	1295	1943	44.3	43.9
Boz cc x 242	9176	285	500	480	484[1]	1749	2624	65.7	44.5
Boz cc x 349-7		440	455	509	445	1849	2774	64.5	43.0
Ellis	9529	340	556	120	445	1461	2192	52.4	41.8
Boz cc x 54-3		305	285	600	265	1455	2183	50.8	43.0
Alpine	9578	430	341	205	403	1379	2069	44.5	46.5
Ohio Winter	7072	290	340	490	535	1655	2483	57.2	43.4
Olympia	6107	315	476	465	506	1762	2644	38.7	45.5
Ky. 56-74	10542	440	70	435	10	955	1433	21.5	44.3

[1] Calculated missing plot

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	19,285.80	—
Varieties	9	17,609.72	—
Error	26	28,575.58	
Total	38		

Mean Yield.....	2256.0	#/A
S.E.$\bar{x}$.	507.3	
L.S.D. (5%).....	NS	
L.S.D. (1%).....	NS	
C.V.	22.48%	

Spring Barley

This past season's work was reduced from the 1960 season in accordance with budget limitations. Only two nurseries were grown this season and are listed hereon with an explanation of each.

Dryland Interstate and Station Yield

This nursery was grown on the Station in field number A-1b. Twenty-five entries were included in the test.

Yields were much lower than normal for this rotation because of the low rainfall in June and July. Considerable difference was noted in plots within the test site. There are yield differences between varieties, however, these were not found to be significant by the variance analysis. The two row entries generally had a higher percentage of plump kernels than the six row entries. Table XXV gives complete data on this trial.

Table XXVI is a summary of barley varieties that were tested this past season and the performance of some since 1952. The comparative data is based on Titan which is equal to one hundred percent. The rest of the varieties are then compared with Titan. Firlbecks III, Hein Flo 225036, Lico x Ogalitsu 56-7570-19, and Piroline are some of the varieties that are considerably higher in yield than Titan.

Irrigated Interstate and Station Yield

The above named nursery was grown in field number Y-5 on the Station. Twenty-eight entries were included in this nursery.

There is a wide range of yields in this nursery and when analyzed statistically, some were found to be significant. Lodging was quite severe throughout the nursery. Firlbecks III was the only variety that was quite resistant to lodging. Ingrid was the highest yielding entry yielding 4357 pounds per acre (90.8 bushels per acre). This nursery produced a high percentage of plumps in all entries with the exception of Aberdeen Selection and Jubilee.

Table XXVIII gives the summary of some barley varieties grown in the irrigated nurseries at Creston in 1952-1961. Ingrid is 124% of Vantage in this summary. There are several varieties in this summary that are much better in yield than Vantage, however, none of them exceed Ingrid.

Table XXV. Agronomic data from dryland interstate and Station yield nursery at Creston, Montana in 1961.
Four row plots, four replications, field number A-1b.
Date Planted: April 25, 1961 Date Harvested: August 9, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. No.	Heading Date	Height in Inches	Grams Per Plot I	II	III	IV	Total Grams	Yield in lbs. /Acre	% Thins[2]	% Plumps[2]	Bu. Wt.
Glacier x Compana	10861	6-26	22.5	210	250	285	310	1055	1583	2	98	46.3
Unitan	10421	6-25	18	280	276	331	325	1212	1819	20	80	46.6
Freja	7130	6-28	17	170	335	534	245	1284	1927	16	84	50.4
Betzes	6398	6-30	18.5	175	285	255[1]	295	1010	1516	31	69	48.5
Svalof 50-109	10524	6-28	18	200	505	235	450	1390	2086	15	85	51.8
Vantage	7324	6-29	17.5	144	304	280	105	833	1250	39	61	44.6
Firlbecks III	10088	6-28	20.5	311	306	362	315	1294	1942	10	90	50.6
Compana	5438	6-24	18.5	165	335	175	440	1115	1673	20	80	45.0
Dekap	3351	6-24	17.5	320	302	395	444	1461	2192	26	74	50.2
Piroline	9558	6-26	21.5	345	610	505	270	1730	2596	6	94	51.9
Titan	7055	6-23	21	345	378	420	395	1538	2308	29	71	47.9
Betzes Erectoides	10871	7- 1	19.5	249	205	225	536	1215	1823	21	79	48.0
Haisa II	10420	6-30	24	374	530	326	312	1542	2314	15	85	51.4
Lico x Ogalitsu	56-7569-12	6-20	19.5	375	280	230	315	1200	1801	17	83	46.0
Lico x Ogalitsu	56-7570-19	6-20	22	420	580	541	315	1856	2784	9	91	41.2
Hungarian Malting	10869	6-29	21.5	392	310	460	305	1467	2201	6	94	51.5
Hein Flo 254/53	10864	6-21	20	405	245	510	281	1441	2162	6	94	51.9
Hein Flo 299/53	225036	6-21	23.5	420	535	306	334	1595	2543	3	97	53.0
Palliser	10860	6-30	23	405	220	306	390	1321	1982	9	91	47.4
Jubilee	Can. 268	6-26	20	526	305	324	495	1650	2476	21	79	48.2

Continued ----

Table XXV. (Continued)

Variety	C. I. No.	Heading Date	Height in Inches	Grams Per Plot I	II	III	IV	Total Grams	Yield Pounds /Acre	% Thins[2]	% Plumps[2]	Bu. Wt.
Glacier x Compana	Moc. 18	6-23	20.5	420	304	160	300	1184	1777	6	94	46.9
Glacier x Compana	Moc. 75	6-24	22.5	515	225	280	584	1604	2407	5	95	44.0
Glacier x Compana	Moc. 24	6-23	21.5	409	348	474	244	1475	2213	7	93	44.1
Glacier x Compana	Moc. 79	6-24	19.5	215	200	201	215	831	1247	11	89	43.4
Glacier x Compana	Moc. 76	6-23	21.5	260	286	264	175	985	1478	7	93	43.0

[1] Calculated missing plot

[2] Plumps = Kernels on top of a 6/64 x 3/4 sieve
Thins = Kernels through a 6/64 x 3/4 sieve

Mean Yield..... 1997
S.E.$\bar{x}$. 318.665
L.S.D. ..... NS
C.V. 15.96%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	1,359.000	x
Varieties	24	18,266.125	1.62
Error	71	11,275.535	
Total	98		

Table XXVI. Summary of yield of barley varieties on dryland at Creston, Montana in 1952-1961, inclusive.

Variety or Cross	C. I. No.	Percent of Titan by years										No. Yrs.	Ave. % of Titan
		1952	1953	1954	1955	1956	1957	1958	1959	1960	1961		
Yield in Titan in bu/A		58.5	58.5	69.7	84.8	69.7	17.3	---	47.8	42.0	48.1		
Betzes	6398	---	88	126	112	116	106	---	92	110	66	8	102
Betzes Erectoides	10871	---	---	---	---	---	---	---	---	123	79	2	101
Compana	5438	123	78	116	82	91	80	---	91	108	73	9	94
Dekap	3351	---	82	107	98	91	108	---	81	125	95	8	98
Firlbecks III	10088	---	---	---	---	---	---	---	101	100	84	3	95
Freja	7130	127	90	144	106	156	82	---	98	112	83	9	111
Glacier x Compana	10861	---	---	---	---	---	---	---	---	110	69	2	90
Glacier x Compana	Moc. 18	---	---	---	---	---	---	---	---	---	77	1	77
Glacier x Compana	Moc. 24	---	---	---	---	---	---	---	---	---	96	1	96
Glacier x Compana	Moc. 75	---	---	---	---	---	---	---	---	---	104	1	104
Glacier x Compana	Moc. 76	---	---	---	---	---	---	---	---	---	64	1	64
Glacier x Compana	Moc. 79	---	---	---	---	---	---	---	---	---	54	1	54
Haisa II	10420	---	---	---	---	---	---	---	106	116	100	3	107
Hein Flo 254/53	10864	---	---	---	---	---	---	---	113	95	94	3	101
Hein Flo 299/53	225036	---	---	---	---	---	---	---	135	94	110	3	113
Hungarian Malting	10869	---	---	---	---	---	---	---	---	116	95	2	106
Jubilee	Can. 268	---	---	---	---	---	---	---	---	---	107	1	107
Lico x Ogalitsu	56-7569-12	---	---	---	---	---	---	---	97	120	78	3	98
Lico x Ogalitsu	56-7570-19	---	---	---	---	---	---	---	---	102	121	2	112
Palliser	10860	---	---	---	---	---	---	---	---	---	86	1	86
Piroline	9558	---	---	---	---	---	117	---	90	112	112	4	108
Svalof 50-109	10524	---	---	---	---	---	---	---	75	111	90	3	92
Titan	7055	100	100	100	100	100	100	---	100	100	100	9	100
Unitan	10421	---	---	132	86	121	80	---	109	119	79	7	104
Vantage	7324	107	92	112	101	143	76	---	109	109	54	9	100

Table XXVII. Agronomic data from irrigated interstate and Station barley yield nursery at Creston, Montana in 1961. Four row plots, five replications, field no. Y-8. (Part I).

Date Planted: May 12, 1961 Date Harvested: Aug. 21, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. No.	Heading Date	Loose Smut	Height in Inches	Lodging Percent
Glacier x Compana	10861	7- 3	x	33	91
Unitan	10421	6-30		36	90
Freja	7130	7- 3		30	88
Betzes	6398	7- 6	x	38	72
Svalof 50-109	10524	7- 4	x	30	78
Vantage	7324	7- 3		37	95
Firlbecks III	10088	7- 5		34	6
Compana	5438	7- 2	x	34	100
Dekap	3351	7- 1		30	100
Piroline	9558	7- 5	x	30	34
Titan	7055	7- 1	x	36	90
Betzes Erectoides	10871	7- 5		38	82
Haisa II	10420	7- 6		35	34
Lico x Ogalitsu	56-7569-12	6-25		28	96
Lico x Ogalitsu	56-7570-19	6-26	x	32	62
Hungarian Malting	10869	7- 7	x	36	79
Hein Flo 254/53	10864	6-29		38	84
Hein Flo 299/53	225036	6-28	x	38	18
Palliser	10860	7- 7		40	93
Jubilee	Can. 268	7- 4		44	73
Ingrid	10083	7- 7		36	46
Aberdeen Selection	51-3425	7- 6		39	86
Gem	7243	6-28	x	38	93
N. D. B116	10647	7- 2	x	41	86
N. D. B117	10648	7- 1	x	40	100
Triall	9538	7- 2		34	89
Glacier x Manchuria	58-5724	7- 1	x	40	86
Glacier x Manchuria	58-5630	7- 1	x	40	97

Table XXVII. Agronomic data from irrigated interstate and Station barley yield nursery at Creston, Montana in 1961. Four row plots, five replications, field no. Y-8. (Part II)

Variety	C. I. No.	Grams Per Plot I	II	III	IV	V	Total Grams	Yield in Lbs./Acre	% Thins[1]	% Plumps[1]	Bu. Wt.
Glacier x Compana	10861	435	650	394	575	510	2564	3078**	5	95	48.5
Unitan	10421	745	640	624	605	600	3214	3858	15	85	48.9
Freja	7130	525	682	430	525	480	2642	3172**	21	79	48.5
Betzes	6398	560	455	490	606	564	2675	3211**	22	78	50.0
Svalof 50-109	10524	645	500	520	600	490	2755	3307**	26	74	48.5
Vantage	7324	635	630	535	545	515	2860	3433**	19	81	48.8
Firlbecks III	10088	705	720	679	755	620	3479	4176	10	90	52.9
Compana	5438	430	365	360	383	302	1840	2209**	11	89	48.3
Dekap	3351	375	600	360	485	519	2339	2808**	25	75	47.5
Piroline	9558	545	665	586	690	660	3146	3777**	11	89	51.4
Titan	7055	600	695	601	690	635	3221	3867	24	76	51.0
Betzes Erectoides	10871	710	605	610	705	424	3054	3666**	11	89	51.2
Haisa II	10420	700	660	563	802	590	3315	3979	12	88	51.9
Lico x Ogalitsu	56-7569-12	625	655	602	695	740	3317	3982	14	86	48.5
Lico x Ogalitsu	56-7570-19	685	640	790	651	640	3406	4089	6	94	49.2
Hungarian Malting	10869	565	380	449	620	533	2547	3057**	6	94	52.0
Hein Flo 254/53	10864	691	699	532	685	684	3291	3951	14	86	50.0
Hein Flo 299/53	225036	680	660	680	806	635	3461	4155	6	94	51.9
Palliser	10860	606	545	505	525	380	2561	3074**	9	91	47.5
Jubilee	Can. 268	678	505	510	589	519	2801	3362**	33	67	45.0
Ingrid	10083	650	805	705	790	680	3630	4357	11	89	51.0

Continued ——

Table XXVII . (Part II - Continued)

Variety	C. I. No.	Grams Per Plot I	II	III	IV	V	Total Grams	Yield in Lbs./Acre	% Thins[1]	% Plumps[1]	Bu. Wt.
Aberdeen Selection	51-3425	534	595	614	510	435	2688	3227**	49	51	45.5
Gem	7243	705	685	590	790	685	3455	4147	6	94	47.5
N. D. B116	10647	760	598	475	495	615	2943	3533**	15	85	48.5
N. D. B117	10648	625	540	460	668	555	2848	3419**			47.8
Triall	9538	565	681	602	720	615	3183	3821*	30	70	49.4
Glacier x Manchuria	58-5724	615	655	456	564	490	2810	3373**	16	84	47.4
Glacier x Manchuria	58-5630	640	635	440	598	500	2813	3377**	24	76	49.0

Ingrid is used as a check in this nursery

* Varieties yielding significantly less than the check (5%)
** Varieties yielding significantly less than the check (1%)

Mean Yield.....3552
S.E.x. 183.2444
L.S.D. (5%)..... 513
L.S.D. (1%)..... 682
C.V. 5.15%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	4	43,939.0000	9.43**
Varieties	27	33,475.7770	7.18**
Error	108	4,660.5833	
Total	139		

Table XXVIII. Summary of yield of barley varieties on irrigation at Creston, Montana in 1952-1961, inclusive.

Variety or Cross	C. I. No.	Percent of Vantage by years										No. Yrs.	Ave. % of Vantage
		1952	1953	1954	1955	1956	1957	1958	1959	1960	1961		
Yield of Vantage in Bu/A		91.6	96.9	97.0	74.1	74.4	70.4	81.9	90.4	55.8	71.5		
Aberdeen Selection	51-3425	---	---	---	---	---	---	---	114	102	94	3	103
Betzes	6398	---	59	---	84	90	89	88	103	117	94	8	91
Betzes Erectoides	10871	---	---	---	---	---	---	---	---	111	107	2	109
Compana	5438	83	46	63	69	74	71	73	98	117	64	10	76
Dekap	3351	---	---	---	77	95	99	88	100	106	82	7	92
Firlbecks III	10088	---	---	---	---	---	---	---	101	135	122	3	119
Freja	7130	113	71	112	113	110	116	104	101	100	92	10	103
Gem	7243	96	60	86	72	---	---	---	95	101	121	7	90
Glacier x Compana	10861	---	---	---	---	---	---	---	---	119	90	2	105
Glacier x Manchuria	58-5630	---	---	---	---	---	---	---	---	---	98	1	98
Glacier x Manchuria	58-5724	---	---	---	---	---	---	---	---	---	98	1	98
Haisa II	10420	---	---	---	---	---	---	---	105	120	116	3	114
Hein Flo 254/53	10864	---	---	---	---	---	---	---	---	124	115	2	120
Hein Flo 299/53	225036	---	---	---	---	---	---	---	---	115	121	2	118
Hungarian Malting	10869	---	---	---	---	---	---	---	---	95	89	2	92
Ingrid	10083	---	---	---	---	132	134	115	113	123	127	6	124
Jubilee	Can. 268	---	---	---	---	---	---	---	---	---	98	1	98
Lico x Ogalitsu	56-7569-12	---	---	---	---	---	---	---	---	113	116	2	115
Lico x Ogalitsu	56-7570-19	---	---	---	---	---	---	---	---	117	119	2	118
N. D. B116	10647	---	---	---	---	---	---	---	---	---	103	1	103
N. D. B117	10648	---	---	---	---	---	---	---	---	---	100	1	100
Palliser	10860	---	---	---	---	---	---	---	---	---	90	1	90
Piroline	9558	---	---	---	---	103	116	98	104	130	110	6	110
Svalof 50-109	10524	---	---	---	---	---	---	112	108	141	96	4	114
Titan	7055	89	56	76	72	71	83	84	86	81	113	10	81
Triall	9538	---	---	---	---	73	95	118	105	---	111	5	100
Unitan	10421	---	---	88	93	103	97	96	114	131	112	8	104
Vantage	7324	100	100	100	100	100	100	100	100	100	100	10	100

Oats

Only two nurseries were grown in 1961. One under irrigation and one under dryland conditions. Only a small nursery was grown under dryland conditions. There were no off-station nurseries this year.

