FIFTEENTH ANNUAL REPORT

1963

NORTHWESTERN MONTANA BRANCH

MONTANA AGRICULTURAL EXPERIMENT STATION

Route Four

Kalispell, Montana

This report deals briefly with fiscal matters and activities and reports in detail the research work done by C. W. Roath, Superintendent with fertilizers, forages, potatoes, and farm flock investigation and by Vern R. Stewart, Associate Agronomist with fertilizers, cereals, oil seed and miscellaneous crops, and weed control.

Research work is also reported by projects in appropriate Research Committee 1963 annual reports.

PART I

Annual Research Report

Northwestern Montana Branch

of the

Montana Agricultural Experiment Station

Kalispell, Montana

by

C. W. Roath

Superintendent

TABLE OF CONTENTS

PART I OF FIFTEENTH ANNUAL REPORT

FISCAL PROJECTS

ADMINISTRATION 1062

Staff:

C. W. Roath, Superintendent since 1948.

Vern R. Stewart, Associate Agronomist. Started at Northwestern Montana Branch Station in 1952.

Help:

Paul Boss, our one full time employee, has been with us since 1955. Audrey Holman relinquished responsibility for clerical work to Jeanette Calbick in September. Ray Vollin, agronomy student at M.S.C. helped during the summer and intends to return in 1964. Tom Mahugh, student at Flathead High School also helped during a portion of the summer of 1963 and plans to return.

Much of the duplication of reports, monthly letters, etc. formerly done for us by the County Agent's office in Kalispell, is now done in our own office.

Two steel desks and chairs and an electric typewriter were purchased.

Crops work at the Western Branch Station in 1963 was largely planned, planted and harvested by Northwestern Staff, men, and equipment, in much the same manner as other off-station work is done. This arrangement is expected to continue in 1964.

The 1963-1964 administrative budget was for $5596.00.

PHYSICAL PLANT 1063

Insurance funds provided the Northwestern Branch Station with a new domestic well and two new all steel buildings in 1963 at a cost of $12,146.81. This constitutes the largest station improvement package since operations were started in 1949.

The well, drilled to a depth of 164 feet, cased with 7" O.D. steel casing, determined by baling to have a capacity of 30 gallon per minute at a pumping level of 30 feet, has been recorded in accordance with Montana Session Laws of 1961.

Building 10, an all steel straight sidewall, 48' x 48', Forage and Livestock facility, has light and power, overhead doors, and concrete floor in the area designed for baled hay storage. Water has been piped in as well.

Building 11, an all steel straight sidewall, 24' x 72', Garage and machine storage building, is also equipped with overhead doors, light and power and concrete floors throughout.

A new automatic jet pump was enstalled, new main line pipe carries the water to the several buildings, including the new livestock building. Electric service was provided the new buildings by means of burried cable.

The budget for 1963-1964 for this project was $3530.00.

GENERAL FARM 1064

New equipment purchased includes a Clipper seed mill and a Jerri plot harvester. A fertilizer attachment for the Cub planter was built for plot work, and a new stainless steel tank plot sprayer built.

Control of the wind erosion problem on the dryland lease was obtained to a gratifying degree by narrowing the strips and seeding alfalfa in 1962. In 1963 we report success.

For the first time since station establishment no irrigation water was obtained from Lake Blaine creek and the entire amount used had to be pumped from Mill creek.

Dryland yields were normal again for the first time in three or four years because of five inches of rain in June. Or would have been, had not hail destroyed much of the spring grain crop.

In total miscellaneous receipts from all sources exceeded the $4000 budget estimate.

The General Farm budget for 1963-1964 was $9010.00. Largest items are machinery leases, $2830.98 and land lease of, $1280.00, fuel and labor.

ACTIVITIES

A Progress Report was issued. Monthly letters were sent to Staff, area agents and Advisory Committee members. Agricultural activities including Division of Agriculture Conference, Planning Conference, Research Committees, and locally, Agriculture Council, Chamber Agriculture Comm., and a School for Fertilizer Dealers were participated in. Talks at meetings in the area were made on request, and articles prepared for farm editions of newspapers.

Annual meetings with Area Agents and with the Advisory Committee for the Northwestern Montana Branch Station continue to be important activities.

RESEARCH PROJECTS

FORAGES 5022

Alfalfa Variety Evaluation:

1 a/b Alfalfa variety evaluation nurseries seeded in 1961 were harvested in two cuttings. Stand estimates were made while stubble was short after the second cutting was removed by counting the occupied sections of the 20 uniframe at 5 locations for each plot. No estimate of drought resistance was made since June precipitation of 5 inches was received and non-irrigated yields were equal to those of the irrigated nursery. Nor was spreading measured since little has occured.

Yields are shown in Table I. Vernal leads other varieties by about a ton per acre in both nurseries. Stands are shown in Table II. Stands remain at 80% or above for all plots with the single exception of one Ladak plot in the dry nursery.

1 c The Winter Hardiness Nursery seeded as a border to the Irrigated Small Seeded Legume Nursery in 1960 was harvested in two cuttings and stand estimated September 10th. See Table III. Yields and stands are best for Vernal, followed by Lahontan, N. Mex. 11-1, N. Mex. 12-2 and Zia in that approximate order.

1 d A date of last cutting nursery was established in 1963 and stands of 87% upward obtained. The planting plan and stands are shown in Table IV.

Table I. Yields by cuttings in tons per acre in 1963 of irrigated alfalfa variety evaluation. T/A @ 12% moisture.

First Cutting: June 19 Second Cutting: August 19

Variety	Cut	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average	Season
Vernal	1	2.24	1.86	2.54	2.50	9.14	2.29	
	2	1.57	1.57	2.54	2.50	8.18	2.05	
	Season	3.81	3.43	5.08	5.00	17.32	4.34	4.34
Orenberg	1	1.82	1.99	1.82	1.40	7.03	1.76	
	2	.97	1.06	1.23	.97	4.23	1.06	
	Season	2.79	3.05	3.05	2.37	11.26	2.82	2.82
Rambler	1	2.41	1.40	2.33	2.50	8.64	2.16	
	2	1.23	1.02	1.61	2.20	6.06	1.52	
	Season	3.64	2.42	3.94	4.70	14.70	3.68	3.68
Teton	1	2.16	1.95	2.22	2.08	8.41	2.10	
	2	.97	.85	1.69	1.14	4.65	1.16	
	Season	3.13	2.80	3.91	3.22	13.06	3.26	3.26
Ladak	1	2.12	1.99	2.46	2.08	8.65	2.16	
	2	1.31	.97	1.44	1.61	5.33	1.33	
	Season	3.43	2.96	3.90	3.69	13.98	3.49	3.49

NOTE: Ladak is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.09232	4.42*
Varieties	4	1.24272	5.03
Error	12	.24717	
Total	19		

$\bar{x}$.....	3.51
S.E.$\bar{x}$.....	.248
L.S.D.(.05)..	.77
C.V.%.....	7.07

Table 2. Stand of alfalfa evaluation varieties, September 10, 1963.
Twenty unit frame Five measurements

IRRIGATED

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Vernal	93	99	98	100	390	97.5
Orenberg	93	95	98	91	377	94.25
Rambler	98	96	95	85	374	93.5
Teton	95	96	98	91	380	95
Ladak	94	96	95	96	381	95.25

DRYLAND

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Vernal	92	91	100	100	383	95.75
Orenberg	85	87	93	97	362	90.5
Rambler	86	85	97	93	361	90.25
Teton	85	80	92	94	351	87.75
Ladak	53	84	96	89	322	80.5

Table I (con't). Yields by cuttings in tons per acre in 1963 of alfalfa variety evaluation. T/A @ 12% moisture (dryland).

First cutting: June 19 Second cutting: August 19

Variety	Cut	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average	Season
Vernal	1	2.08	2.67	2.84	2.75	10.34	2.59	
	2	1.82	2.29	2.29	2.12	8.52	2.13	
	Season	3.90	4.96	5.13	4.87	18.86	4.72	4.72*
Orenberg	1	1.80	1.95	2.54	2.67	8.96	2.24	
	2	1.19	1.44	1.52	1.52	5.67	1.42	
	Season	2.99	3.39	4.06	4.19	14.63	3.66	3.66
Rambler	1	1.44	1.82	2.58	2.96	8.80	2.20	
	2	1.69	.85	1.57	1.57	5.68	1.42	
	Season	3.13	2.67	4.15	4.53	14.48	3.62	3.62
Teton	1	1.91	2.29	2.41	2.12	8.73	2.18	
	2	1.36	1.40	1.69	1.19	5.64	1.41	
	Season	3.27	3.69	4.10	3.31	14.37	3.59	3.59
Ladak	1	1.44	2.20	2.67	1.95	8.26	2.07	
	2	1.19	1.95	1.48	1.36	5.98	1.50	
	Season	2.63	4.15	4.15	3.31	14.24	3.57	3.57

NOTE: Ladak is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.17294	5.23*
Varieties	4	.98638	4.40*
Error	12	.22420	
Total	19		

$\bar{x}$..... 3.829
S.E.$\bar{x}$..... .23675
L.S.D.(.05).. .73
C.V.%..... 6.18

Table 3. Yield in tons per acre by cuttings in 1963 of winter hardiness test of Alfalfa varieties @ 12% moisture.

First cutting: June 20 Second cutting: August 3

Variety	Cutting	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average	Season
Lahontan	1	2.29	1.69	2.69	1.59	8.26	2.07	
	2	2.60	.83	2.48	1.91	7.82	1.96	
	Season	4.89	2.52	5.17	3.50	16.08	4.03	4.03
Vernal	1	3.62	3.05	2.92	2.60	12.19	3.05	
	2	3.18	3.11	2.22	2.86	11.37	2.84	
	Season	6.80	6.16	5.14	5.46	23.56	5.89	5.89
Zia	1	1.18	1.84	2.29	2.54	7.85	1.96	
	2	.89	1.02	1.52	2.10	5.53	1.38	
	Season	2.07	2.86	3.81	4.64	13.38	3.34	3.34
N.Mex. 11-1	1	2.73	3.37	2.22	2.73	11.05	2.76	
	2	2.48	3.11	1.97	2.10	9.66	2.42	
	Season	5.21	6.48	4.19	4.83	20.71	5.18	5.18
N.Mex. 22-2	1	2.29	1.87	2.03	2.45	8.64	2.16	
	2	1.65	1.46	1.33	1.94	6.38	1.60	
	Season	3.94	3.33	3.36	4.39	15.02	3.76	3.76

NOTE: Vernal is used as a check in this nursery.

$\bar{x}$..... 4.44
S.E.$\bar{x}$..... .524
L.S.D.(05)... 1.62
C.V.%..... 11.81

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.12608	
Varieties	4	4.49102	4.09*
Error	12	1.09930	
Total	19		

Stand of Winter Hardiness Alfalfa, September 10, 1963.
Twenty unit frame, five measurements

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Lahontan	69	54	76	57	256	64
Vernal	78	79	81	74	312	78
Zia	37	46	59	63	205	51.25
N.Mex. 11-1	65	79	49	66	259	64.75
N.Mex. 22-2	67	46	37	48	198	49.5

Table 4. Planting Plan and Stand for date of last cutting nursery, 1963.

Date	Variety	Plot Numbers and Stand in Replication										Stand Average
		No.	Stand	No.	Stand	No.	Stand	No.	Stand	No.	Stand	
1	Vernal	1	99	20	93	25	98	37	94	44	92	93.4
1	Flandria	2	98	19	94	26	90	38	87	43	94	92.6
2	Vernal	3	96	12	97	29	95	35	95	48	97	96
2	Flandria	4	100	11	98	30	93	36	92	47	96	95.8
3	Vernal	5	98	18	96	23	98	31	99	50	98	97.8
3	Flandria	6	95	17	99	24	93	32	97	49	98	96.4
4	Vernal	7	97	14	94	21	95	39	92	46	98	95.2
4	Flandria	8	98	13	94	22	97	40	94	45	98	96.2
5	Vernal	9	98	16	90	27	94	33	97	42	95	94.8
5	Flandria	10	97	15	92	28	98	34	98	41	96	96.2

FORAGES (con't) 5022

Irrigated Small Seeded Legumes:

2 a The Montana Small Seeded Legume Irrigated Trial seeded in 1960, containing 21 entries and four replications, was harvested in one cutting on June 27th. Regrowth was ranked 1 to 10 with 10 the most, August 2nd and September 14th, and regrowth clipped following the August 2nd reading. Stand was estimated September 11th and is made up of five occupancy readings per plot using the 20 unit frame. Yield regrowth and stand data are shown in Table 5.

Yields of 1.9 tons per acre or above at 12% moisture in one cutting were obtained from Lakeland and Weibulls Resistana Red Clovers, Vernal Alfalfa and Sanfoin.

Regrowth was greatest from Vernal Alfalfa, Dollard, Lakeland, Penscott and Kenland Red Clovers.

Stands of most entries have been reduced, some to near the vanishing point. Not enough common or Tetra Alsike was in evidence to obtain accurate readings. Best of all entries for stand were Lakeland and Weibulls Resistana Red Clover. Stand of Cicer Vetch has improved.

Table 5. Yield in tons per acre of Irrigated Small Seeded Legumes in 1963.

First Cutting - 60 square feet - 12% moisture (.40656)

Species & Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Zigzag Red Clover	1.39	1.18	1.39	1.54	5.50	1.38
Pennscott Red Clover	.97	1.04	1.35	1.60	4.97	1.24
Kenland Red Clover	1.78	2.20	1.31	1.21	6.50	1.63
Lakeland Red Clover	1.89	2.28	1.49	2.03	7.69	1.92
Dollard Red Clover	1.52	2.16	2.04	1.31	7.03	1.76
Altaswede Red Clover	1.55	2.52	1.95	2.03	8.05	2.01
Ottio Mammoth Red Clover	1.78	1.66	1.56	1.59	6.59	1.65
Wiebulls Tetra Red Clover	1.34	1.40	1.02	1.48	5.24	1.31
Tomminsto Red Clover	1.59	1.56	1.28	1.78	6.21	1.55
Alaskland Red Clover	1.03	1.19	1.15	1.13	4.50	1.13
Manhardy Red Clover	1.30	1.90	1.46	1.72	6.38	1.60
Weib. Raslstana Red Clover	1.44	2.11	2.13	2.16	7.84	1.96
Com. Alsike	1.15	1.08	1.08	1.01	4.32	1.08
Tetra Alsike	1.43	.94	1.53	1.48	5.38	1.35
Vernal Alfalfa	2.78	1.24	2.09	1.88	7.99	2.00
Cicer Milkvetch	1.58	1.65	1.25	1.43	5.91	1.48
Sickle Milkvetch	1.15	1.19	1.34	1.21	4.89	1.22
Sanfoin	2.37	2.55	2.79	1.82	9.53	2.38

NOTE: Kenland is used as a check in this nursery.

$\bar{x}$.....	1.59
S.E.$\bar{x}$.....	.15762
L.S.D.(.05)	.45
L.S.D.(.01)	.60
C.V.%.....	9.91

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.03817	
Varieties	17	.51418	5.17**
Error	51	.09938	
Total	71		

Table 5 (con't). Stand of Irrigated Legumes, September 11, 1963

Five measurements with twenty unit frame.