Montana Dryland

Five entries were included in this nursery. Park was used as the check and all varieties were found to be significantly less in yield than Park. There was little difference in heading dates and in height in the five varieties. The mean yield for the nurseries was 1792 pounds per acre. Park had a yield of 2058 pounds per acre. Table XXIX gives the data on this trial.

Uniform Pacific Northwest

This nursery was grown in field number Y-8 under irrigation. There were thirty-one entries in the nursery.

Basin was the highest yielding variety in the irrigated nursery, but was not significantly higher than Park which is used as a check. In fact, there were no varieties significantly higher in yield than Park in this nursery. Table XXX shows the total data secured from this trial. The leaf lesions recorded in Table XXX were caused from a deficiency of manganese called "grey speck disease". The readings are based on the total infection found on the leaf.

The yields of thirty-one varieties are summarized in Table XXXI. An examination of this table shows the relationship of all varieties to Park and that there are a few varieties higher in yield than Park.

Table XXIX. Agronomic data from dryland oat nursery grown at Creston, Montana in 1961. Four row plots, three replications, field number A-1b.
Date Planted: April 24, 1961 Date Harvested: Aug. 9, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. No.	Heading Date	Height	Grams Per Plot I	II	III	Total Grams	Pounds /Acre	Bu. Wt.
Rodney	6661	6-23	27	290	235	290	815	1630**	37.5
Basin	5346	6-28	29	320	304	320	944	1888*	38.6
Improved Garry	6662	6-28	30	300	255	305	860	1720**	34.0
Park	6611	6-28	28	374	305	350	1029	2058	38.0
Gopher		6-26	27	278	255	295	828	1656**	35.5

Note: Park is used as a check in this nursery
* Varieties yielding significantly less than the check (5%)
** Varieties yielding significantly less than the check (1%)

$\bar{x}$.	1792
S.E.$\bar{x}$.	43.3225
L.S.D. (5%).....	142
L.S.D. (1%).....	206
C.V.	2.42%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	2,856.8	18.27**
Varieties	4	2,705.9	17.31**
Error	8	156.3	
Total	14		

Table XXX . Agronomic data from irrigated oat nursery grown at Creston, Montana in 1961. Four row plots, three replications, field number Y-8.
Date Planted: May 12, 1961 Date Harvested: August 18, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. No.	Heading Date	Height in Inches	Lodging %	Leaf Lesions	Grams Per Plot I	II	III	Total Grams	Pounds Per Acre	Bu. Wt. in Pounds
58 ab 2781	7572	7- 9	44	—	0.0	515	675	605	1795	3590	34.3
Burnett	6537	6-29	43	40	5.0	395	360	425	1180	2360*	36.6
(Roxton x R L 1276) x (Ajax x R L 1276)	5958	7- 6	42	38	0.67	580	440	660	1680	3360	37.6
R. L. 2123.50		7- 7	46	5	4.67	290	303	275	868	1736**	32.0
Clinton 59	4259	6-29	40	—	0.33	445	415	525	1385	2770	36.4
Markton	2053	7- 5	43	75	0.00	360	339	510	1209	2418*	36.2
R. L. 2123.10		7- 8	39	45	4.67	470	385	325	1180	2360*	34.3
47 ab 2635		7- 6	45	30	1.00	540	575	625	1740	3480	36.8
58 ab 2787 (irrigated)	7578	7-10	47	10	0.33	465	605	640	1710	3420	35.8
Park	6611	7- 8	42	48	0.00	475	549	560	1584	3168	35.7
C.I. 4189 x Overland	7263	7- 8	46	68	1.00	449	530	468	1447	2894	36.4
Victory	1145	7-10	47	83	5.67	160	265	425	850	1700**	38.6
Rodney	6661	7- 1	46	—	1.33	215	235	300	750	1500**	27.5
Bannock	2592	7- 8	48	98	0.00	235	335	370	940	1880**	34.9
56 ab 6538	7594	7-10	46	88	5.33	320	425	470	1215	2430*	37.5
58 ab 2782	7573	7- 9	47	—	0.00	450	635	570	1655	3310	33.0
58 ab 2784	7575	7- 9	45	—	0.00	495	535	715	1745	3490	36.2
58 ab 2773	7588	7- 9	45	20	0.00	545	535	589	1669	3338	33.5
58 ab 2777	7591	7- 9	42	20	0.00	610	615	652	1877	3754	35.9
Overland	4181	7- 6	43	75	1.67	460	570	410	1440	2880	36.5
Improved Garry	6662	7- 6	46	60	4.33	385	510	515	1410	2820	35.8

Continued ——

Table XXX . (Continued)

Variety	C. I. No.	Heading Date	Height in Inches	Lodging %	Leaf Lesions	Grams Per Plot I	II	III	Total Grams	Pounds Per Acre	Bu. Wt. in Pounds
58 ab 2779	7593	7-10	45	—	0.00	560	734	720	2014	4028	35.6
Marne	5163	7- 7	47	80	6.00	393	464	425	1282	2564	35.0
Oneida	7458	7- 8	46	30	1.00	355	539	405	1299	2598	35.7
Basin	5346	7- 8	40	25	0.00	520	710	675	1905	3810	35.9
Gopher		7- 2	43	10	0.00	202	355	302	859	1718**	32.1
Bridger		7-10	54	93	2.67	225	240	280	745	1490**	34.6
Bridger x Overland	50-100-15	7-11	47	53	0.33	320	530	344	1194	2388*	37.5
Andrew x Mission	50- 12-18	6-29	40	—	1.00	249	265	315	829	1658**	27.4
Clinton x Mission	50- 1-10	6-30	41	—	0.00	590	445	405	1440	2880	38.1
Russel		7- 5	42	3	1.67	725	445	580	1750	3500	36.5

Note: Park is used as a check in this nursery
* Varieties yielding significantly less than the check (5%)
** Varieties yielding significantly less than the check (1%)

$\bar{x}$	2752
S.E.$\bar{x}$	253.4256
L.S.D. (5%).....	717
L.S.D. (1%).....	953
C.V.	9.21%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	38,049.91500	7.11**
Varieties	30	46,747.50000	8.74**
Error	60	5,348.50283	
Total	92		

Table XXXI . Summary of yield of oat varieties on irrigated land at Creston, Montana in 1952-61, inclusive.

Variety or Cross	C. I. No.	Percent of Park by years										No. Yrs.	Ave. % of Park
		1952	1953	1954	1955	1956	1957	1958	1959	1960	1961		
Yield of Park in Bu/A		129.1	161.7	183.0	113.8	111.7	75.8	102.7	92.8	113.8	99.0		
Bannock	2592	116	100	—	—	—	135	91	117	108	59	7	104
Basin	5346	—	—	—	—	86	116	90	—	110	120	5	104
Bridger	2611	99	79	107	95	111	92	—	126	94	47	9	94
Burnett	6537	—	—	—	—	—	88	84	91	87	75	5	85
Clinton 59	4259	—	—	—	—	—	64	79	66	92	88	5	78
Gopher	2027	103	86	85	73	75	41	—	68	84	54	9	74
Improved Garry	6662	—	—	—	84	95	103	101	97	105	89	7	96
Markton	2053	—	—	—	—	—	67	76	109	94	76	5	84
Marne	5163	—	—	—	—	—	—	95	114	112	81	4	101
Mission	2588	100	92	86	73	81	69	—	88	84	—	8	84
Oneida	7458	—	—	—	—	—	—	—	—	88	82	2	85
Overland	4181	—	—	—	—	108	127	113	111	106	91	6	109
Park	6611	100	100	100	100	100	100	100	100	100	100	10	100
Rodney	6661	—	—	—	69	70	35	48	72	95	47	7	62
Russel		—	—	—	—	—	—	—	—	—	111	1	111
Victory	1145	—	—	—	—	—	107	85	117	89	54	5	90
R.L. 2129.10		—	—	—	—	—	—	—	—	—	75	1	75
R.L. 2123.50		—	—	—	—	—	—	—	—	—	55	1	55
47 ab 2685		—	—	—	—	—	—	—	—	—	110	1	110
56 ab 6538	7594	—	—	—	—	—	—	—	—	106	77	2	92
58 ab 2773	7588	—	—	—	—	—	—	—	—	116	105	2	111
58 ab 2777	7591	—	—	—	—	—	—	—	—	—	119	1	119
58 ab 2779	7593	—	—	—	—	—	—	—	—	—	127	1	127
58 ab 2781	7572	—	—	—	—	—	—	—	—	—	113	1	113
58 ab 2782	7573	—	—	—	—	—	—	—	—	103	104	2	104
58 ab 2784	7575	—	—	—	—	—	—	—	—	99	110	2	105
58 ab 2787	7578	—	—	—	—	—	—	—	—	—	108	1	108
C.I. 4189 x Overland	7263	—	—	—	—	—	—	81	115	101	91	4	97
Andrew x Mission	50-12-18	—	—	—	—	—	—	—	—	—	52	1	52
Bridger x Overland	50-100-15	—	—	—	—	—	—	—	—	115	75	2	95
Clinton x Mission	50-1-10	—	—	—	—	—	—	—	—	—	91	1	91
(Roxton x RL 1276) x (Ajax x RL 1276)	5958	—	—	—	—	—	—	—	110	95	106	3	104

Seed Production

Seven and one half bushels of foundation Westmont was produced in field number E-4. This crop was grown from line row seed obtained from line rows grown at Bozeman, Montana. It was seeded in thirty-five inch rows, sprayed with 2,4-D, and cultivated once during the growing season. The production from this plot was placed with growers in Flathead County.

Lemhi foundation was seeded in Y-6. Before seeding, however, the area (Y-6) was sprayed with a pound of Avadex per acre. The seed used was produced in 1945. Stands were very poor. If this was due to the herbicide or age of seed, the author did not determine. No grain was harvested from this seed plot.

TITLE: Forage Investigations

PROJECT NUMBER: 5022

PERSONNEL: Leader - Vern R. Stewart
Cooperators - E. R. Hehn

FUNDS: State and Commercial

LOCATION: Field Number Y-7

PROBABLE DURATION: Indefinite

EXPERIMENTAL DATA: Corn Silage Varieties

INTRODUCTION

This portion of the forage investigation project will be concerned with the annual forages. Work this past season was primarily on silage corn production. In addition, there was some seedings made of rape (Dwarf Essex) and peas for pasture and forage. Each of these crops will be discussed later in this part of the report.

MATERIALS AND METHODS

Seed for the corn variety trials and cultural studies is supplied by many different hybrid seed companies in the United States. The companies pay the Experiment Station a fee for testing their different hybrid lines of corn.

The variety nursery was grown in two row plots, twenty feet long and spaced forty-two inches between rows. It was a simple lattice design with four replications. Fourteen entries were included in the test.

Seeding was done with a belt seeder and a given number of kernels were seeded in each row to give a plant population of approximately 30,000 plants per acre. The plots were irrigated three times during the growing season. Cultivations were done when necessary. Three were made. To control Canadian Thistle, 2,4-D was applied when corn was small (6"-8").

Plots were harvested by hand. They were weighed using a spring scale and sling to hold the corn. Sixteen feet of each row was harvested or an area of 106.67 square feet. A small sample, five or six stalks, was selected, chopped, and weighed from two replications to be used in calculating yields. These were oven dried. The data are reported on a twelve percent moisture corrected basis. P.A.G. 55 is used as a check in this nursery.

RESULTS AND DISCUSSION

This is the second year for hail on the corn nurseries. Hail on September 1 did considerable damage to the corn. Leaves were riddled and much of the leaf of the plant was on the ground by harvest time. Temperatures during the months of July and August were higher than normal making for real good growing conditions for corn. Yields were not real high but quite good. The medium maturity classes seem to give the most dry weight yield. The early varieties such as Idahybrid 216 and 330 were very low in yield, but did have some degree of maturity in the grain. Using P.A.G. 55 as a check, five entries were found to be significantly higher in yield. See Table XXXII for yield of the study.

EXPERIMENTAL DATA: Corn Production Study

MATERIALS AND METHODS

The cultural study on silage corn was designed as follows. Two plant populations were used in three different seedings and row spacings. The three spacings were fourteen inch rows, seven inch rows, and forty-two inch rows or the standard method of seeding. Plant populations were 80,000 and 300,000 plants per acre. The seven inch rows were obtained by using a grain drill, also the fourteen inch in the same manner except every other hole in the drill was plugged. The forty-two inch rows were planted with a field corn planter. The plantings were thirty feet wide and went across the entire plot or about 575 feet. Planting and spacings were as follows:

7 inch rows	80,000 plants per acre
14 inch rows	80,000 plants per acre
42 inch rows	80,000 plants per acre
7 inch rows	300,000 plants per acre

Samples were cut by hand at random in three different locations in each plot. In the seven and fourteen inch rows a square yard was harvested, in the forty-two inch rows, sixteen feet of two rows was harvested for yield. The study was harvested in mid-August because of the wild oats in the study, so there was not a full season's growth on the corn at the time it was harvested.

Samples for moisture content were taken but failure to record the green weights of the samples made it impossible to record this data in a twelve percent corrected dry basis. Therefore, these data may be somewhat misleading as far as yields are concerned. The variety used in this study was P.A.G. 55.

RESULTS AND DISCUSSION

The highest yield on a green matter basis was obtained from the seven inch spacing and a seeding rate of 80,000 plants per acre. This was

somewhat higher than the 300,000 plants per acre seeding rate in the seven inch spacing. There was a definite symptom of nitrogen deficiency in the latter seeding rate. The corn was quite short and tended to yellow early in the growing season. It is felt by the author that an 80,000 plants per acre stand was not obtained in the forty-two inch rows and does in part account for the very low yield in the forty-two inch rows. Table XXXIII shows the yield data from this study. A mean of thirty-one tons per acre was obtained which is very good for this area.

EXPERIMENTAL DATA: Rape and Peas

MATERIALS AND METHODS

The need for a good annual pasture in late summer is needed for sheep on the Northwestern Montana Branch Station. To obtain this, two crops were planted on the Station in the early spring. The crops planted were Dwarf Essex rape and Canadian field peas. The crops were put in with a grain drill on a good seed bed with good moisture.

RESULTS AND DISCUSSION

The results of this study are very negative. The competition of the sow thistle in the rape was so great that the rape made little growth and in the interest of weed control, this was plowed under.

The peas were allowed to mature, cut for hay, and then left in the windrow for sheep feed. No yield data was obtained nor were any weight gains reported for the sheep.

Table XXXII. Yield data from commercial hybrid corn nursery grown for silage at Creston, Montana in 1961. Two row plots, four replications, field number Y-7.

Date Planted: May 29, 1961 Date Harvested: Sept. 7, 1961
Size of Plot: 106.667 sq. ft.