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Zigzag	44	54	82	78	258	64.5
Pennscott	31	44	46	45	166	41.5
Kenland	52	64	42	49	207	51.75
Lakeland	82	75	81	63	301	75.25
Dollard	59	55	73	71	258	64.5
Altaswede	40	51	87	79	257	64.25
Ottio Mammoth	22	54	66	60	202	50.5
Weib. Tetra Red	9	40	39	45	133	33.25
Tomminsto	39	60	71	83	253	63.25
Alaskland	14	23	34	33	104	26
Manhardy	47	42	60	57	206	51.5
Weib. Resist	58	68	72	71	269	67.25
Vernal Alfalfa	47	41	66	75	229	57.25
Cicer	49	51	52	63	215	53.75
Sickle	19	16	20	46	101	25.25
Sanfoin	35	62	56	55	208	52

Table 5 (con'T). Regrowth of Irrigated Small Seeded Legumes
Rank 1 - 10 with 10 most.

Variety	August 2 Rep. I	Rep. II	Rep. III	Rep. IV	Average	September 4 Rep. I	Rep. II	Rep. III	Rep. IV	Average	Season
Zigzag	2	2	3	3	2.5	2	3	2	2	2.25	3
Pennscott	5	8	6	5	6	5	4	4	5	4.5	9
Kenland	6	8	5	5	6	4	6	4	3	4.25	8
Lakeland	5	7	5	6	5.75	5	5	4	5	4.75	9
Dollard	4	7	7	5	6	5	5	5	3	4.5	9
Altaswede	2	3	3	2	2.5	1	3	2	2	2	3
O. Mammoth	5	4	4	3	4	5	5	3	2	3.75	5
Weib. Tetra	2	4	3	3	3	2	3	2	3	2.5	4
Tomminsto	3	3	4	3	3.25	3	3	4	3	3.25	4
Alaskland	6	7	6	5	6	3	6	4	3	4	7
Manhardy	3	2	2	3	2.5	2	2	2	2	2	3
Weit. Resist.	4	4	4	4	4	3	4	4	4	3.75	3
Com. Alsike	1	1	1	2	1.25	1	0	1	0	.5	1
Tet. Alsike	1	1	1	1	1	1	0	0	0	.25	1
V. Alfalfa	10	6	8	8	8	7	5	8	6	6.5	10
Cicer Vetch	5	5	4	4	4.5	2	3	2	2	2.5	5
Sickle Vetch	3	3	3	2	2.75	1	1	2	1	1.25	2
Sanfoin	8	7	5	5	6.25	5	3	3	3	3.5	6

Table 5 (con't). Protein of Legumes

Variety	7/3/62 A	7/3/62 B	7/5/63 A	7/5/63 B	Total	Average 4 Samples
Zigzag	12.6	10.8	11.3	12.1	46.8	11.7
Pennscott	8.5	12.2	11.5	12.0	44.2	11.05
Kenland	11.5	12.1	11.3	12.9	47.8	11.95
Lakeland	13.2	11.2	12.4	12.3	49.1	12.28
Dollard	11.1	11.5	10.1	11.5	44.2	11.05
Altaswede	12.9	13.4	11.6	10.8	48.7	12.18
Ottio Mammoth	11.1	11.4	11.7	10.9	45.1	11.28
Weibulls Tetra Red	11.9	11.4	11.7	12.6	47.6	11.9
Tomminsto	12.5	12.6	13.7	11.4	50.2	12.55
Alaskland			10.3	12.3	22.6	11.3
Manhardy	11.1	11.7	12.9	13.1	48.8	12.2
Weibulls Resistana	11.5	12.5	9.5	12.3	45.8	11.45
Com. Alsike	10.5	9.0			(2) 19.5	9.75
Tetra Alsike	10.2	9.2			(2) 19.4	9.70
Vernal Alfalfa	11.1	10.1	13.2	15.1	49.5	12.75
Cicer Vetch	10.4	12.1	14.4	14.2	51.1	13.8
Sanfoin	10.8	9.4	11.2	10.4	41.8	10.45

FORAGES (con't) 5022

Dryland Small Seeded Legumes:

2 b The thirteen entry Dryland Legume Nursery seeded in 1960 was harvested in one hay cutting on June 27th. On August 2nd and September 4th regrowth was ranked 1 to 10 with 10 the most. Regrowth was clipped after the August 2nd ranking. Stand estimates consisting of five occupancy measurements with the 20 unit frame were made for plots with a reasonable number of live plants remaining, otherwise, they were called missing plots. Yield data, regrowth rank and stand data are shown in Table 6.

In 1963 Sanfoin ranks highest in yield in this nursery with Cicer Milkvetch second. Others with very acceptable yields, this the third year of harvest, are Sickle Milkvetch, Vernal Alfalfa and Zigzag, Dollard and Lakeland Red Clover. Tetra Alsike which was high in the nursery the previous two years had disappeared.

In regrowth rank Vernal Alfalfa was high followed by Sanfoin and Lakeland and Dollard Red Clover.

Vernal had the best remaining stands, followed by Cicer Vetch which was much improved over previous years, Dollard and Lakeland Red Clover, and Sanfoin.

Table 6. Yield in tons per acre of Small Seeded Legumes, dryland in 1963. (12% moisture) 60 square feet, first cutting. (.40656)

Variety & Species	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Zigzag Red Clover	1.79	2.43	1.93	1.93	8.08	2.02*
Pennscott Red Clover	1.46	1.65	1.35	1.93	6.39	1.60
Kenland Red Clover	1.58	1.62	1.48	1.26	5.94	1.49
Lakeland Red Clover	1.73	2.24	1.35	2.07	7.39	1.85
Dollard Red Clover	1.68	2.45	2.00	1.73	7.86	1.97*
Vernal Alfalfa	2.52	1.48	1.78	2.10	7.88	1.97*
Cicer Milkvetch	2.53	2.13	2.16	2.44	9.26	2.32*
Sickle Milkvetch	2.24	2.25	1.40	2.24	8.13	2.03*
Sanfoin	3.30	3.07	2.22	2.89	11.48	2.87*

NOTE: Kenland is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.30245	3.11
Varieties	8	.65451	6.72**
Error	24	.09733	
Total	35		

$\bar{x}$.....	2.01
S.E.$\bar{x}$.....	.15599
L.S.D.(.05)..	.45
L.S.D.(.01)..	.62
C.V.%.....	7.76

Table 6 (con't). Regrowth of Dryland Small Seeded Legumes
Rank 1 - 10, with 10 most

Variety	August 2					September 4					
	Rep. I	Rep. II	Rep. III	Rep. IV	Average	Rep. I	Rep. II	Rep. III	Rep. IV	Average	Season
Zigzag	1	2	3	1	1.75	1	4	2	1	2	1
Pennscott	5	4	5	4	4.5	5	5	3	3	4	4
Kenland	6	5	4	6	5.25	6	5	2	5	4.5	5
Lakeland	6	5	5	5	5.25	6	7	4	6	5.75	7
Dollard	4	4	5	5	4.5	6	6	6	5	5.75	6
Vernal Alfalfa	10	10	10	10	10	10	8	7	7	8	9
Cicer Vetch	6	3	5	5	4.75	4	3	2	4	3.25	3
Sickle Vetch	4	2	3	3	3	2	2	1	2	1.75	2
Sanfoin	8	7	6	7	7	6	6	4	4	5	8

Table 6 (con't). Stand of Dryland Legumes - September 11, 1963
Based on Occupancy in 20 Unit Frame, 5 per plot.

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Zigzag	52	63	49	13	177	44.25
Pennscott	42	40	25	25	132	33
Kenland	51	38	40	49	178	44.5
Lakeland	54	69	50	52	225	56.25
Dollard	53	64	59	56	232	58
Com. Alsike						gone
Tetra Alsike						gone
Vernal Alfalfa	86	75	62	72	295	73.75
Cicer Vetch	71	67	60	78	276	69
Sickle Vetch	27	35	24	40	126	31.5
Sanfoin	66	59	37	66	228	57

FORAGES (con't) 5022

Intrastate Irrigated Test of White Clover Varieties:

3 This test of five white clover varieties was seeded in five replicats in the spring of 1963 and stands of 90% or above, based on five measurements with 20 unit frame, obtained for all plots. The planting plan and stand percentages are shown in Table 7.

Table 7. Planting Plan and Stand of White Clover Varieties

Variety	No.	Stand	No.	Stand	No.	Stand	No.	Stand	No.	Stand	Average
Pilgrim	1	95	7	92	15	94	18	95	24	94	94
Merit	2	94	10	97	14	96	16	97	23	100	96.8
Com. Ladino	3	93	6	100	12	96	19	98	25	94	96.2
Com. White	4	90	8	100	11	94	20	92	22	98	94.8
Holland White	5	96	9	96	13	94	17	94	21	98	95.6

FORAGES (con't) 5022

Sanfoin Evaluation:

4a Dryland Pastures:

Dryland pasture plots with seven entries in which Sanfoin is the legume which was seeded in 1961, harvested four times in 1963 at approximately thirty day intervals, beginning May 20th. Yields in tons per acre at 12% moisture by plots and cuttings are shown in Table 8.

Sanfoin yields were one-half ton per acre above any grass. Sanfoin grass mixtures were above the same grasses by an average of .94 tons per acre. In the case of the low yielding grass in the study, seeding Sanfoin with it increased seasons yields by 1.59 tons per acre. Grasses did much better in relation to Sanfoin this season than in 1962 when there was considerable less summer precipitation.

4b Sanfoin compared to alfalfa in other nurseries:

	T/A	
Nursery	Sanfoin	Alfalfa
Legume nursery (dryland)	2.87	1.97
Legume nursery (irrigated)	2.38	2.00

4c Seed Plot:

A dryland seed plot of approximately one acre was seeded in rows and cultivated to produce seed for further trials.

4d Sanfoin Evaluation:

Encouraged by results from initial seedings of Sanfoin in legume nurseries, dry and irrigated, in dryland pastures, an attempt has been made to determine the place for and use of the crop in the area by a series of off-station plantings and by suppling seed to various individuals for trials of their own. Results in the next three years should either incourage or discourage seeding and set the pattern for use. A list of persons receiving seed and locations of off-station seedings follows.

Person	Location	Lbs. Seed	Type of Planting & Notes
DesChamps	Missoula	5#	dryland
Mikkelson	Thompson Falls	5#	
Schroeder	Missoula	4#	
Teeple	Libby	4#	replicated nursery & pasture, dry, fair stand and growth
Beebe	Libby	5#	dry, fair stand and growth
Roth	Clinton		included in replicated nursery
Weidemeyer	Fortine		dry strip test, overcome by weeds
Branson	Belnap		included in replicated nursery
Lenarz	Eureka		dry strip test, good stand and growth

Table 8. Yield in Tons per Acre by Cuttings in 1963 of Sanfoin and Grass Dryland Pasture Clippings. (12% Moisture)

Number	Entry	Cutting	Date	Rep. I	Rep. II	Rep. III	Rep. IV	Total	Average for Season
1	Sanfoin	1	5/20	.76	1.02	.68	.59	3.05	
		2	6/17	.76	.80	.68	.47	2.71	
		3	7/19	.55	.72	.51	.34	2.12	
		4	8/30	.25	.34	.17	.21	.97	
		Season		2.32	2.88	2.04	1.61	8.85	2.21
2	Sanf. & Neb. 50	1		.68	1.19	.68	.76	3.31	
		2		.80	.80	.34	.25	2.19	
		3		.55	.59	.51	.34	1.99	
		4		.34	.42	.08	.13	.97	
		Season		2.37	3.00	1.61	1.48	8.46	2.13
3	Sanf-Stipa	1		.93	.93	.76	.76	3.38	
		2		.93	.59	.85	.51	2.88	
		3		.68	.55	.51	.55	2.29	
		4		.34	.17	.21	.17	.89	
		Season		2.88	2.24	2.33	1.99	9.44	2.36
4	Stipa	1		.08	.08	.17	.08	.41	
		2		.25	.17	.21	.25	.88	
		3		.17	.38	.34	.30	1.19	
		4		.17	.17	.21	.04	.59	
		Season		.67	.80	.93	.67	3.07	.77
5	San & Nordan	1		1.27	1.02	1.02	.85	4.16	
		2		.72	.80	.59	.64	2.75	
		3		.59	.64	.59	.59	2.41	
		4		.25	.34	.25	.25	1.09	
		Season		2.83	2.80	2.45	2.33	10.41	2.60

Table 8 (con't). Yield in tons per acre by cuttings in 1963

Number	Entry	Cutting	Date	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average for Season
6	Nordon	1	5/20	.68	.93	1.02	1.69	4.32	
		2	6/17	.34	.17	.13	.21	.85	
		3	7/19	.38	.38	.30	.34	1.40	
		4	8/30	.13	.08	.04	.08	.33	
		Season		1.53	1.56	1.49	2.32	6.90	1.73
7	Neb. 50	1		1.02	1.02	.85	.68	3.57	
		2		.34	.30	.17	.42	1.23	
		3		.55	.42	.38	.42	1.77	
		4		.21	.08	.04	.08	.41	
		Season		2.12	1.82	1.44	1.60	6.98	1.75

NOTE: Neb. 50 is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.36950	2.52
Varieties	6	1.45253	9.90**
Error	18	.14666	
Total	27		

$\bar{x}$..... 1.93
S.E.$\bar{x}$..... .19148
L.S.D.(.05).. .57
L.S.D.(.01).. .78
C.V.%..... 9.91

FORAGES (con't) 5022

One Cutting Hays

5 A preliminary field strip test of one-cutting hay mixtures seeded in 1961 and harvested in 1962 produced from 2.3 ton to 4.82 ton per acre in one cutting made July 6th, and from .92 ton to 1.98 ton per acre regrowth harvested September 3rd. This seemed to warrant further work designed for statistical analysis and including species and varieties adapted to the study in maturity characteristics. Such a study was initiated in 1963, having twelve entries including Vernal Alfalfa and Sanfoin as two cutting checks. Seedings were made on the Northwestern Branch Station, on the Western Branch Station, and in off-station locations in Lincoln and Sanders Counties.

Very good stands and growth was obtained on the station plots, and fair stands and growth on Lincoln County plots. Those in Sanders County have not been checked.

The planting plan follows:

One Cutting Hay Nursery

	Entries	Plot numbers in Replication I	II	III	IV
1	Vernal Alfalfa (Check) 2 cuts	1	17	33	43
2	Lincoln Brome & Altaswede	2	22	36	42
3	Lincoln Brome & Mammoth	3	23	25	40
4	Tall-A 12465 & Altaswede	4	19	32	37
5	Tall-A 12465 & Mammoth	5	14	35	44
6	Tall-98526 & Altaswede	6	16	26	38
7	Tall-98526 & Mammoth	7	20	27	48
8	Sanfoin (2 cut check)	8	21	34	41
9	Timothy & Altaswede	9	24	29	47
10	Timothy & Mammoth	10	13	31	46
11	Intermediate & Altaswede	11	15	30	39
12	Intermediate & Mammoth	12	18	28	45

Plots to be 20 feet long with 5 feet alleys, 2 feet apart. Plots to consist of 7 rows, 6 inches apart. First seed 4 grass rows, then seed 3 legume rows between 4 grass rows. Also seed 7 rows in check plots. Lbs/A: Alfalfa 8#; Sanfoin 12#; grass 6# of Timothy and 8# of others. Clover 8#.

FORAGES (con't) 5022

Orchardgrass Evaluation

6 The Chinook-Potomac Orchardgrass variety comparisons, irrigated and dry-seeded in 1961, were harvested in one cutting on June 19th, and stands determined to be 90% or above for all plots.