Variety	Grams Per Plot I	II	III	IV	Total Lbs. of Dry Matter	Corrected to 12% Moisture Tons/Acre
Dekalb 45	22.1	21.4	18.5	19.0	81.0	4.63
Dekalb 46	23.9	26.5	19.3	20.0	89.7	5.11
Dekalb 50	29.2	21.9	19.4	22.4	92.9	5.31
Dekalb 238	26.9	25.8	21.7	25.8	100.2	5.72*
Dekalb 415a	27.4	22.1	24.8	23.0	97.3	5.56
Dekalb B116	31.0	27.3	20.8	27.1	106.2	6.07**
Dekalb 633	31.0	25.2	22.9	29.3	108.4	6.19**
Dekalb 640	27.7	25.5	24.0	26.3	103.5	5.91**
Dekalb 886	27.7	21.2	26.8	24.1	99.8	5.70
Idahybrid 216	15.0	16.1	13.3	16.1	60.5	3.45
Idahybrid 330	26.9	24.2	24.7	21.3	97.1	5.55
PAG 55	25.1	21.4	21.4	19.4	87.3	5.00
PAG 418	28.6	27.2	22.3	24.3	102.4	5.86
PAG 434	25.5	23.4	24.3	29.5	107.7	6.16**

Note: PAG 55 is used as check in this nursery
* Varieties yielding significantly more than the check (5%)
** Varieties yielding significantly more than the check (1%)

$\bar{x}$.	5.44
S.E.$\bar{x}$. ...	.2509
L.S.D.(5%)	.71
L.S.D.(1%)	.86
C.V.	4.61%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	49.62	10.30**
Varieties	13	40.9611	8.50**
Error	39	4.817692	
Total	55		

Table XXXIII. Yield data from corn production study grown at Creston, Montana in 1961. Field number Y-7.
Date Planted: May 22, 1961
Date Harvested: August 14, 1961

Seeding Method	Population Per Acre	Plot Yield in Tons /A green weight I	II	III	Total Tons	Ave. Tons/ Acre
Seven inch rows	60,000	42.0	35.0	39.6	116.6	38.9**
Fourteen inch rows	80,000	26.6	31.5	29.0	87.1	29.0**
Forty-two inch rows	80,000	16.3	13.8	22.5	52.6	17.5
Seven inch rows	300,000	41.1	35.9	38.7	115.7	38.6**

Note: Forty-two inch rows used as a check in this nursery
** Method yielding significantly more than the check (1%)

$\bar{x}$.	31.0
S.E.$\bar{x}$.	1.9202
L.S.D.(5%)..	6.7
L.S.D.(1%)..	10.1
C.V.	6.19%

TITLE: Weed Investigations

PROJECT NUMBER: 5021

PERSONNEL: Leader - Vern R. Stewart
Consultant - L. O. Baker

FUNDS: State and Commercial

LOCATION: Station and off-station

PROBABLE DURATION: Indefinite

EXPERIMENTAL DATA:

INTRODUCTION

The use of chemicals in weed control has been the basis of all weed research at the Northwestern Montana Branch Station. The research reported in this report will include many different herbicides and several crop and weed species. A general statement on plot size, application technique, and equipment will be included under materials and methods. Under results and discussion, each specific experiment will be explained and discussed.

MATERIALS AND METHODS

Generally, all plots were five feet wide and twenty feet long or one hundred square feet. This plot size is used because of the equipment size. Sometimes the plots are in widths of five feet multiples, depending on the crop, weed, or other factors involved in the experiment being conducted.

All liquid herbicides are applied with a nursery type sprayer mounted on a garden tractor. It is a boom type sprayer and covers five feet. A constant pressure is maintained by an air compressor mounted on the tractor which forces air into a tank containing the herbicide being used. The machine is calibrated each time it is used and the speed is set to put on the desired gallonage per acre. A pressure of thirty pounds per square inch is usually used for most compounds.

When necessary to work herbicides such as Avadex into the soil, this is done with a double disk. Plots are usually designed and laid out to make this as convenient as possible.

Time of application for a specific chemical and how applied (foliar or soil) will be discussed when each individual trial is discussed later in this section of the report. A total of six studies were conducted in 1961.

RESULTS AND DISCUSSION

Control of Wild Oats, (Avena fatua), with Herbicides in Cereal Crops

This study was composed of two parts on two crops - spring wheat and spring barley. The objectives of these studies were (1) to find an effective and economical method for control of wild oats in cereal crops and (2) to determine the effect of certain herbicides on recommended varieties of barley and wheat.

The first part of this study was to measure the effect of certain compounds on the yield of Centana spring wheat and Freja spring barley. These studies were set up in a simple randomized block. The wheat and barley were seeded in an area (field number Y-6) of known wild oat population. The herbicides used and method of application were as follows:

Avadex - (2,3,-Dichloroallyl diisopropylthiol-carbamate)4# per gallon.
Avadex was applied before seeding and incooperated in the top two inches as soon as possible after application.

Carbyne - (4-Chloro-2-butynyl-N-(3-chlorophenyl)carbamate) 1 pound per gallon.
Carbyne was applied when most of the wild oats were in the two leaf stage.

Monsanto CP 23426 - This compound is similar to Avadex and was handled in the same manner in this test.

Geigy 34361 - (2-allylamino-4-chloro-6-isoproylamino-5-triazine) 50% wetable powder.
The above compound was applied after the wild oats had emerged.

Readings on a scale of 1 - 10 were made on this trial where 1 indicates no control and 10 indicates complete control. This was a visual inspection.

Table XXXIIIa shows the scores for the fifteen different treatments of herbicides on Centana spring wheat. There was no yield data obtained from this study because of a hail storm on September 1, 1961. The wild oat population was not uniform throughout this study. This, then accounts for the nine and ten readings in some check plots. It was noted by observation that 1.5 pounds of Avadex per acre decreased the stand of wheat. There was quite a severe reduction in stand where three pounds per acre of Geigy 34361 was used, also a stunting of growth was noted in this plot. This material controlled the broadleafed weeds as well as the wild oats.

In Table XXXIV are given data for the above mentioned herbicides on Freja spring barley. A fairly uniform stand of wild oats was evident in this part of the test. There is no difference in yield that would be considered significant, however, a difference in wild oat control was quite different between plots treated with herbicides and the check plots. In general, the middle rate of the herbicides gave the best control of the wild oats except Geigy 34361 where three pounds per acre gave the most wild oat control. Geigy 34361 tended to stunt the growth of barley at the three pound rate.

The second part of this study was done in cooperation with other workers in the field. Its purpose is stated in objective number two earlier in this manuscript. This was a split plot design with the treatments being the main effects and varieties the sub plots. Two chemicals were used, namely, Avadex and Carbyne. The chemical description and how applied is included earlier in the report and will not be repeated here. Each chemical was handled as a test so that in the analysis there are treatments or rates of chemicals as the main effect and varieties as the sub plot. Thus, we have a report for Avadex and a report for Carbyne and their effect on six spring wheat varieties and six varieties of spring barley which are recommended for certification in Montana. The study was all conducted under irrigated conditions.

Avadex on Wheat

The yield data of Avadex application on wheat are summarized in Table XXXVI. There were yield differences due to the rate of Avadex applications, but these were found to be nonsignificant by the variance analysis. The yields due to varieties were significant, however, these can not be considered real because of the hail storm that did considerable damage to standing wheat. Those varieties which were lodged such as Rescue and Sawtana were much higher in yield. There was a definite affect on all varieties when 1.5 pounds per acre of Avadex was used. This tended to reduce stands.

Avadex on Barley

There were not any significant differences between treatments of Avadex in this part of the study. There were highly significant differences between varieties with their performance being about what would be expected based on past history. Unitan was high in yield followed by Ingrid. No difference in sieve size was found because of treatment of Avadex. Varieties were different for sieve sizes as would be expected. Tables XXXVIII and XXXIX give yield data and sieve size data, respectively.

Carbyne on Wheat

Hail damage on this part of the test makes the results recorded in Table XLI inconclusive and do not provide any good research information. It is interesting to note that variety yields do not vary as much as they do in the Avadex report.

Carbyne on Barley

The rate of Carbyne per acre did not have any effect on the yield of barley varieties when they were treated with rates of 0.25 to 0.75 pounds per acre. Variety yields were significantly different as determined by the variance analysis. Unitan was the highest yielding variety in the study followed by Ingrid. Sieve size differences were noted between the 0 and 0.50 rates. These data were not analyzed statistically. Tables XLII, XLIII, and XLIV present the results of the Carbyne study on spring barley varieties.

Chemical Control of (Lithospernum arvense)

The objective of this test was to control wheat thief, (Lithospernum arvense), in fall seeded winter wheat. The plot size was five by twenty feet in an established stand of winter wheat. This wheat was seeded in seven inch rows.

Four chemicals were used in this study, namely, (1) 2,4-D amine, (2,4D-dichlorophenyloxy acetic acid), (2) Banvel T (2-methoxy-3,5,6-trichloro-benzoic acid), (3) Butoxone amine (4-(2,4-dichlorophenoxy) butyric acid, demethyl amine salt), and (4) Butoxone ester (4-(2,4-dichlorophenoxy butric acid) iso-octyl ester.

Applications were made when the wheat thief was growing vigorously and in the bud stage.

There was no evidence of any control with Banvel T or the Butoxone products. 2,4-D was the only herbicide that gave any degree of control. The planting plan follows and shows rates and plot layout.

WEED CONTROL PLAN
on
Established Winter Wheat
Control of Wheat Thief (Lithospernum arvense)

Chemical	Rate/Acre	Plot Numbers I	II	III
Check		1	12	21
2,4-D Amine	1.0	2	10	20
Banvel T	.5	3	13	23
Banvel T	1.0	4	15	24
Butoxone amine	.5	5	9	17
Butoxone amine	1.0	6	14	18
Butoxone ester	1.0	7	16	19
Butoxone ester	2.0	8	11	22

Control of Annual Weeds in Silage Corn

The objectives of this study were to control wild oats and broadleafed weeds in solid seedings of corn. The herbicide study was set up in conjunction with the cultural study on corn as described on page ___. The herbicide treatments were applied at right angles across the cultural treatments.

The herbicides used in the test are listed below and when and how applied.

Atrazine - 80% -(2-chloro-4-ethylamino-6-isopro-pylamino-5-triazine).
It was applied pre-emergence in a liquid form with the sprayer described on page ___.

Simazine - 80% -(2-chloro-4,6, bis-(ethylamino)-5-triazine.
This compound was applied pre-emergence in a liquid form with the sprayer described page ___.

Avadex - (2-3,-Dichloroallyl diisopropylthiol-carbamate) 4 pounds per gallon.
Avadex was incorporated into the soil before the corn was seeded.

Esteron 99 (Granules) - 2,4-Dichlorophenoxy acetic acid Propylene Glycol Butyl ether esters.
This was applied by hand in the granular form when weeds had started to emerge.

Premerge (Granules) - Alkanolamine Salts (of the Ethanol and Isopropanol series) of the Dinitro-o-sec-Butylphenol 16.5%.
This was applied by hand before emergence of crop or weeds.

The scale used for reading the results of this test was 0 - 10.

The stands of wild oats were fairly uniform in this test, however, replication one did have a lower wild oat population than found in replications two and three.

Data presented in Table XLV show that Avadex gave the greatest amount of wild oat control in the study. There was not any control of broadleaf weeds with Premerge or Esteron 99.

Control of Broadleafed Weeds in Kenland Red Clover

The objectives of this test were to control several species of broadleafed weeds in red clover and to determine the effect of some herbicides on the clover plants.

All chemicals used in this study were applied as liquids. Those used and their chemical composition are listed hereon: (1) Butoxone amine (4(2,4-dichlorophenoxy) butyric acid dimethylamine salt, (2) Butoxone ester 4(2,4-dichlorophenoxy) butyric acid, iso-octyl ester, (3) Premerge (Alkanolamine Salts (of the Ethanol and Isopropanol series) of Dinitro-o-sec-Butylphenol.

All chemicals were applied on May 1. The temperature was quite high that day being 69° F. The clover was about three inches tall and most of the broadleafed weeds very small. A heavy rain followed the application.

All rates of Butoxone amine or ester caused severe damage to the clover. Some rates of Butoxone controlled the weeds, whereas, there was no evidence of weed control with the two rates of Premerge. The height of clover on June 5 was somewhat reduced from the check plots. The clover was clipped after measuring. No further evaluations were made of this test because there was no evidence of difference between the treated and untreated plots. Table XLVI shows the data obtained from this study.

Control of Grassy and Broadleafed Weeds in Potatoes

Grassy weeds in potatoes within the row sometimes are difficult to remove. The same is also true of some of the broadleafed weeds. A study was designed to study the above problem. The objectives were to (1) determine the effect of Dalapon on potatoes and their yield and (2) measure weed control in potatoes.

Two herbicides were used in this study, namely, Dalapon-(2,2 dichloropropionic acid and Premerge, described on page ___). A compound furnished by the Dow Chemical Company called Dynawet was used with Dalapon in one series of treatments. Rows were twenty feet long, forty-two inches wide and each plot consisted of two rows. One row, sixteen feet long, was harvested for yield in each plot. Applications were made pre-emergence of the potato plant.

There are differences in yield with the Dalapon plus Premerge giving the highest yield, however, these yields were not found to be significantly different when analyzed statistically. Increasing the Dalapon rate tended to increase the number of rough potatoes in a plot. Table XLVII shows all the data obtained from this study.

Effect of Two Herbicides on Certain Legumes at Seeding Time

Seeding legumes without a companion crop has some merit in that the companion crop tends to rob moisture and nutrients for small seedlings of legumes. The objective was to determine what effect some of these compounds had on new seeding of certain legumes, namely, alfalfa, Trefoil, red clover, and Ladino clover. The chemicals used were Avadex and Butoxone. Avadex was applied to the soil and worked in with a disk and Butoxone was a post-emergence treatment

made June 16, 1961. The chemical composition of these herbicides is given earlier in this manuscript and will not be repeated here.

Avadex was applied May 4, 1961. The weather was cloudy and the soil very moist. The temperature was 50° F. The soil is quite sandy but because of the wet conditions, it packed quite severely. Legumes were seeded immediately after the Avadex application. All these operations caused the above mentioned packing of the soil. The packed soil had considerable influence on the emergence of the legumes which was quite poor for Trefoil.

No data or results are made at this time. This study is being carried to next season when, if stands warrant it, measurements and other data will be obtained. The following table shows the rates of the herbicides.

PLAN

Effect of Herbicides on Seedling of Legumes

Chemical	Rate	Plot Numbers I	II	III
Avadex	.5	1	12	14
	1.0	2	11	18
	1.5	3	7	16
Butoxone Amine	.5	4	9	17
	1.0	5	8	15
	2.0	6	10	13

Table XXXIIIa. The effect of certain chemicals on the control of wild oats in spring wheat. Four row plots, three replications, field number Y-6 at Creston, Montana in 1961. Date Planted: May 13, 1961

Chemical	Rate/Acre	I	II	III	Average
Avadex	.5	9*	9[1]	10	9.3
Avadex	1.0	9	9[1]	10	9.3
Avadex	1.5	9	10[1]	10[1]	9.7
Carbyne	.25	10	10	10	10
Carbyne	.50	10	10	10	10
Carbyne	1.00	10	9	10	9.7
Monsanto CP 23426	.5	9	7	10	8.7
Monsanto CP 23426	1.5	10	10	9	9.7
Monsanto CP 23426	2.0	9	9	9	9
Geigy - 34361	a .75	5	10	10	8.3
Geigy - 34361	b 1.5	8	10	10	9.3
Geigy - 34361	c 3.0	7	10	10	9[2]
Check	a	1	8	10	6.3
Check	b	1	5	9	5
Check	c	1	1	9	3.7

* Score 1-10 1 - no control 10 - complete control

[1] Poor stand

[2] Stunted growth

Table XXXIV. Yield data and the effect of certain herbicides on the control of wild oats (Avena fatua) in spring barley at Creston, Montana in 1961. Four row plots, three replications, field number Y-6.
Da te Planted: May 13, 1961 Date Harvested: August 21, 1961 Size of Plot: 32 sq. ft.