Irrigated Yields in T/A, 12% Moisture, June 19

Variety	Rep. I	Rep. II	Rep. III	Rep. IV	Total	Average
Chinook	1.14	1.23	1.31	1.16	4.84	1.21
Potomac	1.00	.87	1.14	1.04	4.05	1.01

Dryland Yields in T/a, 12% Moisture, June 19

Variety	Rep. I	Rep. II	Rep. III	Rep. IV	Total	Average
Chinook	.55	.68	.85	1.14	3.22	.81
Potomac	.47	.78	.83	1.19	3.27	.82

FORAGES (con't) 5022

Irrigated Wheatgrass Nursery

7a This nursery was harvested for hay July 5th, and regrowth which was from one to six inches high ranked for yield 1 - 10 with 10 the most September 4th. This data appears in Table 9. Yields generally exceeded two tons per acre with S.D. 20 (Oahe) leading with 3.09 tons per acre.

Dryland Wheatgrass Nursery

7b This nursery was harvested for hay July 5th. Regrowth never exceeded four inches in height, was very uniform and was not measured. Spread was measured September 4th by placing the 40 unit frame across the rows in five plot locations and counting occupied sections. Yield is shown in Table 10, spread in Table 11.

S.D. 20 (Oahe) was way out in front of other varieties in yield.

Spread was greatest for Sodar Streambank, and considerably less for tall wheatgrasses than for intermediates. Most vigorously spreading of the Talls is Mandan 1422 and of the Intermediates is Amur.

Table 9. Yield in tons per acre of irrigated Wheatgrass in 1963. (40656)

Variety	Cut	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average	Regrowth rank
B - Whitman	1	1.41	1.96	2.07	2.47	7.91	1.98	
	Regrowth	1	5	4	3	13		3
Siberian	1	1.47	2.52	1.94	2.20	8.13	2.03	
	Regrowth	1	5	3	3	12		2
Tall Manden 1422	1	1.72	2.35	2.72	2.44	9.23	2.31	
	Regrowth	3	3	5	2	13		3
Tall Neb. 985263	1	2.02	1.91	2.63	2.81	9.37	2.34	
	Regrowth	5	3	4	3	15		5
Tall S 64	1	1.74	2.47	2.28	2.84	9.33	2.33	
	Regrowth	6	3	3	4	16		6
Tall Alkar	1	2.20	2.62	2.48	2.48	9.78	2.45	
	Regrowth	5	6	4	2	17		7
Tall A-12465	1	1.91	2.62	2.48	2.48	9.49	2.37	
	Regrowth	6	3	4	5	18		8
Interm Amur	1	2.32	2.75	3.06	1.84	9.97	2.49	
	Regrowth	4	4	5	4	17		7
Int. Greenar	1	1.90	2.72	2.25	2.62	9.49	2.37	
	Regrowth	4	2	3	3	12		2
Int. Idaho 3	1	2.18	3.04	2.58	2.78	10.58	2.65	
	Regrowth	3	4	5	3	15		5
Int. Neb. 50	1	1.98	2.81	3.14	2.65	10.58	2.65	
	Regrowth	4	4	3	5	16		6
Int. Ree	1	2.08	2.42	2.65	2.89	10.04	2.51	
	Regrowth	2	5	3	3	13		3
Int. S.D. 20; Oahe	1	2.18	3.14	3.63	3.42	12.37	3.09 ✓	
	Regrowth	3	4	4	3	14		4
Pubesc Mandan 759	1	1.98	2.72	2.20	2.35	9.25	2.31	
	Regrowth	4	3	2	2	11		1
Pubesc Topar	1	1.42	2.06	2.19	2.12	7.79	1.95	
	Regrowth	5	3	3	4	16		6
Pubesc Utah 109	1	1.98	2.32	2.29	2.13	8.72	2.18	
	Regrowth	5	6	4	4	19		9
Stb. Soder	1	1.71	2.58	2.92	2.68	9.89	2.47	
	Regrowth	2	3	4	2	11		1

NOTE: Neb 50 is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.79487	24.83
Varieties	16	.30345	4.20*
Error	48	.07229	
Total	67		

$\bar{x}$.....	2.38
S.E.$\bar{x}$.....	.13443
L.S.D.(.05)..	.38
L.S.D.(.01)..	.51
C.V.%.....	5.65

Table 10. Yield in tons per acre of dryland Wheatgrass in 1963.
Hay cutting, 60 square feet, July 5. (40656)

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Whitmar	.79	.61	1.17	.64	3.21	.80
Siberian	1.09	1.32	1.42	.76	4.59	1.15
T - Mandan 1422	1.46	.80	1.00	.70	3.96	.99
T - Neb. 985263	1.31	.98	.74	.79	3.82	.96
T - S 64	1.57	.89	1.17	.81	4.44	1.11
T - Alkar	1.28	1.03	.93	1.49	4.73	1.18
T - A-12465	1.54	.82	1.24	.92	4.52	1.13
Int. - Amur	1.52	1.31	.95	1.01	4.79	1.40
Int. - Greenar	1.27	1.10	1.01	1.52	4.90	1.23
Int. - Idaho 3	.78	1.05	1.25	1.23	4.31	1.08
Int. - Neb. 50	1.02	1.14	1.29	.84	4.29	1.07
Int. - Ree	1.11	1.07	1.29	1.16	4.63	1.16
Int. - Oahe Sd. 20	1.56	1.26	2.49	2.70	8.01	2.00
P - Mandan 759	1.07	.82	1.30	1.47	4.66	1.17
P - Topar	.65	.81	.91	.71	3.08	.77
P - Utah 109	.95	1.08	.98	.79	3.80	.95
Stb. - Sodar	.59	.38	.25	.38	1.60	.40

NOTE: Neb. 50 is used as a check in this nursery.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.12282	1.48
Varieties	16	.39842	4.79**
Error	48	.08310	
Total	67		

$\bar{x}$..... 1.08
S.E.$\bar{x}$..... .14414
L.S.D.(.05).. .41
L.S.D.(.01).. .55
C.V.%.....13.36

Table 11. Spread of dryland Wheatgrass
Based on 5 measurements per plot.

Variety	Rep.I	Rep.II	Rep.III	Rep.IV	Total	Average
Whitmar	16	30	30	22	98.0	24.5
Siberian	29	35	31.5	34.5	130.0	32.5
Tall Mandan 1422	38	51.5	33	34.5	156.0	39.0
Tall Neb. 985263	31	38	30.5	26	125.5	31.4
Tall S-64	32.5	33	31	30.5	127.0	31.8
Tall Alkar	36.5	35	34	34.5	140.0	35.0
Tall A-12465	32	36.5	31.5	34.5	144.5	36.1
Interm - Amur	91	84.5	81.5	75	332.0	83.0
Interm - Grunar	71.5	70.5	59.5	70.5	272.0	68.0
Interm - Idaho 3	70	77.5	67.5	68	283.0	70.8
Interm - Neb. 50	79	81	77	69	306.0	76.5
Interm - Ree	82	78.5	75.5	72.5	308.5	77.1
Interm - S.D. 20	74.5	77.5	82	75	309.0	77.3
Pubescent Man 759	80.5	74	75.5	72	302.0	75.5
Pubescent Topar	80.5	85	79.5	72	317.0	79.3
Pubescent Utah 109	76	72	80.5	83.5	312.0	78
Streambank - Sodar	95	89	88.5	87	359.5	89.9

FORAGES (con't) 5022

8 Responding to a request from the county agent of Missoula County for a grass nursery in the Clinton area, a 12 entry nursery was prepared for seeding. Space limitations at the planting site made it necessary to drop two entries. This planting plan follows. Two cutting harvest is planned.

Planting plan for Missoula County Grass Nursery
Don Roth - Clinton Seeded 5/1/63

Lbs./A	Entries	Plot Numbers in Replication			
		Rep.I	Rep.II	Rep.III	Rep.IV
8	Intermediate Wheatgrass	1	14	28	37
6	Crested Wheatgrass	2	18	30	36
8	Tall Wheatgrass	3	19	21	34
8	Smooth Bromegrass	4	15	27	31
6	Orchardgrass	5	13	22	32
6	Tall Fescue	6	16	23	40
6	Russian Wild Rye	7	17	29	35
6	Sherman Big Bluegrass	8	20	24	39
12	Sanfoin	9	11	26	38
6	Alfalfa	10	12	25	33

Plots are 4 rows, 20 feet long, 2 feet between plots, 3 foot alleys.
Because of space limitation no border plots were seeded.

FERTILIZERS 5020

Fertilizers for Potatoes:

Two trials of 24 treatments and four replications were conducted in 1963. One was on the Hern place in Lake County, one on the Koenig Bros. place in Flathead County.

Treatments were adjusted so that the rates of NP_2O_5 and K_2O were equal, and the amount of boron used reduced. Otherwise, the planting plan was the same as in 1962. The growing season was longer than in 1962, however, early blight did considerable damage to Lake County plots, particularly to those with low nitrogen application.

Stands were reduced by heavy roguing in some plots. There was apparently no relation between treatment and excessive roguing, so plot yields of plots with less than 80% stands were adjusted upward by addition of a number of pounds determined by multiplying the needed number of hills by the pounds per hill for the treatment (4 rep. total lbs. - 4 rep. total hills, actual). This markedly evened the data.

The potatoes were planted by the grower with his own seed and equipment. Fertilizers were side-dressed by the N. W. Mont. Branch Station crew using a specially constructed belt attachment and ground units mounted on a Cub tractor, and carefully weighed and packaged materials.

The Planting Plan is shown in Table I. Table 2 presents stand, yield and other data for the Lake County Location. Column 1 lists treatments described in Table I by number, Column 2 lists plot numbers. Column 3 shows the number of hills per plot by actual count. Roguers raised cain by taking out weak and unhealthy appearing plants. Their activities are hard to explain since stands were thus reduced in one or more reps. of all treatments. Column 4 lists actual count of tubers from each plot. Column 5 shows tubers per hill, actual numbers. Column 4 ÷ actual no. of hills, Col. 3. Column 6 shows actual weight of tubers harvested. Column 7 shows average size in ozs. of all tubers harvested. Weight, Col. 6 ÷ number Col. 4. Per cent Hollow, Col. 8, was determined by cutting 10 tubers taken at random from each plot. The yield shown in Col. 9 has been adjusted for stand. Need for this was indicated by obviously low plot yields from several treatments associated with low stand counts, and by determining that: 1. Irrespective of treatment, plots with low stand were low in yield. 2. Plots with low stand varied by treatment. 3. Plots with 80% stand were equal in yield to those with better stands. Hence, in Col. 9 all plot yields in plots with less than 80% stand (24 hills) are adjusted by addition of 4 rep. average pounds per hill for treatment, times the needed number to bring stands to 24 hills. In Col. 10 the percentage is determined by actual pounds of rough ÷ actual pounds total per plot. In Col. 11 the % saleable, ie(100% less % cull) times Col. 9 yield. In Col. 12, apparent damage to vines by early blight on September 13 was ranked 1 - 10 the most, or nearly completely vine killed.

Fertilizers for Potatoes (con't):

Table 4 presents plot data for the Flathead County location. Column descriptions for the Lake County trial apply equally well in this location, except that stands were adjusted to 22 hills rather than 24, and since no blight damage readings were taken there is no comparable Column 12. A "discolored" column has been added. Some browning in tuber centers was noted and recorded. This discoloration is thought to be a preliminary phase of the hollow heart condition.

Table 5 is "Response to Fertilizers on Potatoes, Flathead County 1963". Both set and size appear to be important yield components, for both locations, and high yielding treatments have more as well as larger tubers.

The percentage of hollow tubers was much less than in 1962. In Lake County eight treatments have 5% or more hollow tubers. Four of these are treatments with the SO_4 form of Potash. One has extra boron, one is out of balance because of low potash, and one is out of balance because of low nitrogen. In Flathead County only 9 treatments have hollow tubers. One has boron, two have SO_4 form of potash, and six are out of balance because of low or high use of one material in relation to the others. It is interesting that the same treatments produce the high yields in both locations. While these differ in some respects all have one thing in common, at least 120 pounds actual N per acre.

Specific gravity was determined from composite samples from all reps. from the Hern, Lake County location and found to vary from 1.090 to 1.098. There was little relation to treatment. Those with gravity readings from 1.090 to 1.095 had all three rates of N, P and K. Those with readings from 1.095 to 1.098 also had all three rates.

Table I. 1963 Planting Plan

Treatment Number	Materials Used Per Acre				Plot Number in Reps.				Treatment Description
	N	P_2O_5	K_2O	Minor	1	2	3	4	
1	0	0	0	0	3	35	62	94	33.5-0-0 Amon. Nitrate, 0-54-0 F.U. Phosphate & KCL form of Potash
2	60	60	60	0	20	32	65	73	" " "
3	180	60	60	0	1	47	64	81	" " "
4	60	180	60	0	17	43	56	76	" " "
5	180	180	60	0	9	28	69	86	" " "
6	60	60	180	0	7	37	72	74	" " "
7	180	60	180	0	24	41	50	83	" " "
8	60	180	180	0	15	45	58	77	" " "
9	180	180	180	0	4	33	68	89	" " "
10	-20	120	120	0	11	25	66	92	" " "
11	220	120	120	0	22	39	51	79	" " "
12	120	20	120	0	18	27	55	95	" " "
13	120	220	120	0	13	48	53	82	" " "
14	120	120	20	0	2	44	60	87	" " "
15	120	120	220	0	19	34	61	75	" " "
16	120	120	120	0	5	40	57	93	" " "
17	60	180	60	0	23	42	49	80	" " K_2SO & form of Potash
18	180	180	60	0	10	38	70	78	" " "
19	60	180	180	0	12	29	63	91	" " "
20	180	180	180	0	21	26	59	90	" " "
21	120	120	120	0	6	36	71	85	Both Ammonium Sulfate & Ammonium Nitrate used, KCL form of potash
22	120	120	120	0	16	46	52	84	" " "
23	120	120	120	A-B	14	31	54	96	" " "
24	120	120	120	A	8	30	67	88	" " "

A-B Zinc sulfate, manganese sulfate, copper sulfate and ammonium molibdate

A These plus Borax

Table 2 (con't).

1 Treatment Number	2 Plot Number	3 Stand No.Hills	4 Number Of Tubers	5 Set Tubers/Hill	6 Gross Lbs. per Plot	7 Size Oz/Tuber	8 % Hollow	9 Adjusted Gross Lbs.	10 % Culls	11 Sorted Lbs/Plot	12 Blight * on Vines
9	33	24	217	9.0	77.5	5.71		77.5	2.58	75.50	3
15	34	18	181	10.0	56	4.95		73.04	13.39	63.26	6
1	35	25	179	7.2	52	4.65		52	8.65	47.50	9
21	36	15	140	9.3	51.5	5.89		76.97	24.27	58.29	5
6	37	25	245	9.8	74	4.83		74	2.03	72.50	5
18	38	19	186	9.8	62	5.33		76.65	8.06	70.47	3
11	39	24	215	9.0	75.5	5.62		75.5	9.93	68.00	3
16	40	20	214	10.7	58	4.34		67.92	19.83	54.45	6
7	41	22	205	9.3	66	5.15		72.14	3.03	69.95	5
17	42	25	205	8.2	58.5	4.57	20	58.5	8.54	53.50	8
4	43	26	254	9.8	68	4.28		68	5.88	64.00	7
14	44	25	210	8.4	65	4.95		65.0	1.54	64.00	4
8	45	30	254	8.5	72	4.54		72	6.25	67.50	5
22	46	25	201	8.0	66	5.25		66.0	6.06	62.00	4
3	47	23	205	8.9	65.5	5.11		68.09	14.50	58.22	3
13	48	26	220	8.5	66	4.8		66.0	8.33	60.50	5
17	49	28	132	4.7	34.5	4.18		34.5	1.45	34.00	8
7	50	17	175	10.3	51.5	4.71		72.99	9.71	65.90	6
11	51	27	218	8.1	64.5	4.73		64.5	2.33	63.00	5
22	52	20	193	9.7	54	4.48		64.92	.93	64.32	9
13	53	28	215	7.7	59	4.39		59.0	6.78	55.00	8
23	54	20	192	9.6	54.5	4.54	10	64.42	5.50	60.88	9
12	55	27	212	7.9	59	4.45		59.0	3.39	57.00	6
4	56	20	202	10.1	45	3.56		54.12	4.44	51.72	9
16	57	24	239	10.0	64.5	4.32		64.5	3.10	62.50	7
8	58	19	149	7.8	36	3.87	20	47.45	8.33	43.50	10
20	59	23	250	10.9	82	5.25	20	84.72	7.93	78.00	3
14	60	12	89	7.4	39	7.01	20	71.4	15.38	60.42	6
15	61	25	213	8.5	70	5.26		70	6.43	65.50	7
1	62	20	157	7.9	35	3.57		40.92	11.43	36.24	9
19	63	22	198	9.0	70	5.66	10	75.10	21.43	59.01	5
3	64	17	169	10.0	54.5	5.16		72.63	11.01	64.63	6