Chemical	Rate/Acre		I	II	III	Ave.	I	II	III	Total	Lbs. Per Acre	Yield in Bu. /Acre	Bu. Wt. in Pounds
Avadex	.5		6[1]	3	8	5.7	785	445	755	1985	1986	39.8	49.9
Avadex	1.0		7	5	7	6.3	776	650	695	2121	2122	42.5	49.9
Avadex	1.5		5	6	7	6.0	595	640	594	1829	1830	36.5	50.1
Carbyne	.25		2	1	5	2.7	529	355	450	1334	1334	26.6	49.8
Carbyne	.50		3	5	5	4.3	497	675	556	1728	1729	35.1	49.2
Carbyne	1.00		6	8	5	6.3	760	335	578	1673	1674	35.2	47.5
Monsanto CP 23426	.5		7	5	4	5.3	681	405	589	1675	1676	34.3	48.9
Monsanto CP 23426	1.5		7	5	7	6.3	695	495	658	1848	1849	36.2	51.1
Monsanto CP 23426	2.0		8	7	5	6.7	795	715	540	2050	2051	41.1	49.9
Geigy - 34361	a	.75	1	3	1	1.7	480	505	526	1511	1512	30.3	48.9
Geigy - 34361	b	1.5	1	2	6	3.0	500	505	730	1735	1736	37.0	46.9
Geigy - 34361	c	3.0	4	9	4	5.7	655	625	476	1756	1757	36.2	48.5
Check	a		1	1	1	1.0	429	451	530	1410	1411	28.2	50.0
Check	b		1	1	1	1.0	375	381	770	1526	1527	31.5	48.5
Check	c		1	1	1	1.0	450	441	545	1436	1437	32.0	44.9

[1] Scale 1 - 10 1 - no control 10 - complete control

$\bar{x}$	1708
S.E.$\bar{x}$.	202.88
L.S.D.	NS
C.V.	11.88%

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	41,954.465	3.06
Treatment	14	18,543.96214	1.36
Error	28	13,711.08571	
Total	44		

Table XXXV. Yield data from wheat varieties treated with Avadex (2,3-Dichloroallyl diisopropylthiol-carbamate), four rates, six varieties, three replications, split plot design, field number Y-8 at Creston, Montana in 1961.
Date Planted: May 23, 1961
Date Harvested: September 15, 1961
Size of Plot: 16 square feet

Rate	Variety	Plot Yield in Grams I	II	III	Total
0	Centana	275	436	435	1146
	Sawtana	256	470	370	1096
	Lee	215	423	295	933
	Ceres	156	335	446	937
	Rescue	300	510	395	1205
	Thatcher	195	400	395	990
		1397	2574	2336	6307
.75	Centana	345	244	350	939
	Sawtana	400	440	505	1345
	Lee	315	432	280	1027
	Ceres	310	335	355	1000
	Rescue	428	455	427	1310
	Thatcher	385	410	305	1100
		2183	2316	2222	6721
1.0	Centana	192	295	435	922
	Sawtana	400	345	365	1110
	Lee	290	175	265	730
	Ceres	266	245	431	942
	Rescue	341	400	390	1131
	Thatcher	240	296	330	866
		1729	1756	2216	5701
1.5	Centana	175	150	165	490
	Sawtana	480	270	460	1210
	Lee	245	145	275	665
	Ceres	226	150	195	571
	Rescue	290	330	320	940
	Thatcher	235	185	291	711
		1651	1230	1706	4587

Table XXXVI. Yield data from wheat varieties treated with Avadex (2,3-Dichloroallyl diisopropylthiol-carbamate), four rates, six varieties, three replications, split plot design at Creston, Montana in 1961. Field no. Y-8.
Date Planted: May 23, 1961 Date Harvested: Sept. 15, 1961
Size of Plot: 16 sq. ft.

	Varieties							
Rate	Cen-tana	Saw-tana	Lee	Ceres	Res-cue	That-cher	Total	Ave. Yield Bu/A
0	1146	1096	933	937	1205	990	6307	35.0
.75	939	1345	1027	1000	1310	1100	6721	37.0
1.00	922	1110	730	942	1131	866	5701	31.7
1.50	490	1210	665	571	940	711	4587	25.5
Total	3497	4761	3355	3450	4586	3667	23316	32.4 $\bar{x}$
Ave. Yield Bu/Acre	29.1	39.6	28.0	28.8	38.2	30.6		
Bu. Wt. in Lbs.	56.1	58.4	55.7	58.4	56.4	55.7		

$\bar{x}$..... 32.4
L.S.D. for varieties(5%).... 5.9
L.S.D. for varieties(1%).... 7.9

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	24,404.665	1.13
Rate	3	47,835.110	2.22
Error a	6	21,569.557	
Main Plots	11		
Variety	5	32,116.066	6.26*
R x V	15	4,357.578	
Error b	40	5,130.500	
Total	71		

Table XXXVII. Yield data from barley varieties treated with Avadex (2,3-Dichloroallyl diisopropylthiol carbamate). Four rates, six varieties, three replications, split plot design at Creston, Montana in 1961. Field number Y-8.
Date Planted: May 23, 1961 Date Harvested: August 24, 1961 Size of Plot: 16 sq. ft.

		Plot Yield in Grams				Percent Thins			Total	Percent Plumps			Total
Rate	Variety	I	II	III	Total	I	II	III	Thins	I	II	III	Plumps
0	Ingrid	700	540	890	2130	7	10	10	27	93	90	90	273
	Unitan	695	1265	860	2820	15	15	16	46	85	85	84	254
	Compana	345	431	432	1208	9	15	15	39	91	85	85	261
	Betzes	740	486	410	1636	20	40	35	95	80	60	65	205
	Freja	574	810	585	1969	15	11	20	46	85	89	80	254
	Dekap	784	625	425	1834	45	45	53	143	55	55	47	157
		3838	4157	3602	11597	111	136	149	396	489	464	451	1404
.75	Ingrid	784	784	710	2278	6	5	10	21	94	95	90	279
	Unitan	701	850	780	2331	15	17	20	52	85	83	80	248
	Compana	376	470	440	1286	25	15	26	66	75	85	74	234
	Betzes	740	592	660	1992	18	35	30	83	82	65	70	217
	Freja	594	912	745	2251	10	6	14	30	90	94	86	270
	Dekap	629	616	351	1596	40	45	65	150	60	55	35	150
		3824	4224	3686	11734	114	123	165	402	486	477	435	1398
1.0	Ingrid	750	665	846	2261	10	11	8	29	90	89	92	271
	Unitan	654	930	840	2424	19	12	15	46	81	88	85	254
	Compana	384	470	576	1430	10	6	10	26	90	94	90	274
	Betzes	665	599	415	1679	20	25	32	77	80	75	68	223
	Freja	631	840	608	2079	11	7	15	33	89	93	85	267
	Dekap	780	620	405	1805	49	45	60	154	51	55	40	146
		3864	4124	3690	11678	119	106	140	365	481	494	460	1435
1.5	Ingrid	717	690	757	2164	6	6	5	17	94	94	95	283
	Unitan	760	880	695	2335	16	14	15	45	84	86	85	255
	Compana	460	460	517	1437	11	15	10	36	89	85	90	264
	Betzes	795	509	736	2040	26	27	18	71	74	73	82	229
	Freja	655	884	842	2381	16	10	14	40	84	90	86	260
	Dekap	579	581	414	1574	48	65	64	177	52	35	36	123
		3966	4004	3961	11931	123	137	126	386	477	463	474	1414

Table XXXVIII. Yield data from barley varieties treated with Avadex (2,3-Dichloroallyl diisopropylthiol carbamate). Four rates, six varieties, three replications, split plot design, field number Y-8 at Creston, Montana in 1961
Date Planted: May 23, 1961 Date Harvested: August 24, 1961 Size of Plot: 16 sq. ft.

Rate	Varieties						Total	Average #/Acre	Ave. Yield in Bushels/Acre
	Ingrid	Unitan	Compana	Betzes	Freja	Dekap			
0	2130	2820	1208	1636	1969	1834	11,597	3867	80.5
.75	2278	2331	1286	1992	2251	1596	11;734	3913	81.5
1.00	2261	2424	1430	1679	2079	1805	11,678	3894	81.1
1.50	2164	2335	1437	2040	2381	1574	11,931	3978	82.9
Total	8833	9910	5361	7347	8680	6809	46,940		
Ave. #/A	4418	4957	2681	3675	4341	3406		$\bar{x}$ = 3913 #/A	
Yield Bu/A	92.0	103.2	55.8	76.5	90,4	70.9		$\bar{x}$ = 81.5 bu/A	
Bu. Wt.	53.8	48.9	47.7	52.1	52.4	48.0		Variety L.S.D.(5%) 695#/A or 14.5 bu/A	
								Variety L.S.D.(1%) 929#/A or 19.3 bu/A	

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	26,423.605	10.48**
Rate	3	1,124.667	
Error a	6	2,521.015	
Main Plots	11		
Varieties	5	223,772.226	11.36*
R x V	15	10,920.2593	
Error b	40	19,698.0675	
Total	71		

Table XXXIX. Sieve size data (through and on a 5/64 screen) from barley varieties treated with Avadex (2,3-Dichloroallyl diisopropylthiol carbamate).

Rate	Ingrid	Unitan	Compana	Betzes	Freja	Dekap	Total	Average
Thins in Percent								
0	27	46	39	95	46	143	396	22.0
.75	21	52	66	83	30	150	402	22.3
1.00	29	46	26	77	33	154	365	20.3
1.50	17	45	36	71	40	177	386	21.4
Total	94	189	167	326	149	624		
Average	7.8	15.7	13.9	27.2	12.4	52.0		
Plump in Percent								
0	273	254	261	205	254	157	1404	78.0
.75	279	248	234	217	270	150	1398	77.7
1.00	271	254	274	223	267	146	1435	79.9
1.50	283	255	264	229	260	123	1414	78.6
Total	1106	1011	1033	874	1051	576		
Average	92.2	84.3	86.1	72.8	87.6	48.0		

Table XL. Yield data from wheat varieties treated with carbyne (4-Chloro-2-butynyl-N-(3 Chlorophenyl)Carbamate). Four rates, six varieties, three replications, split plot design at Creston, Montana in 1961. Field number Y-8.
Date Planted: May 23, 1961
Date Harvested: September 15, 1961
Size of Plot: 16 square feet

Rate	Variety	Plot Yield in Grams I	II	III	Total
0	Centana	405	510	290	1205
	Sawtana	410	515	396	1321
	Lee	390	370	210	970
	Ceres	430	360	165	955
	Rescue	340	505	465	1310
	Thatcher	335	435	280	1050
		2310	2695	1806	6811
.25	Centana	410	411	385	1206
	Sawtana	395	408	408	1211
	Lee	386	305	274	965
	Ceres	430	380	375	1185
	Rescue	415	390	385	1190
	Thatcher	320	308	330	958
		2356	2202	2157	6715
.50	Centana	465	425	374	1264
	Sawtana	435	437	360	1232
	Lee	402	190	280	872
	Ceres	335	381	305	1021
	Rescue	420	382	450	1258
	Thatcher	345	365	376	1086
		2402	2186	2145	6733
.75	Centana	390	339	385	1114
	Sawtana	505	315	435	1255
	Lee	426	526	310	1262
	Ceres	330	530	424	1284
	Rescue	450	275	365	1090
	Thatcher	420	516	290	1226
		2521	2501	2209	7231

Table XLI. Yield data from spring wheat varieties treated with carbyne (4-Chloro-2-butynyl N-(3-Chlorophenyl) Carbamate), four rates, three replications, split plot design.

Rate	Varieties						Total	Yield in Bushels/Acre
	Centana	Sawtana	Lee	Ceres	Rescue	Thatcher		
0	1205	1321	970	955	1310	1050	6811	37.8
.25	1206	1211	965	1185	1190	958	6715	37.3
.50	1264	1232	872	1021	1258	1086	6733	37.4
.75	1114	1255	1262	1284	1090	1226	7231	40.2
Total	4789	5019	4069	4445	4848	4320	27490	38.2
Yield Bu/Acre	39.9	41.8	33.9	37.0	40.4	36.0	38.2	
Bu. Wt. in Lbs.	56.8	58.2	55.6	58.5	55.8	55.6		

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	2	22,384.015	3.23
Treatment	3	3,269.833	----
Error a	6	6,939.570	
Total Main Plots	11		
Varieties	5	10,919.256	2.41
V x T	15	4,598.722	1.02
Error b	40	4,523.9805	
Total	71		

Table XLII. Yield data from barley varieties treated with Carbyne (4-Chloro-2-butynyl-N-(3 Chlorophenyl Carbamate). Four rates, six varieties, three replications, split plot design, field number Y-8 at Creston, Montana in 1961.
Date Planted: May 23, 1961 Date Harvested: August 24, 1961 Size of Plot: 16 sq. ft.

		Plot Yield in Grams				Percent Thins				Percent Plumps			
Rate	Variety	I	II	III	Total	I	II	III	Total	I	II	III	Total
0	Ingrid	525	689	815	2029	30	11	5	46	70	89	95	254
	Unitan	760	1025	905	2690	19	9	9	37	81	91	91	263
	Compana	435	460	468	1363	20	4	7	31	80	96	93	269
	Betzes	625	675	577	1877	26	20	15	61	74	80	85	239
	Freja	550	818	695	2063	28	10	18	56	72	90	82	244
	Dekap	599	726	415	1740	65	45	60	170	35	55	40	130
		3494	4393	3875	11762	188	99	114	401	412	501	486	1399
.25	Ingrid	596	625	925	2146	26	15	7	48	74	85	93	252
	Unitan	846	955	710	2511	11	8	15	34	89	92	85	266
	Compana	505	477	480	1462	15	10	15	40	85	90	85	260
	Betzes	690	642	505	1837	35	27	26	88	65	73	74	212
	Freja	679	800	690	2169	15	8	23	46	85	92	77	254
	Dekap	570	651	510	1731	55	55	48	158	45	45	52	142
		3886	4150	3820	11856	157	123	134	414	443	477	466	1386
.50	Ingrid	560	708	822	2090	26	35	10	71	74	65	90	229
	Unitan	830	925	905	2660	15	11	7	33	85	89	93	267
	Compana	470	585	589	1644	16	10	14	40	84	90	86	260
	Betzes	684	585	640	1909	35	35	15	85	65	65	85	215
	Freja	520	860	540	1920	21	11	31	63	79	89	69	237
	Dekap	681	640	648	1969	55	44	55	154	45	56	45	146
		3745	4303	4144	12192	168	146	132	446	432	454	468	1354
.75	Ingrid	545	730	1026	2301	30	---	6	36	70	---	94	164
	Unitan	795	1050	865	2710	15	10	10	35	85	90	90	265
	Compana	469	474	425	1368	7	15	14	36	93	85	86	264
	Betzes	776	689	401	1866	20	30	25	75	80	70	75	225
	Freja	488	735	545	1768	25	9	18	52	75	91	82	248
	Dekap	595	684	484	1763	36	30	48	114	64	70	52	186
		3668	4362	3746	11776	133	94	121	348	467	406	479	1352

Table XLIII. Yield data from barley varieties treated with Carbyne (4-Chloro-2-butynyl-N-(3 Chlorophenyl Carbamate). Four rates, six varieties, three replications, split plot design, field number Y-8 at Creston, Montana in 1961.
Date Planted: May 23, 1961 Date Harvested: August 24, 1961 Size of Plot: 16 sq. ft.

Rate	Variety						Total	Average Lbs./Acre	Average Bushels/Acre
	Ingrid	Unitan	Compana	Betzes	Freja	Dekap			
0	2029	2690	1363	1877	2063	1740	11762	3922	81.7
.25	2146	2511	1462	1837	2169	1731	11856	3953	82.3
.50	2090	2660	1644	1909	1920	1969	12192	4065	84.7
.75	2301	2710	1368	1866	1768	1763	11776	3927	81.8
Total	8566	10571	5837	7489	7920	7203	47586		
Ave. #/Acre	4284	5287	2920	3746	3961	3603			
Ave. Bu/Acre	89.2	110.1	60.8	78.0	82.5	75.0			
Bu. Wt. in Lbs.	52.9	49.2	48.6	51.5	51.2	48.3			

$\bar{x}$..... 3967 #/A 82.6 bu/A
Yield L.S.D.(5%)... 585 #/A 12.2
Yield L.S.D.(1%)... 783 #/A 16.3

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	2	63,150.125	13.80**
Rate	3	2,251.313	
Error a	6	4,576.44	
Main Plots	11		
Varieties	5	208,052.166	14.86**
R x V	15	5,083.2487	
Error b	40	141,005.5278	
Total	71		

Table XLIV . Seive size data (through and on a 5/64 screen) from barley varieties treated with Carbyne (4-Chloro-2-butynyl-N-(3 Chlorophenyl Carbamate).