Table 2 (con't).

1 Treatment Number	2 Plot Number	3 Stand No.Hills	4 Number Of Tubers	5 Set Tubers/Hill	6 Gross Lbs. per Plot	7 Size Oz/Tuber	8 % Hollow	9 Adjusted Gross Lbs.	10 % Culls	11 Sorted Lbs/Plot	12 Blight * on Vines
2	65	26	241	9.3	55.5	3.68		55.5	3.60	53.50	8
10	66	26	215	8.3	55	4.09		55.0	3.64	53.00	6
24	67	27	247	9.1	87	5.64		87.0	2.87	84.50	3
9	68	28	239	8.5	85	5.69		85	5.29	80.50	1
5	69	27	224	8.3	80	5.71		80	6.88	74.50	2
18	70	25	202	8.1	74	5.86		74.0	5.41	70.00	2
21	71	20	148	7.4	53	5.73		64.32	4.72	61.28	4
6	72	25	162	6.5	50	4.94		50	0	50.00	7
2	73	26	153	5.9	35.5	3.71		35.5	1.41	35.00	9
6	74	21	152	7.2	37	3.89		43.99	2.70	42.80	8
15	75	25	216	8.6	62.5	4.63		62.5	2.40	61.00	6
4	76	21	177	8.4	44	3.98		50.84	0	50.84	7
8	77	27	248	9.2	59.5	3.84		59.5	.84	59.00	6
18	78	20	171	8.6	57	5.33	10	68.72	17.54	56.67	4
11	79	24	224	9.3	82	5.86	10	82.0	6.71	76.50	3
17	80	23	147	6.4	42.5	4.63	10	44.46	5.88	41.85	8
3	81	27	215	8.0	66	4.91		66.0	3.03	64.00	3
13	82	23	178	7.7	61	5.48		63.6	7.38	58.91	5
7	83	23	222	9.7	81	5.84		84.07	12.35	73.69	4
22	84	18	132	7.3	46	5.58	10	62.38	13.04	54.25	6
21	85	28	216	7.7	77	5.70		77.0	3.90	74.00	5
5	86	19	167	8.8	57	5.46		71.75	6.14	67.34	3
14	87	27	227	8.4	74	5.22	10	74.0	1.35	73.00	5
24	88	15	121	8.1	43	5.69	10	69.82	6.98	64.95	6
9	89	27	175	6.5	63	5.76		63.0	11.11	56.00	5
20	90	21	160	7.6	51	5.10	10	59.16	5.88	55.68	5
19	91	25	203	8.1	52	4.10		52.0	3.85	50.00	7
10	92	19	126	6.6	28	3.56		37.3	0	37.30	9
16	93	26	172	6.6	50	4.65		50.0	6.00	47.00	4
1	94	22	141	6.4	13.5	1.53		16.46	1.85	16.16	10
12	95	28	156	5.6	39	4.0		39.0	2.56	38.00	5
23	96	27	161	6.0	49	4.87		49.0	6.12	46.00	6

Table 3. Response to Fertilizers in Lake County in 1963

Treatment Number	4 Plot Average Response: Set No./Hill	Size Oz/Tuber	% Hollow	Blight Rank *	Sorted Yield in Lbs. form 90 sq. ft.: Rep.I	Rep.II	Rep.III	Rep.IV	Total	1.21 Cwt/A
9	8.5	5.62	2.5	2	70.74	75.50	80.50	56.00	282.74	342.12
11	8.73	5.55	2.5	1	73.26	68.00	63.00	76.50	280.76	339.72
5	8.28	5.73	0	1	70.74	59.22	74.50	67.34	271.80	328.88
7	9.25	5.31	0	3	58.23	69.95	65.90	73.69	267.77	324.00
24	8.05	5.93	7.5	4	47.37	68.50	84.50	64.95	265.32	321.04
18	8.58	5.51	7.5	1	62.83	70.47	70.00	56.67	259.97	314.56
15	9.13	5.01	0	5	69.11	63.26	65.50	61.00	258.87	313.23
21	7.98	5.77	0	4	63.19	58.29	61.28	74.00	256.76	310.68
20	8.43	5.17	7.5	2	65.00	56.67	78.00	55.68	255.35	308.97
13	8.13	5.13	2.5	5	79.50	60.50	55.00	58.91	253.91	307.23
14	8.03	5.55	7.5	4	55.51	64.00	60.42	73.00	252.93	306.05
22	8.55	5.14	2.5	6	68.88	62.00	64.32	54.25	249.45	301.83
23	7.98	5.06	2.5	6	65.97	69.50	60.88	46.00	242.35	290.24
3	8.4	5.01	0	3	49.34	58.22	64.63	64.00	236.19	285.79
16	8.68	4.69	0	4	71.50	54.45	62.50	47.00	235.45	284.89
19	8.48	4.97	5.0	7	62.66	59.95	59.01	50.00	231.62	280.26
8	8.75	4.19	5.0	7	59.73	67.50	43.50	59.00	229.73	277.97
6	8.13	4.53	0	8	58.25	72.50	50.00	42.80	223.55	270.50
4	8.93	4.1	0	8	55.00	64.00	51.72	50.84	221.56	268.09
12	7.33	4.37	0	4	52.67	58.00	57.00	38.00	205.67	248.86
2	8.13	4.08	0	9	52.00	61.15	53.50	35.00	201.65	244.00
10	8.23	3.84	5.0	8	56.85	38.86	53.00	37.30	186.01	225.07
17	6.68	4.74	7.5	8	56.50	53.50	34.00	41.85	185.85	224.88
1	6.98	3.32	0	10	31.22	47.50	36.24	16.16	131.12	158.66

* 10 most vine damage.

Table 4. Plot data for Potato Fertilizers in Flathead County in 1963.