Rate	Varieties: Ingrid	Unitan	Compana	Betzes	Freja	Dekap	Total	Average Percent
Thins in Percent								
0	46	37	31	61	56	170	401	23.6
.25	48	34	40	88	46	158	414	17.4
.50	71	33	40	85	63	154	446	24.8
.75	36[1]	35	36	75	52	114	348	19.3[1]
Total	201	139	147	309	217	596	1609	
Ave. %	18.3[2]	11.6	12.3	25.8	18.1	49.7		$\bar{x}$ = 22.7 21.3
Plumps in Percent								
0	254	263	269	239	244	130	1399	
.25	252	266	260	212	254	142	1386	
.50	229	267	260	215	237	146	1354	
.75	164[1]	265	264	225	248	186	1352	
Total	899	1061	1053	891	983	604	5491	
Ave. %	81.7	88.4	87.7	74.2	81.9	50.3		$\bar{x}$ = 77.3

[1] 2 measurements on Ingrid only

[2] 2 measurements on Ingrid only

Table XLV . Herbicide application on silage corn for control of wild oats,
Date Planted: May 22, 1961 Date Harvested. August 14, 1961

Chemical	Rate #/A	1	2	3	Total	Average
Atrazine	1	10	7	0	17	5.67
Atrazine	2	10	3	5	18	6.00
Atrazine	3	10	2	3	15	5.00
Simazine	1	8	0	0	8	2.67
Simazine	2	10	1	0	11	3.67
Simazine	3	10	0	0	10	3.33
Avadex	.5	10	9	5	24	8.00
Avadex	1.0	10	8	6	24	8.00
Avadex	1.5	10	8	6	24	8.00
Esteron 99 (Granules)	5	7	0	0	7	2.33
Esteron 99 (Granules)	10	6	0	0	6	2.00
Premerge (Granules)	60	8	0	0	8	2.67
Premerge (Granules)	90	5	0	0	5	1.67
Check	—	5	4	0	5	1.67

0 – 10 0 – no control 10 – complete control

Table XLVI. Control of broadleafed weeds in Kenland Red Clover (Trifoluim pratense) using certain chemicals.

Chemical	Rate/A	Height		Degree of Control			Effect on Clover[1]		
				I	II	III	I	II	III
Butoxone Amine	.5	22	22	SWC	SWC	—-	D	SD	SD
Butoxone Amine	1.0	22	24	SWC	SWC	—-	SD	SL	SD
Butoxone Amine	1.5	22	20	SWC	WC	——	SD	SD	—
Butoxone Amine	2.0	23	24	SWC	SWC	WC	SD	SD	SD
Butoxone ester	.5	24	24	NWC	NWC	——	SD	SD	SD
Butoxone ester	1.0	20	21	SWC	SWC	SWC	SD	SD	SD
Butoxone ester	1.5	20	21	NWC	SWC	WC	SD	SD	SD
Butoxone ester	2.0	20	19	SWC	WC	WC	SD	SL	SD
Premerge	1 qt.	24	25	NWC	NWC	——	—	—	—
Premerge	2 qt.	24	25	NWC	NWC	——	—	—	—
Check	--	24	24	——	——	——	—	—	—

[1] Ester more severe than amine form of Butoxone

SD severe damage to clover plants
WC weed control
SWC some weed control
NWC no weed control

Table XLVII. Data from a herbicide study on potatoes conducted at Creston, Montana in 1961.
Two row plots, three replications.
Date Planted: May 26, 1961 Date Harvested: Sept. 25, 1961 Size of Plot: 53.33 sq. ft.

Chemical	Rate[1] #/Acre	Replications I	II	III	Total Pounds	Yield Cwt/A	Wt. of rough potatoes I	II	III	Total	
Dalapon	2	29	27	35	91	247.8	—	6.00	2.25	8.25	4.13
Dalapon	3	31	31	44	106	288.6	.75	1.75	1.75	4.25	1.42
Dalapon	5	41	34	32	107	291.3	7.00	4.75	9.75	21.50	7.17
Dalapon + Dynawet	2	21	38	32	91	247.8	—	2.00	10.50	12.50	6.25
Dalapon + Dynawet	3	35	32	36	103	280.4	—	16.25	10.00	26.25	13.13
Dalapon + Dynawet	5	34	32	37	103	280.4	7.75	2.25	13.00	23.00	7.63
Dalapon + Premerge	2 + 1.5 qt.	31	40	31	102	277.7	14.00	3.00	1.75	18.75	6.25
Dalapon + Premerge	3 + 1.5 qt.	43	44	41	128	348.5	9.00	4.00	7.00	20.00	6.67
Dalapon + Premerge	5 + 1.5 qt.	35	46	42	123	334.9	3.00	3.25	16.00	22.25	7.42
Check	—	34	36	37	107	291.3	3.00	2.00	1.50	6.50	2.17

[1] Acid equivalent

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	2	30.23335	1.27
Treatment	9	46.5848	1.96
Error	18	23.73537	
Total	29		

$\bar{x}$ 288.9
S.E.$\bar{x}$. 22.97
L.S.D. ..... NS
C.V. 7.95%

TITLE: Preliminary Investigations

PROJECT NUMBER: 5028

PERSONNEL: Leader - Vern R. Stewart
Cooperator - R. F. Eslick

FUNDS: State

LOCATION: Station

PROBABLE DURATION: Indefinite

EXPERIMENTAL DATA:

INTRODUCTION

The purpose of this project is to investigate and study crops that may have economic value in Northwestern Montana. Because of restricted acreage of some of the more commonly grown crops, this research became one of great importance to the economy of Northwestern Montana.

Materials studied this past season were (1) Dwarf Essex rape, (2) mustards, and (3) a new oil crop nursery.

MATERIALS AND METHODS

Materials for the crops studied under this project are supplied by the cooperators at the Main Station in Bozeman. Seeding was done with the nursery type seeder which has been described in previous annual reports. In most of these crops, weeds have been controlled by mechanical means.

Dwarf Essex Rape

Approximately one-half acre block of Dwarf Essex rape was seeded in field number F-3. Seeding was done with a vegetable planter with rows being spaced twenty-four inches. Seeding date was August 15. Most of the material seeded on the 15th of August had emerged by the 21st of August. Stands were very good throughout the plot. Because of fan weed between the rows, the block was cultivated September 30, 1960. No further work was done on this plot until harvest.

Most of the rape plants grew quite tall (6 to 8 feet). Lodging was quite severe in the entire block.

Harvesting of the plot was done with an Allis Chalmers all crop harvester. The machine was used because of the ground driven reel feature. A power reel causes considerable loss because the seed is knocked off the plant before it reaches the combine.

A total of 1160 pounds of seed was harvested from 28,480 square feet for a yield of 1774 pounds per acre.

It is felt by the author that solid seeding would give more satisfactory results than the twenty-four inch spacing for seeding. It was observed during the 1961 growing season that there was less lodging in the close seeding technique.

Mustard Nursery

Mustard nurseries were seeded this past season on dryland and irrigated lands. They were seeded in four row plots ten feet long and four replications.

The dryland nursery was plowed under after a severe dust storm destroyed a greater portion of the material. The irrigated nursery was irrigated once during the growing season. A hail storm at noon on September 1, 1961 destroyed all the plots not harvested on August 21, 1961. Because of the hail storm and the loss of the later material, no variance analysis was made. Commercial was the highest yielding line in the study. Table XLXVIII shows data obtained from this nursery.

Interstate New Crop Nursery

This nursery is grown throughout the Experiment Station system in Montana. This material is being screened for oil composition and use. Ten different entries were included in this year's study. Two inches of water were applied once during the growing season.

Only three entries were harvested. The other entries were destroyed by hail on September 1 except Amaranthus retroflexus. Camelina satura was outstanding in yield and is quite early in maturity. Table XLIX shows the names of entries, yield data, and stand measurements that were obtained.

Table XLVIII. Agronomic data from Intrastate mustard nursery grown at Creston, Montana in 1961. Four row plot, four replications.
Seeding Date: May 18, 1961 Size of Plot: 16 sq. ft.

Variety	Source	Harvest Date	Plot Yield in Grams I	II	III	IV	Total Grams	Yield in Lbs./Acre
Increase B	60-9219	8-21	145	165	210	160	680	1020
Commercial	60-8099	8-21	185	265		175	625	1250
48-6687	60-8513	8-21	190	155	200	200	745	1118
48-6729	60-8520	8-21	175	175	167	200	717	1076
49-6477-1	60-8350					110	110	660
58-8062-2	60-8786	8-21		130		185	315	945
59-7861-3	60-9256*			100			100	600
58-8063-16T	60-9233	8-21	175	125	135		435	870
	60-9220							
Commercial		8-21	124		176		300	900

Note: Remaining plots and lines destroyed by hail 9-1-61.

Table XLIX. Agronomic data from Interstate New Crop Nursery grown at Creston, Montana in 1961.
Four row plots, four replications, field number Y-8.
Date Seeded: May 18, 1961 Size of Plot: 16 sq. ft.

Variety	C. I. No.	Stand Percent	Harvest Date	Plot Yield in Grams I	II	III	IV	Total Grams	Yield in Lbs/Acre
Crambe Abyssinica	Nu24427	100	—						
Crambe orientalis	Tu41153	0	—						
Rapistrum rugosum	Tu41363	.75	—						
Isatis aucheri	Tu41180	0	—						
Camelina sativa	60-9145	95	8-21	330	285	330	225	1170	1756
Amaranthus retroflexus	60-9123	100	9-27	155	145	145	150	595	892
Brassica juncea	49-5934-2	100	—			225		225	1350
Eruca sativa	60-9350	58.75	—						
Raphanus sativa Crimson Giant	60-9114	100	—						
Alyssum dasycarpum	Tu41231	0	—						

Note: Hail on September 1, 1961 destroyed all other plots.

Part III

1961

ANNUAL RESEARCH REPORT

Soils Section

Northwestern Montana Branch Station

Kalispell, Montana

by

Donald R. Graham
Assistant in Soils

Table of Contents

List of Tables

List of Tables (Con't.)

List of Tables (Con't.)

Fertility Status of Major Soil Groups in Flathead County
According to Soil Test Information

Soil Groups

The 190 mapped soil units in the agricultural area of Flathead County have been classified into thirteen groups by Mr. Clinton W. Bourne, formerly Associate Professor of Soils, Montana State College. These groups were based primarily upon similar profile characteristics with some allowance made for intricate inclusion patterns and similar management requirements. The groups were delineated on a detailed soil survey map of scale 1:20000, ignoring inclusions up to ten acres in size. These maps are on file at the Northwestern Montana Branch Station.

Four soil groups were chosen for intensive study based upon the proportionate area they represent and the importance of the agriculture practiced on them. Group A consists of deep, well drained, black soils of the Creston, Flathead, and Yeoman series. Group B constitutes the deep, loamy, well drained, dark grayish brown soils of the following series: Kalispell, Prospect, Tally, Blanchard, and Flathead Complex. The deep, moderately well drained to imperfectly drained, gray and dark gray soils compose Group C, primarily of the Swims and Somers series. Group D soils, shallow to moderately deep, loamy, well drained, grayish and grayish brown consist of the Kiwanis and Walters series. These four soil groups comprise over 75,000 acres in Flathead County.

Soil Test Data

Fertility levels of each major soil group were determined by compiling and comparing soil test information taken from each soil group. These soil tests were made at the request of farmers desiring fertilizer recommendations. The samples were taken during the spring of 1960 and analysis was done at the Flathead County Soil Testing Laboratory under the direction of W.W. Mauritson, County Extension Agent. Approximately 1400 samples were analyzed, but only those samples were used in the study which could be defintely identified as coming from a particular major soil group.

The number of soil tests from each of the major soil groups appears in Table I.

Table I. Number of samples analyzed from each of the major soil groups

	Organic Matter	Phosphorous	Potassium	pH
Group A	55	54	48	56
Group B	98	94	85	92
Group C	68	65	49	68
Group D	33	33	28	31

Table II shows the medium level of organic matter, phosphorous, potassium, and pH for each of the soil groups. Indications are that Group C soils (deep, moderately well drained to imperfectly drained, gray and dark gray soils) may have a higher pH than at least the Group A soils (deep, well drained, black soils). Group D (shallow to moderately deep, loamy, well drained, grayish and grayish brown soils) appears to possess a lower organic matter content that the other groups.

Table II. Medium levels of organic matter, phosphorous, potassium, and pH from four soil groups

	pH	O.M. %	P_2O_5 #/a	K_2O #/a
Group A - deep, well drained, black soils	7.6	3.4	60	380
Group B - deep, well drained, dark grayish brown soils	7.8	3.2	44	333
Group C - moderately well drained to imperfectly drained gray and dark gray soils	8.1	3.3	22	310
Group D - shallow to moderately deep loamy, well drained, grayish and grayish brown soils	8.0	2.5	30	200

Phosphorous levels decreased in the following manner: Group A (deep, well drained, black soils); Group B (deep, loamy, well drained, dark grayish brown soils); Group D (shallow to moderately deep loamy, well drained, grayish and grayish brown soils); Group C (moderately well drained to imperfectly drained, gray and dark gray soils). Potassium levels decreased as follows: Group B (deep, loamy, well drained, dark grayish brown soils); Group A (deep, well drained, black soils); Group C (moderately well drained to imperfectly drained, gray and dark gray soils); Group D (shallow to moderately deep, loamy, well drained to imperfectly drained, gray and dark gray soils).

Figure I shows the percentage of the samples from each soil group which fell into various phosphorous levels. Indications are that Group C soils (moderately well drained to imperfectly drained, gray and dark gray soils) contained a large percentage of samples which were extremely low, although all soil groups possessed many samples in the very low range. Group A (deep, well drained, black soils), the most intensively farmed soils, consisted of a few samples rather high in phosphorous probably due to heavy applications of phosphate fertilizer.

As indicated by Figure 2, Group D (shallow to moderately deep, loamy, well drained, grayish and grayish brown soils) have a relatively low organic matter content with 45% of the samples below 2.5 percent. This soil group

was developed principally under forest and is probably the least productive of the groups. Significant differences do not appear to exist between the other groups.

Group D (shallow to moderately deep, loamy, well drained, grayish and grayish brown soils) were also low in potassium with fifty percent of the samples containing less than 200 pounds of available potassium per acre. Figure 3, Group B (deep, loamy, well drained dark grayish brown soils) were highest in potassium with 80% of the samples with over 400 pounds of available potassium per acre. Group A and C (deep, well drained, black soil and moderately well drained to imperfectly drained, gray and dark gray soils, respectively) generally contained from 200 to 500 pounds of available potassium per acre.

Figure 4, Group D (shallow to moderately deep, loamy, well drained, grayish and grayish brown soils) and Group C (moderately well drained to imperfectly drained, gray and dark gray soil) were of generally high pH with over 80% of the samples being over 7.5, while about 75% of Group A soils (deep, well drained, black soil) were of pH less than 8. About 70% of Group B soils (deep, loamy, well drained, dark grayish brown soils) possessed of pH between 7.5 and 8.5.

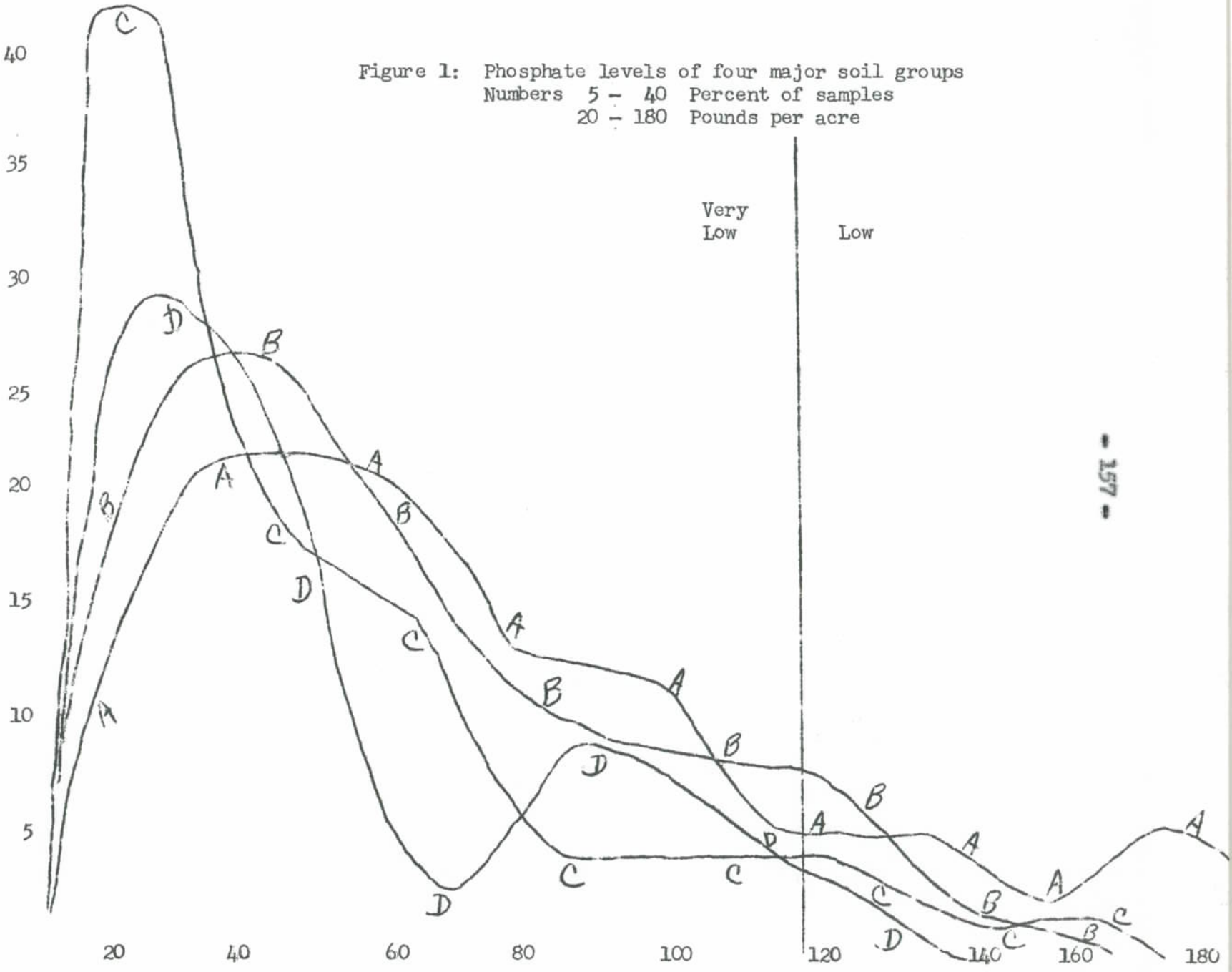


Figure 1: Phosphate levels of four major soil groups
Numbers 5 - 40 Percent of samples
20 - 180 Pounds per acre

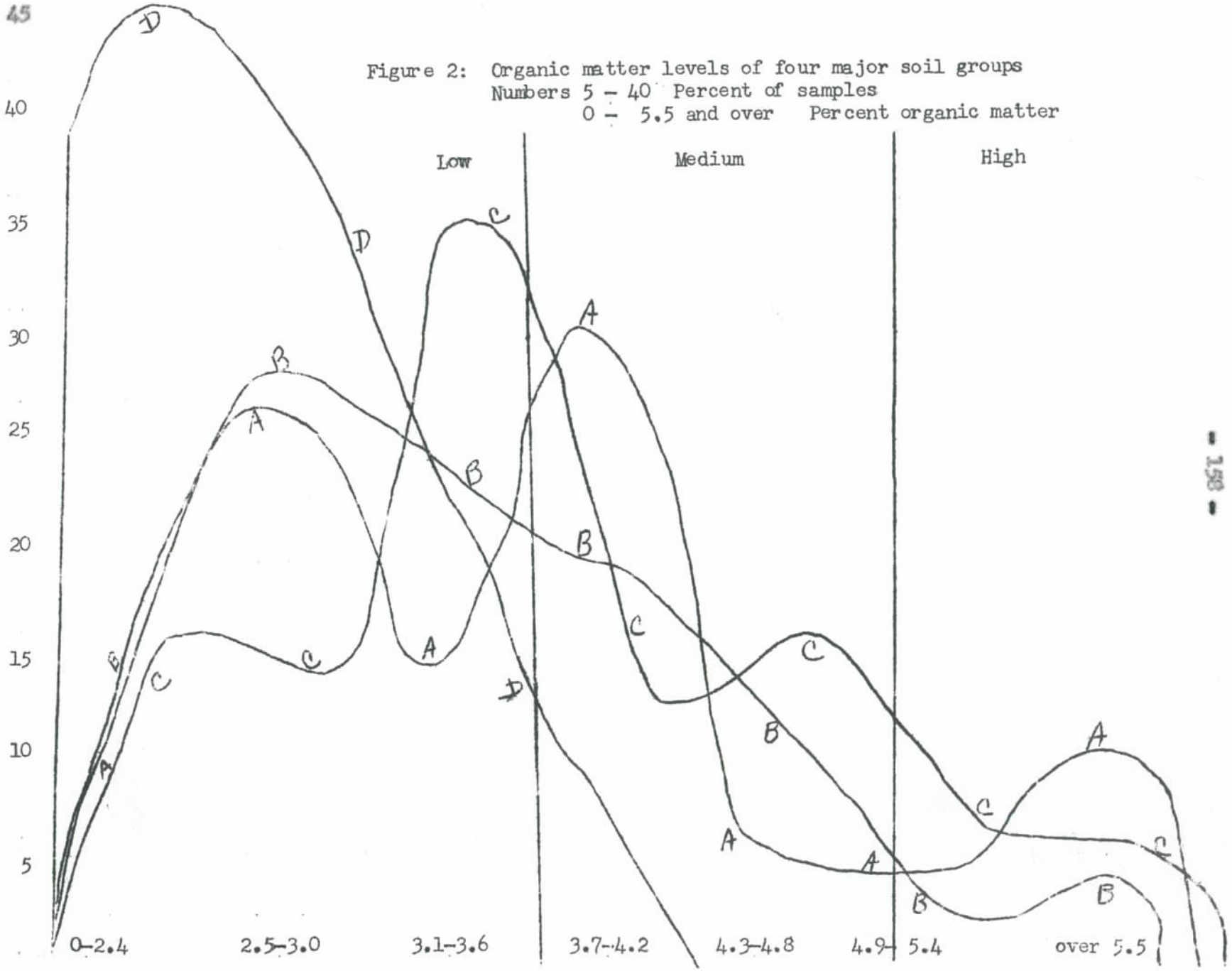


Figure 2: Organic matter levels of four major soil groups
Numbers 5 - 40 Percent of samples
0 - 5.5 and over Percent organic matter

Figure 3: Potassium levels of four major soil groups

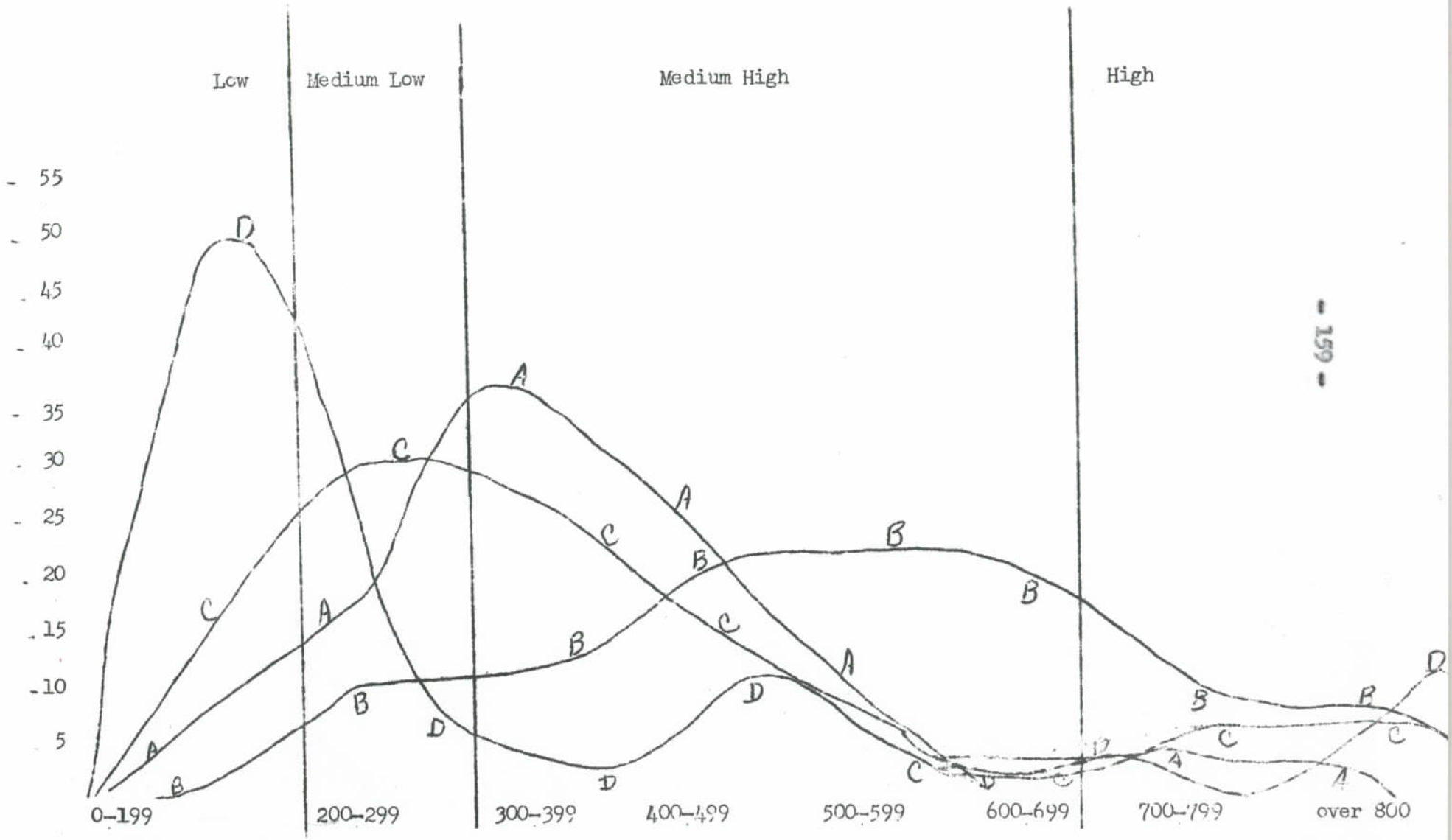
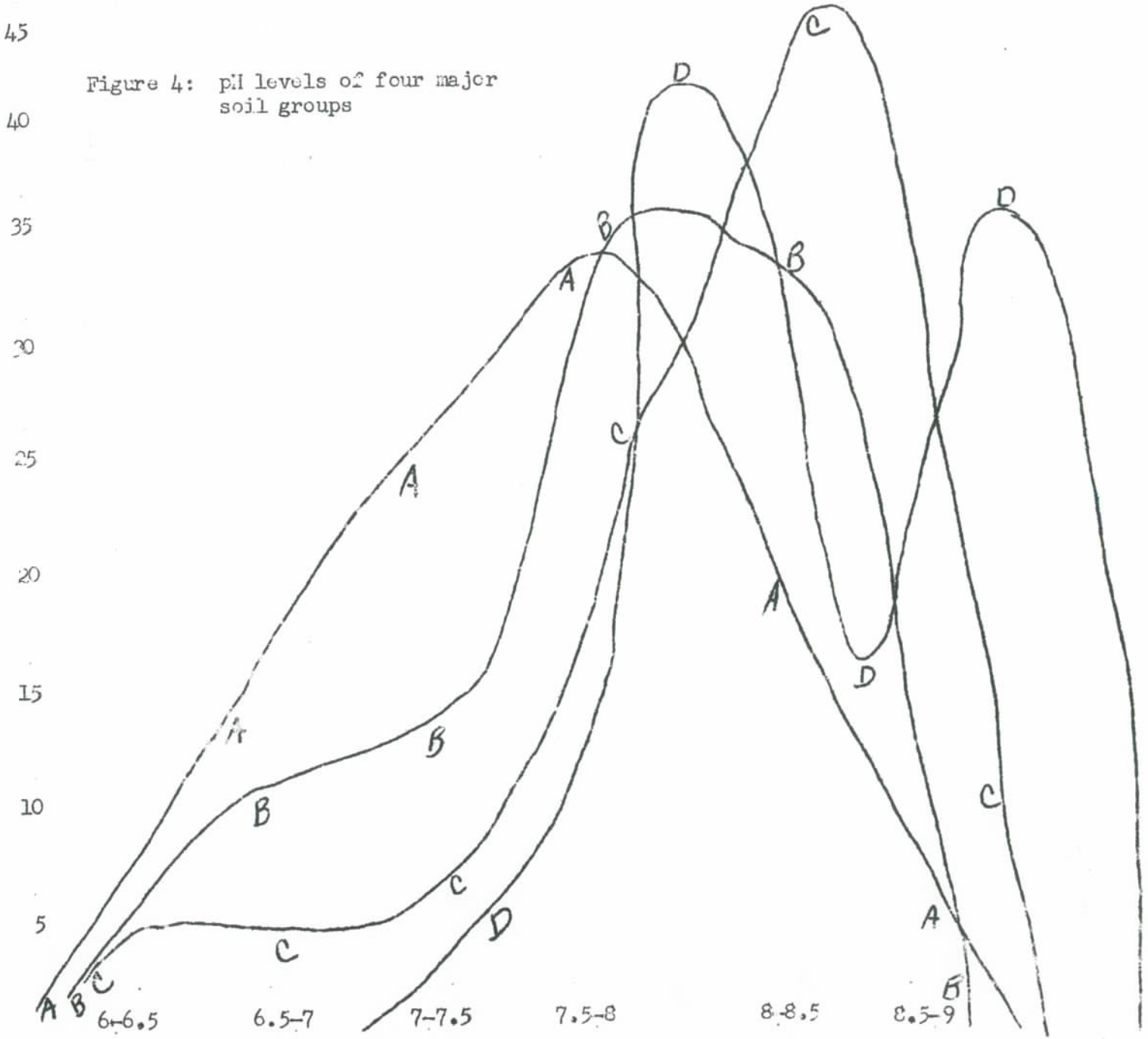


Figure 4: pH levels of four major soil groups



Summary Report of the Effect of Nitrogen and Phosphorous Fertilizers on Eight Northwestern Montana Soil Types

In an attempt to determine the relative fertility levels of the four major soils groups, field trials were conducted in 1960 on two soil types from each of the four major soil groups. These trials consisted of rates of nitrogen and phosphorous on barley.

The trial sites were located by Mr. John Cloninger, Soils Scientist, Soil Conservation Service, and were chosen principally because of their similarity to the description of the particular soil type in question. The trial sites were critically examined for uniformity of depth and consistancy of horizon.

A composite soil sample was taken from locations within each trial site prior to its establishment and analysis was determined at the Flathead County Soil Testing Laboratory.

In 1961 similar field trials were placed on Swims soils in three locations in an attempt to determine variations in fertility levels within one soil type. One trial was also placed on Flathead series.

The fertilizer rates included in these trials were 0, 15, 30, and 45 pounds of nitrogen and 0, 40, and 80 pounds of phosphorous in a factorial arrangement. Plots were designed in a randomized block with three replications. Plots consisted of four one foot rows twenty feet long.

In general most sites indicated a significant response to nitrogen with the exception of three locations, two on Swims silty clay loam in 1961. None of these soils which didn't respond to nitrogen were high in organic matter and yields varied from 19 to 49 bushels per acre. The highest yielding site was irrigated as was one other trial which produced comparable yields but responded to nitrogen.

Three soils contained over four percent organic matter and all gave a significant response and produced higher average yields than other dryland soils with lower organic matter levels.

Only one of the three trials on Swims silty clay loam in 1961 responded significantly to nitrogen. This trial also produced the highest yields. No trials in 1961 were irrigated.

Only four of the sites established during the two year period indicated a response to phosphorous. In general this occurred on soils appearing to possess not more than 41 pounds of P_2O_5 according to the soil test. Only two soils with less than 40 pounds of P_2O_5 didn't respond to phosphorous fertilization. Treatment means, however, in most cases indicated a yield increase by application of phosphorous.

With the information now available no definite differences between the fertility levels of the soils or soil groups seem to occur. Nitrogen, in general, gives a response while phosphorous responses are not nearly as certain to occur.

Table III. Effect of nitrogen and phosphorous fertilization on barley grain yields on Creston silt loam, 1960

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	11.2	17.4	29.4	21.4	
	Rep. 2	32.0	22.5	31.9	14.7	
	Rep. 3	19.8	18.8	30.3	32.4	
	Total	63.0	58.7	91.6	65.5	23.2
40	Rep. 1	12.9	27.8	27.3	22.5	
	Rep. 2	27.8	28.4	32.7	32.7	
	Rep. 3	31.3	27.6	39.4	36.8	
	Total	72.0	83.8	99.4	92.0	28.9
80	Rep. 1	11.9	17.9	23.6	24.3	
	Rep. 2	26.8	29.4	30.6	30.9	
	Rep. 3	22.8	38.0	34.4	31.0	
	Total	61.5	85.3	88.6	86.2	26.8
Nitrogen Average		21.8	25.3	31.1	27.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	621.0	310.5		
Nitrogen	3	405.1	135.0	5.29*	3.05
Phosphorous	2	179.7	89.9	3.52*	3.44
N x P	6	110.0	18.3	0.72	2.55
Error	22	561.8	25.5		
Total	35	1877.6			

$\bar{x}$ 26.3
C.V. 19.2

Table IV. Effect of nitrogen and phosphorous fertilization on barley grain yields on Flathead fine sandy loam, 1960

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	6.4	7.7	10.2	11.0	
	Rep. 2	7.0	9.0	10.1	13.9	
	Rep. 3	4.6	7.2	8.2	15.6	
	Total	18.0	23.9	28.5	40.5	9.2
40	Rep. 1	5.1	11.3	12.6	13.6	
	Rep. 2	7.4	9.6	12.2	12.8	
	Rep. 3	8.5	8.6	13.5	16.7	
	Total	21.0	29.5	38.3	43.1	11.0
80	Rep. 1	8.9	10.1	11.5	12.3	
	Rep. 2	9.8	10.0	12.1	18.8	
	Rep. 3	6.9	9.4	6.6	11.9	
	Total	25.6	29.5	30.2	43.0	10.7
Nitrogen Average		7.2	9.2	10.8	14.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	10.5	5.3		
Nitrogen	3	227.7	75.9	21.24*	3.05
Phosphorous	2	21.1	10.6	2.95	3.44
N x P	6	15.4	2.6	0.71	2.55
Error	22	78.6	3.6		
Total	35	353.3			

$\bar{x}$ 10.3
C.V. 5.8

Table V. Effect of nitrogen and phosphorous fertilization on barley grain yields on Kalispell loam, 1960

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	3.1	9.2	10.5	9.6	
	Rep. 2	2.1	8.5	14.0	12.4	
	Rep. 3	1.6	7.1	9.4	12.2	
	Total	6.8	24.8	33.9	34.2	8.3
40	Rep. 1	1.3	9.1	8.8	13.4	
	Rep. 2	2.4	8.4	12.2	11.0	
	Rep. 3	1.6	5.8	14.3	8.1	
	Total	5.3	23.3	35.3	32.5	8.0
80	Rep. 1	2.8	6.9	10.7	15.6	
	Rep. 2	1.6	6.9	10.6	5.4	
	Rep. 3	1.3	7.9	14.1	10.3	
	Total	5.7	21.7	35.4	31.3	7.8
Nitrogen Average		2.0	7.8	11.6	10.9	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	2.3	1.2		
Nitrogen	3	518.6	139.5	39.7*	3.05
Phosphorous	2	1.4	0.7	.2	3.44
N x P	6	2.7	0.5	.1	2.55
Error	22	95.9	4.4		
Total	35	620.9			

$\bar{x}$ 8.1
C.V. 26.0

Table VI. Effect of nitrogen and phosphorous fertilization on barley grain yields on Tally fine sandy loam, 1960

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0 — Bushels per acre	15	30	45	Phosphorous Average
0	Rep. 1	59.1	41.9	54.9	57.2	
	Rep. 2	31.8	47.3	45.0	61.4	
	Rep. 3	41.3	45.3	46.6	34.7	
	Total	132.2 44.0 37.84	133.5 44.5 38.27	146.5 48.8 41.96	153.3 51.1 43.95	47.1
40	Rep. 1	45.0	51.7	47.9	58.1	
	Rep. 2	40.4	45.2	60.9	61.7	
	Rep. 3	34.5	53.2	57.0	53.1	
	Total	119.9 39.9 34.31	150.1 50.0 43.00	165.8 55.2 47.47	172.9 57.4 49.36	50.7
80	Rep. 1	43.8	49.6	49.4	45.8	
	Rep. 2	38.2	40.6	43.8	36.1	
	Rep. 3	61.9	55.5	58.7	69.1	
	Total	143.9 47.9 41.19	145.7 48.5 41.71	151.9 50.6 43.51	151.0 50.3 43.26	49.4
Nitrogen Average		44.0	47.7	51.6	53.0	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	171.2	85.6		
Nitrogen	3	442.5	147.5	1.61	3.05
Phosphorous	2	75.5	37.8	0.41	3.44
N x P	6	226.4	37.7	0.41	2.55
Error	22	2017.8	91.7		
Total	35	2933.4			

$\bar{x}$ 49.1
C.V. 3.3

Table VII. Effect of nitrogen and phosphorous fertilization on barley grain yields on Swims silty clay loam, 1960

Phosphorous Lbs./ Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per Acre				
0	Rep. 1	14.4	18.5	14.8	28.7	
	Rep. 2	20.1	22.6	28.4	16.3	
	Rep. 3	15.3	17.9	19.1	27.5	
	Total	49.8	59.0	62.3	72.5	20.3
40	Rep. 1	14.4	25.9	30.0	31.3	
	Rep. 2	25.5	23.8	24.6	22.4	
	Rep. 3	17.6	20.0	23.5	23.8	
	Total	57.5	69.7	78.0	77.5	23.6
80	Rep. 1	14.7	22.2	25.3	15.9	
	Rep. 2	15.7	28.2	24.9	25.3	
	Rep. 3	16.6	22.8	17.2	16.3	
	Total	47.0	73.2	66.4	57.5	20.3
Nitrogen Average		17.1	22.4	23.0	23.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	67.7	33.9		
Nitrogen	3	219.3	73.1	3.80*	3.05
Phosphorous	2	84.4	42.2	2.19	3.44
N x P	6	88.5	13.8	0.77	2.55
Error	22	422.9	19.2		
Total	35	882.8			

$\bar{x}$ 21.4
C.V. 20.5

Table VIII. Effect of nitrogen and phosphorous fertilization on barley grain yields on Somers silty clay loam, 1960

Phosphorous Lbs./acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	19.6	11.9	15.1	27.1	
	Rep. 2	9.0	25.1	21.3	25.5	
	Rep. 3	11.9	15.4	24.9	25.9	
	Total	40.5	52.4	61.3	78.5	19.4
40	Rep. 1	32.2	19.8	28.8	28.6	
	Rep. 2	21.0	27.2	31.2	26.8	
	Rep. 3	14.4	20.1	21.6	26.2	
	Total	67.6	67.1	81.6	81.6	24.8
80	Rep. 1	25.2	31.7	36.3	34.4	
	Rep. 2	15.9	16.9	21.3	22.9	
	Rep. 3	21.6	20.9	27.8	29.1	
	Total	62.7	69.5	85.4	86.4	25.3
Nitrogen Average		19.0	21.0	25.4	27.4	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	132.0	66.0		
Nitrogen	3	402.9	134.3	4.48*	3.05
Phosphorous	2	257.0	128.5	4.29*	3.44
N x P	6	58.9	9.8	0.33	2.55
Error	22	659.8	30.0		
Total	35	1510.6			

$\bar{x}$ 23.2
C.V. 23.6

Table IX. Effect of nitrogen and phosphorous fertilization on barley grain yields on Walters silty clay loam, 1960

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	47.8	44.7	34.1	58.4	
	Rep. 2	48.1	42.2	45.6	55.0	
	Rep. 3	38.5	50.0	43.4	42.2	
	Total	134.4	136.9	123.1	155.6	45.8
40	Rep. 1	44.7	49.8	55.6	66.9	
	Rep. 2	37.8	54.4	65.1	49.9	
	Rep. 3	37.6	44.8	51.6	44.5	
	Total	120.1	149.0	172.3	161.3	50.2
80	Rep. 1	52.8	59.4	60.3	60.1	
	Rep. 2	36.8	39.6	54.1	44.1	
	Rep. 3	28.7	52.6	52.9	56.6	
	Total	118.3	151.6	167.3	160.8	49.8
Nitrogen Average		41.4	48.6	51.4	53.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	360.6	180.3		
Nitrogen	3	714.6	238.2	4.95*	3.05
Phosphorous	2	141.3	70.7	1.47	3.44
N x P	6	463.8	77.3	1.61	2.55
Error	22	1058.9	48.1		
Total	35	2739.2			

$\bar{x}$ 48.6
C.V. 14.3

Table X. Effect of nitrogen and phosphorous fertilization on barley grain yields on Swims silty clay loam on the Earl Fritz farm, 1961

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	63.7	42.4	44.3	67.6	
	Rep. 2	60.3	28.3	26.6	34.1	
	Rep. 3	49.5	39.8	39.3	59.4	
	Total	173.5	110.5	110.2	161.1	46.3
40	Rep. 1	41.9	54.9	55.1	43.0	
	Rep. 2	52.9	41.8	50.9	55.9	
	Rep. 3	34.7	46.4	36.4	43.3	
	Total	129.5	143.1	142.4	142.2	46.4
80	Rep. 1	51.8	42.7	37.8	48.4	
	Rep. 2	35.4	48.4	31.5	39.2	
	Rep. 3	28.1	41.3	48.6	60.1	
	Total	115.3	132.4	117.9	147.9	42.8
Nitrogen Average		46.5	42.9	41.2	50.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	352.9	176.5		
Nitrogen	3	42.7	14.2	0.15	3.05
Phosphorous	2	109.2	54.6	0.56	3.44
N x P	6	127.4	21.2	0.22	2.55
Error	20	1944.7	97.2		
Total	33	2576.9			

$\bar{x}$ 45.2
C.V. 21.8

Table XI. Effect of nitrogen and phosphorous fertilization on barley straw yields on Swims silty clay loam on the Earl Fritz farm, 1961

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Tons per acre				
0	Rep. 1	3.72	2.61	3.27	4.17	
	Rep. 2	3.46	2.25	2.49	2.61	
	Rep. 3	3.10	2.81	3.27	3.93	
	Total	10.28	7.67	9.03	10.71	3.14
40	Rep. 1	2.89	3.80	3.61	2.68	
	Rep. 2	3.46	3.10	3.17	3.57	
	Rep. 3	2.61	3.39	2.30	2.95	
	Total	8.96	10.29	9.08	9.20	3.13
80	Rep. 1	3.08	3.02	2.72	3.06	
	Rep. 2	2.38	3.19	2.15	3.08	
	Rep. 3	2.08	2.89	2.83	3.89	
	Total	7.54	9.10	7.70	10.03	2.86
Nitrogen Average		3.00	3.01	2.87	3.33	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	.605	.303		
Nitrogen	3	1.054	.351	1.34	3.05
Phosphorous	2	.587	.294	1.12	3.44
N x P	6	2.134	.356	1.36	2.55
Error	20	5.241	.262		
Total	33	9.621			

$\bar{x}$ 3.04
C.V..... 16.80

Table XII. Effect of nitrogen and phosphorous fertilization on barley grain yields on Swims silty clay loam soil, Gordon Grier farm, 1961

Phosphorous Lbs./acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	12.9	11.3	10.4	12.3	
	Rep. 2	15.9	17.1	22.9	20.1	
	Rep. 3	21.3	20.4	25.4	27.6	
	Total	50.1	48.8	58.7	60.0	18.1
40	Rep. 1	13.1	15.3	17.5	14.9	
	Rep. 2	14.9	17.3	17.5	16.9	
	Rep. 3	25.3	24.1	31.1	34.1	
	Total	53.3	56.7	66.1	65.9	20.2
80	Rep. 1	14.6	13.0	18.8	15.9	
	Rep. 2	14.9	13.1	20.0	18.4	
	Rep. 3	17.8	34.7	23.4	20.7	
	Total	47.3	60.8	62.2	55.0	18.8
Nitrogen Average		16.7	18.5	20.8	20.1	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	815.1	407.6		
Nitrogen	3	87.8	29.3	1.98	3.05
Phosphorous	2	26.3	13.1	0.89	3.44
N x P	6	33.4	5.6	0.38	2.55
Error	22	325.8	14.8		
Total	35	1288.4			

$\bar{x}$ 19.0
C.V. 20.3

Table XIII. Effect of nitrogen and phosphorous fertilization on barley straw yield on Swims silty clay loam soil, Gordon Grier farm, 1961

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Tons per acre				
0	Rep. 1	.81	.79	.68	.81	
	Rep. 2	1.02	1.00	1.34	1.19	
	Rep. 3	1.23	1.17	.79	1.74	
	Total	3.06	2.96	2.81	3.74	1.05
40	Rep. 1	.85	.94	1.02	1.06	
	Rep. 2	.91	.98	1.06	1.02	
	Rep. 3	1.45	1.34	1.89	2.00	
	Total	3.21	3.26	3.97	4.08	1.21
80	Rep. 1	.94	.83	1.17	1.06	
	Rep. 2	.94	.85	1.38	1.13	
	Rep. 3	1.23	2.00	1.36	1.34	
	Total	3.11	3.68	3.91	3.53	1.19
Nitrogen Average		1.04	1.10	1.19	1.26	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	1.915	.958		
Nitrogen	3	.252	.084	1.36	3.05
Phosphorous	2	.185	.093	1.49	3.44
N x P	6	.245	.041	0.66	2.55
Error	22	1.363	.062		
Total	35	3.960			

$\bar{x}$ 1.15
C.V. 21.7

Table XIV. Effect of nitrogen and phosphorous fertilization on barley grain yields in Swims silty clay loam soil, Ben Seney farm, 1961

Phosphorous Lbs./acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	50.3	82.3	82.1	73.0	
	Rep. 2	55.7	52.0	76.3	63.4	
	Rep. 3	55.7	73.4	66.1	66.5	
	Total	161.7	207.7	224.5	202.9	66.4
40	Rep. 1	61.6	61.8	80.4	65.8	
	Rep. 2	52.8	43.8	78.8	76.3	
	Rep. 3	52.3	54.7	79.4	68.9	
	Total	166.7	160.3	238.6	211.0	64.7
80	Rep. 1	73.8	75.6	73.4	84.8	
	Rep. 2	43.8	73.3	81.6	75.4	
	Rep. 3	70.4	65.1	89.3	76.4	
	Total	187.2	214.0	244.3	236.6	73.5
Nitrogen Average		57.3	64.7	78.6	72.3	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	349.7	174.9		
Nitrogen	3	2285.9	762.0	12.03*	3.05
Phosphorous	2	530.2	265.1	4.18*	3.44
N x P	6	448.7	74.8	1.18	2.55
Error	22	1393.8	63.3		
Total	35	5008.3			

$\bar{x}$ 68.2
C.V. 11.7

Table XV. Effect of Nitrogen and phosphorous fertilization on barley straw yields on Swims silty clay loam soil, Ben Seney farm, 1961

Phosphorous Lbs./Acre		Nitrogen 0	Nitrogen 15	Nitrogen 30	Nitrogen 45	Phosphorous Average
		Tons per acre				
0	Rep. 1	2.57	4.76	4.72	4.89	
	Rep. 2	3.02	2.66	4.31	3.66	
	Rep. 3	2.81	3.85	3.87	3.49	
	Total	8.40	11.27	12.90	12.04	3.72
40	Rep. 1	3.49	4.23	4.55	3.91	
	Rep. 2	2.68	2.30	3.23	4.02	
	Rep. 3	2.68	2.85	4.17	3.46	
	Total	8.85	9.38	11.95	11.39	3.46
80	Rep. 1	4.10	3.87	4.17	4.50	
	Rep. 2	2.19	3.72	4.21	4.04	
	Rep. 3	3.51	3.29	5.04	4.21	
	Total	9.80	10.88	13.42	12.75	3.90
Nitrogen Average		3.01	3.50	4.25	4.02	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	4.097	2.049		
Nitrogen	3	8.349	2.783	10.30*	3.05
Phosphorous	2	1.173	.587	2.17	3.44
N x P	6	.512	.085	0.32	2.55
Error	22	5.942	.270		
Total	35	20.073			

$\bar{x}$ 36.9
C.V. 14.1

Table XVI. Effect of nitrogen and phosphorous fertilization on barley grain yields on Flathead fine sandy loam, Experiment Station 1961

Phosphorous Lbs./Acre		Nitrogen in pounds per acre 0	15	30	45	Phosphorous Average
		Bushels per acre				
0	Rep. 1	5.8	7.2	15.0	12.6	
	Rep. 2	10.9	16.6	11.3	22.2	
	Rep. 3	1.7	11.3	19.3	11.6	
	Total	18.4	35.1	45.6	46.4	12.1
40	Rep. 1	3.5	11.8	22.6	24.8	
	Rep. 2	7.6	22.0	27.8	28.6	
	Rep. 3	2.4	16.8	15.3	22.6	
	Total	13.5	50.6	65.7	76.0	17.2
80	Rep. 1	8.2	10.3	20.2	22.6	
	Rep. 2	13.8	17.4	26.9	18.5	
	Rep. 3	3.8	9.1	27.3	25.0	
	Total	25.8	36.8	74.4	66.1	16.9
Nitrogen Average		6.4	13.6	20.6	20.9	

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	188.3	94.2		
Nitrogen	3	1277.0	425.7	30.34*	3.05
Phosphorous	2	193.0	96.5	6.88*	3.44
N x P	6	177.3	29.6	2.11	
Error	22	308.6	14.0		
Total	35	2144.2			

$\bar{x}$ 15.4
C.V. 24.3

Table XVII. Sites and soil test data of 1960 nitrogen and phosphorous fertilizer trials on barley.

Group	Type	Soil Test Data			Average Crop Yield
		Organic Matter %	P_2O_5 #/A	pH	
A	Creston silt loam	4.5*	24**	7.5	26.3
A	Flathead very fine sandy loam	2.3*	36	8.2	10.3
B	Kalispell loam	3.4*	74	7.4	8.1
B	Tally fine sandy loam	3.2	44	8.1	49.1***
C	Swims silt loam	4.1*	104	7.8	21.4
C	Somers silty clay loam	5.2*	76**	7.6	23.2
D	Kiwanis loam ****	2.7	13	8.1	----
D	Walters silt loam	3.4*	74	7.9	48.6***

Table XVIII. Sites and soil test data of 1961 nitrogen and phosphorous fertilizer trials on Swims silty clay loam soil.

Site	Location	Soil Test Data				Average Crop Yield
		Organic Matter %	P_2O_5 #/A	K_2O #/A	pH	
1	Earl Fritz farm	3.7	84	150	8.0	45.2
2	Gordon Grier farm	2.3	188	487	7.4	19.0
3	Ben Seney farm	2.3*	41**	210	7.9	68.2

* Responded significantly to nitrogen at the 5% level

** Responded significantly to phosphorous at the 5% level

*** Trials on irrigated land

**** Crop failure

Effect of Potassium Fertilization on Established Grass-Legume Hay on Flathead County Soils

In the fall of 1960 a series of simple trials were placed in various locations involving one rate of phosphorous with one or two rates of potash in unreplicated strips. The phosphorous and potash were broadcast on established grass-legume hay in the form of treble super phosphate and muriate of potash, respectively. The treatments were placed in adjacent ten foot strips, approximately 300 feet long.

All of these trials were on specific soil types but were selected because of their low potassium soil test levels. Soils included were Flathead and Yeoman of the deep, well drained, black soils; Blanchard of the deep, loamy, well drained, dark grayish brown soils, Corvallis of the imperfectly drained, gray and dark gray soils, and Kiwanis of the shallow, loamy, well drained, grayish and grayish brown soils.

These trials were established by Mr. Art Lyman, former County Extension Agent from Flathead County and members of the National Plant Foods Institute.

Harvest was accomplished by taking random one yard quadrates from each strip at the early bloom stage in two cuttings.

In general, 100 pounds of phosphorous tended to increase the yields with an average of .61 tons per acre over the no fertilizer plot. In no case did an addition of potash further increase the yield significantly. Nor was any response found from applications of potash applied alone.

On several of the trials, there appeared to be a decrease in yield on the potash applied plots in the first cutting followed by a relative increase in the second cutting. Since the trials were very simple and yielded no possibility of statistical analysis, no conclusion can be made as to the cause of the decrease in first cutting crop yields. Perhaps, sampling errors were responsible.

These trials were placed on soils which gave low potash soil test readings. Accepting the validity of the potash soil tests and the results of the simple trials, one would have to conclude that the potassium levels of Flathead County soils are presently adequate for alfalfa-grass hay and pasture.

Table XIX. Effect of phosphorous and potassium on alfalfa hay yield on Kiwanis loam, strip trials, 1961

Treatment	Tons Per Acre* Sample I	II	III	IV	Average
100# P_2O_5	2.84	2.19	2.79	2.57	2.60
100# P_2O_5 + 90# K_2O	2.57	3.09	2.34	3.10	2.78
100# P_2O_5 + 135# K_2O	2.98	2.72	2.49	2.64	2.71
Check (no fertilizer)	1.89	2.41	2.34	2.11	2.19

* Yield from two cuttings

Table XX. Effect of phosphorous and potassium on hay yield on Flathead fine sandy loam, 1961

Treatment	3 year old alfalfa Tons Per Acre* Sample I	II	III	Average
100# P_2O_5	3.20	3.02	2.53	2.92
100# P_2O_5 + 135# K_2O	3.28	2.64	2.19	2.70
Check (no fertilizer)	3.14	2.19	2.14	2.49

Treatment	5 year old alfalfa-brome grass mixture Tons per Acre* Sample I	II	III	Average
100# P_2O_5	2.57	2.76	2.64	2.66
100# P_2O_5 + 135# K_2O	2.19	2.15	2.19	2.18
Check (no fertilizer)	1.28	1.36	2.34	1.66

* Yield from two cuttings

Table XXI. Effect of phosphorous and potassium on hay yields on two soils

	Yeoman silt loam 3 year old alfalfa Tons Per Acre* Sample			
Treatment	I	II	III	Average
66# K_2O	3.82	3.16	3.07	3.35
33# K_2O	4.12	3.54	4.52	4.05
Check	4.37	3.84	3.28	3.83

	Corvallis silty clay loam 18 year old alfalfa Tons Per Acre** Sample			
Treatment	I	II	III	Average
135# K_2O	1.28	1.74	2.11	1.71
90# K_2O	1.43	1.74	2.61	1.93
Check	1.43	1.59	2.94	1.99

* Yield from two cuttings

** Yield from one cutting

Effect of Potassium and Boron Fertilization on Potato Yield in Northwestern Montana

Five trials were established on soils of differing potash levels using potatoes as the crop. Treatments included two sources of potassium each at rates of 0, 25, 50, 75, and 100 pounds of K_2O per acre. Three boron treatments were incorporated into the trial, 4 pounds of boron alone and the same rates in combination with 50 pounds of K_2O from each potassium source.

The fertilizer material was banded approximately two inches below and to either side of the seed pieces immediately after planting. Fertilization with nitrogen and phosphorous was left up to the discretion of the individual farmer and was done prior to or during the seeding operation.

The plots consisted of two forty-inch rows, twenty feet long of which ten feet of each row were harvested after the first severe frost. Plots were arranged in a randomized block design and replicated three times.

Statistically, only the trial on Flathead fine sandy loam on Walt Mangle's in Lake County gave a significant response to any treatment compared to the no fertilizer treatment. Generally, the yield appeared to increase with each additional increment of potash to 100 pounds of K_2O per acre. Indications are that even higher rates may have given additional response. The potash soil test on this trial indicated it to be lowest of any of the trial sites.

Comparison of potash sources seems to show that the muriate of potash produced at least as much response as potassium sulfate if not more. This would indicate that the sulfur present in the potassium sulfate had no influence on the yield.

No other trial showed a significant response to any potash or boron treatment. These soils varied in potash soil test levels with one almost as low as the Walt Mangle site.

Quality data was taken on each treatment by compositing the replications. The Walt Mangle site produced potatoes which were up to 70% hollow in certain treatments. This data is quite erratic and since it cannot be handled statistically it will not be considered.

In general, certain soils of very low potash levels may respond to potassium but with an undetermined effect on quality. However, most of the potato land appears to possess adequate potassium levels.

Further studies are needed as to the effect of potassium on quality and yield of these very low potassium soils before any reliable recommendations can be made.

Table XXII. Effect of potassium and boron fertilization on potato yields on Flathead fine sandy loam, Abe Dubay Farm in Lake County, 1961

	Treatments											
# Boron	0	0	0	0	0	0	0	0	0	4	4	4
# K_2O*	0	25	50	75	100	0	0	0	0	0	0	50
# K_2O**	0	0	0	0	0	25	50	75	100	0	50	0
	Cwt. per acre											
Rep. I	242.0	255.1	242.0	215.8	202.7	300.8	235.4	189.7	235.4	183.1	222.4	202.7
Rep. II	183.1	202.7	235.4	307.4	274.7	176.6	307.3	255.1	228.9	235.4	235.4	235.4
Rep. III	294.3	261.6	346.6	287.8	340.1	235.4	327.0	359.7	274.7	294.3	228.9	242.0
Average	239.8	239.8	274.7	270.3	272.5	237.6	289.9	268.2	246.3	237.6	228.9	226.7

* Lbs. K_2O as muriate of potash

** Lbs. K_2O as potassium sulfate

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	27372.8	13686.4		
Treatments	11	14627.3	1329.8	0.76	2.26
Error	22	38236.4	1738.0		
Total	35	80236.5			

$\bar{x}$..... 252.7
C.V. 16.5

Table XXIII. Effect of potassium and boron fertilization on potato yields on Flathead fine sandy loam, Walt Mangle farm in Lake County, 1961

	Treatments											
# Boron	0	0	0	0	0	0	0	0	0	4	4	4
# K_2O*	0	25	50	75	100	0	0	0	0	0	0	50
# K_2O**	0	0	0	0	0	25	50	75	100	0	50	0
	Cwt. per Acre											
Rep. 1	222.4	228.9	248.5	222.4	281.2	222.4	248.5	222.4	261.6	215.8	261.6	235.4
Rep. 2	223.9	242.0	255.1	287.8	261.6	228.9	255.1	255.1	287.8	215.8	228.9	255.1
Rep. 3	215.8	215.8	268.1	215.8	274.7	228.9	215.8	248.5	235.4	202.7	209.3	268.1
Average	222.4	228.9	257.2	242.0	272.5	226.7	239.8	242.0	261.6	211.4	233.3	252.9

* Lbs. K_2O as muriate of potash
** Lbs. K_2O as potassium sulfate

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	1753.5	876.8		
Treatments	11	10350.3	940.9	2.88*	2.26
Error	22	7185.4	326.6		
Total	35	19289.2			

$\bar{X}$ 240.9
C.V. 7.47

Table XXIV. Effect of potassium and boron fertilization on potato yields on Kalispell loam Bauer farm, 1961

	Treatments											
#Boron	0	0	0	0	0	0	0	0	0	4	4	4
# K_2O*	0	25	50	75	100	0	0	0	0	0	0	50
# K_2O**	0	0	0	0	0	25	50	75	100	0	50	0
	Cwt. por acre											
Rep. 1	255.1	261.6	255.1	255.1	261.6	242.0	274.7	255.1	268.1	248.5	228.9	248.5
Rep. 2	294.3	261.6	255.1	235.4	248.5	274.7	274.7	248.5	255.1	228.9	242.0	248.5
Rep. 3	255.1	235.4	255.1	242.0	242.0	242.0	261.6	222.4	242.0	268.1	228.9	235.4
Average	278.2	252.9	255.1	210.8	250.7	252.9	270.3	242.0	255.1	248.5	233.3	244.1

* Lbs. K_2O as muriate of potash
** Lbs. K_2O as potassium sulfate

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	983.7	491.9		
Treatments	11	3592.7	326.7	1.93	2.26
Error	22	3721.0	169.1		
Total	35	8297.4			

$\bar{x}$ 249.5
C.V. 5.2

Table XXV. Effect of potassium and boron fertilization on potato yields on Creston silt loam, Experiment Station, 1961

	Treatments											
# Boron	0	0	0	0	0	0	0	0	0	4	4	4
# K_2O*	0	25	50	75	100	0	0	0	0	0	0	50
# K_2O**	0	0	0	0	0	25	50	75	100	0	50	0
	Cwt. per acre											
Rep. 1	372.8	300.8	398.9	327.0	307.4	327.0	291.0	320.5	291.0	300.8	333.5	320.5
Rep. 2	294.3	281.2	268.1	323.7	313.9	307.4	294.3	343.4	300.8	300.8	287.8	369.5
Rep. 3	317.2	402.2	274.7	359.7	300.8	271.4	333.5	313.9	340.1	313.9	278.0	300.8
Average	328.1	328.1	313.9	336.8	307.4	301.9	306.3	325.9	310.6	305.2	299.8	330.3

* Lbs. K_2O as muriate of potash

** Lbs. K_2O as potassium sulfate

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	108079.8	54039.9		
Treatments	11	54232.4	4930.2	0.50	2.26
Error	22	215347.0	9788.5		
Total	35	377659.2			

$\bar{x}$ 316.2

C.V. 31.3

Table XXVI. Effect of potassium and boron fertilization on potato yields on Flathead fine sandy loam, K. B. Johnson farm, 1961

	Treatments											
# Boron	0	0	0	0	0	0	0	0	0	4	4	4
# K_2O*	0	25	50	75	100	0	0	0	0	0	0	50
# K_2O**	0	0	0	0	0	25	50	75	100	0	50	0
	Cwt. per acre											
Rep. 1	228.9	215.8	209.3	196.2	196.2	215.8	209.3	196.2	183.1	242.0	163.5	222.4
Rep. 2	176.6	202.7	202.7	215.8	196.2	183.1	176.6	235.4	215.8	235.4	196.2	202.7
Rep. 3	202.7	189.7	196.2	202.7	235.4	189.7	202.7	150.4	189.7	209.3	189.7	196.2
Average	202.7	202.7	202.7	204.9	209.3	196.2	196.2	194.0	196.2	228.9	183.1	207.1

* Lbs. K_2O as muriate of potash
** Lbs. K_2O as potassium sulfate

Analysis of Variance

Source	df	SS	MS	F	F 5%
Replications	2	684.3	342.2		
Treatments	11	4020.4	365.5	0.86	2.26
Error	22	9323.9	450.5		
Total	35	14028.6			

$\bar{x}$ 202.0

C.V. 10.5

Table XXVII. Effect of potassium and boron on potato quality

Treatments			Percent rough tubers					
K_2O #/A	Form	Boron #/A	Flathead* Dubay	Mangle	Johnson	Creston* Station	Kalispell* Bauer	Ave.
0			15.1	10.4	8.1	10.6	7.8	10.4
25	cl**		10.4	11.0	7.1	21.5	14.7	12.9
50	cl		13.9	17.8	11.9	15.1	20.5	15.8
75	cl		22.6	12.2	4.2	16.5	13.9	13.9
100	cl		18.8	11.4	4.4	18.5	14.9	13.6
Average			16.4	13.1	6.9	17.9	16.0	14.1
25	S***		15.2	11.6	6.3	15.7	9.8	11.7
50	S		24.4	17.1	7.7	22.4	7.7	15.9
75	S		18.8	8.9	6.1	16.5	28.3	15.7
100	S		12.6	10.6	6.7	12.0	6.9	9.8
Average			17.8	12.1	6.7	16.7	13.2	13.3
		4	25.8	18.6	10.9	22.9	12.4	18.1
50	S	4	22.4	14.7	17.1	17.9	18.8	18.2
50	cl	4	22.6	18.8	18.2	19.4	7.2	17.2
Average			23.6	17.4	15.4	20.1	12.8	17.7

* Soil Series

** Muriate of potash

*** Potassium sulfate

Table XXVIII. Effect of potassium and boron on potato tuber size

Treatments			Ounces per tuber					
			Flathead			Creston	Kalispell	
K_2O #/A	Form	Boron #/A	Dubay	Mangle	Johnson	Station	Bauer	Ave.
0			4.4	5.2	6.7	9.5	7.7	6.7
25	cl		4.2	4.1	7.0	8.8	7.8	6.4
50	cl		4.5	5.1	6.8	9.0	8.0	6.7
75	cl		4.5	4.5	6.5	8.4	7.2	5.3
100	cl		4.7	5.4	6.4	9.3	7.4	6.6
25	S		4.2	5.1	6.6	8.9	7.5	6.5
50	S		4.6	5.1	7.2	8.9	7.5	6.6
75	S		4.6	5.3	6.5	9.4	8.3	6.8
100	S		4.5	5.5	6.9	9.3	7.8	6.8
		4	4.4	5.7	7.2	10.0	8.0	7.1
50	S	4	4.3	6.2	7.6	9.6	7.9	7.1
50	cl	4	4.5	6.6	8.0	9.2	7.4	7.1