Treatment Number	Plot Number	Stand Hills/Plot	Number of Tubers	Set Tubers/Hill	Gross Lbs. per Plot	Size Oz/Tuber	Dis-colored	% Hollow	Adjusted Gross Lbs.	% Culls	Sorted # per Plot
3	1	21	142	6.76	46	5.18	0	0	48.05	5.43	45.44
14	2	22	141	6.41	51	5.79	0	0	51.00	10.78	45.50
1	3	20	73	3.65	21	4.60	0	0	22.98	9.52	20.79
9	4	21	134	6.38	50	5.97	0	40	52.33	15.00	44.48
16	5	8	47	5.88	18	6.13	0	10	43.76	30.56	30.39
21	6	21	176	8.38	58.5	5.32	0	20	60.73	12.82	52.94
6	7	22	104	4.73	34	5.23	0	0	34.00	17.65	28.00
24	8	19	93	4.89	43	7.40	0	0	50.47	32.56	34.04
5	9	17	91	5.35	43	7.56	0	20	54.25	22.09	42.27
18	10	22	137	6.23	49	5.72	0	0	49.00	9.18	44.50
10	11	21	91	4.33	27	4.75	0	0	28.36	7.41	26.26
19	12	20	104	5.20	35.5	5.46	0	0	39.64	4.23	37.96
13	13	17	112	6.59	38	5.43	0	0	48.95	7.89	45.09
23	14	22	168	7.64	61.5	5.86	0	0	61.50	4.07	59.00
8	15	22	146	6.64	43	4.71	0	0	43.00	4.65	41.00
22	16	22	150	6.82	51	5.44	0	0	51.00	3.92	49.00
4	17	22	169	7.68	55	5.21	0	0	55.00	21.81	43.00
12	18	21	150	7.14	52	5.55	0	0	53.78	7.69	49.64
15	19	21	124	5.90	38	4.90	0	0	39.76	10.53	35.57
2	20	20	127	6.35	36.5	4.60	0	0	40.06	2.74	38.96
20	21	22	114	5.18	41	5.75	1	0	41.00	15.85	34.50
11	22	21	134	6.38	46	5.49	0	0	48.11	5.43	45.50
17	23	23	128	5.57	45	5.75	0	0	45.00	2.22	44.00
7	24	20	128	6.4	42	5.25	0	0	46.02	1.19	45.47
10	25	21	93	4.43	20	3.44	0	0	21.36	10.00	19.22
20	26	22	106	4.82	42	6.34	1	0	42.00	5.95	39.50
12	27	23	95	4.13	25	4.21	0	0	25.00	4.00	24.00
5	28	21	95	4.52	29	4.88	0	0	31.25	10.34	28.02
19	29	17	75	4.41	21	4.48	0	0	31.35	2.38	30.60
24	30	23	132	5.73	47.5	5.76	0	10	47.5	5.26	45.00
23	31	22	139	6.32	48	5.53	1	0	48.00	14.58	41.00
2	32	21	77	3.67	18	3.74	0	0	19.78	0	19.78
9	33	19	76	4.00	33	6.95	0	0	39.99	9.09	36.35
15	34	22	116	5.27	36	4.97	1	0	36.00	11.11	32.00

Table 4 (con't).

Treatment Number	Plot Number	Stand Hills/Plot	Number of Tubers	Set Tubers/Hill	Gross Lbs. per Plot	Size Oz/Tuber	Dis-colored	Per cent Hollow	Adjusted Gross Lbs.	per cent Culls	Sorted # per Plot
1	35	22	87	3.95	17	3.13	0	0	17.00	0	17.00
21	36	22	121	5.50	34.5	4.56	0	0	34.5	1.45	34.00
6	37	18	80	4.44	19	3.80	0	0	24.52	0	24.52
18	38	21	113	5.38	36.5	5.17	0	0	38.67	10.96	34.43
11	39	23	121	5.26	40	5.29	2	0	40.00	3.75	38.50
16	40	19	113	5.95	32	4.53	0	0	37.52	4.69	35.76
7	41	22	140	6.36	41	4.69	0	0	41.00	0	41.00
17	42	24	121	5.04	31	4.10	0	0	31.00	4.84	29.50
4	43	22	96	4.36	25.5	4.25	1	0	25.50	0	25.50
14	44	21	95	4.52	28	4.72	0	0	29.76	0	29.76
8	45	22	125	5.68	35	4.48	0	0	35.00	5.71	33.00
22	46	23	155	6.74	40	4.13	0	0	40.00	0	40.00
3	47	22	105	4.77	36	5.49	1	0	36.00	11.11	32.00
13	48	19	104	5.47	35.5	5.46	0	0	42.07	0	42.07
17	49	24	141	5.88	39	4.43	0	0	39.00	11.54	34.50
7	50	24	135	5.63	39.5	4.68	0	0	39.50	5.06	37.50
11	51	25	149	5.96	53	5.69	0	10	53.00	2.83	51.50
22	52	21	124	5.90	41	5.29	2	0	42.98	2.44	41.93
13	53	23	146	6.35	47.5	5.21	1	0	47.50	3.16	46.00
23	54	24	177	7.38	64	5.79	0	0	64.00	14.06	55.00
12	55	21	104	4.95	44	6.77	0	0	45.78	6.82	42.66
4	56	15	71	4.73	27	6.08	0	0	40.23	11.11	35.76
16	57	23	107	4.65	38	5.68	0	0	38.00	13.16	33.00
8	58	23	139	6.04	44.5	5.12	0	0	44.50	5.06	42.25
20	59	25	137	5.48	48	5.61	0	0	48.00	8.33	44.00
14	60	22	109	4.95	30.5	4.48	1	0	30.5	9.84	27.50
15	61	20	106	5.30	36.5	5.51	0	0	40.02	5.48	37.83
1	62	24	93	3.88	23	3.96	0	0	23.00	10.87	20.50
19	63	24	112	4.67	36.5	5.21	0	0	36.50	13.70	31.50
3	64	22	143	6.50	55.5	6.21	2	10	55.50	14.41	47.50
2	65	24	185	7.71	55	4.76	0	0	55.00	12.73	48.00

Table 4 (con't)

Treatment Number	Plot Number	Stand Hills/Plot	Number of Tubers	Set Tubers/Hill	Gross Lbs. per Plot	Size Oz/Tuber	Dis-colored	Per cent Hollow	Adjusted Gross Lbs.	Per Cent Culls	Sorted # per Plot
10	66	23	140	6.09	40	4.57	0	0	40.00	7.50	37.00
24	67	23	172	7.48	62	5.77	0	0	62.00	4.03	59.50
9	68	20	141	7.50	55	6.24	0	0	59.66	9.09	54.24
5	69	22	161	7.32	60	5.96	0	10	60.00	5.83	56.50
18	70	22	153	6.95	53	5.54	1	0	53.00	8.49	48.50
21	71	22	135	6.14	51.5	6.10	0	0	51.50	9.71	46.50
6	72	21	122	5.81	33	4.33	1	0	34.38	7.58	31.77
2	73	19	116	6.11	40	5.52	0	0	45.34	21.25	35.71
6	74	23	120	5.22	30	4.00	0	0	30.00	3.33	29.00
15	75	24	137	5.71	43	5.02	0	0	43.00	4.65	41.00
4	76	21	143	6.81	44	4.92	0	0	45.89	9.09	41.72
8	77	20	120	6.00	35.5	4.73	0	0	39.14	5.68	36.92
18	78	22	150	6.82	50.5	5.39	0	0	50.50	8.91	46.00
11	79	23	155	6.74	55	5.68	0	0	55.00	10.91	49.00
17	80	20	104	5.20	35.5	5.46	0	0	38.80	11.27	34.43
3	81	22	127	5.77	41	5.17	0	0	41.00	14.63	35.00
13	82	23	171	7.43	58.5	5.47	2	0	58.50	9.40	53.00
7	83	23	161	7.00	56.5	5.61	0	0	56.50	1.77	55.50
22	84	21	121	5.76	40.5	5.36	0	0	42.48	2.47	41.43
21	85	21	113	5.48	47	6.65	1	0	49.23	2.13	48.18
5	86	24	139	5.79	57	6.56	0	0	57.00	14.91	48.50
14	87	24	139	5.79	47	5.41	0	0	47.00	8.51	43.00
24	88	23	165	7.17	67	6.50	0	0	67.00	9.70	60.50
9	89	24	160	6.67	58	5.80	0	0	58.00	4.31	55.50
20	90	23	161	7.00	59	5.86	1	10	59.00	10.17	53.00
19	91	22	119	5.41	41	5.51	0	0	41.00	15.85	34.50
10	92	21	124	5.90	30	3.87	0	0	31.36	3.33	30.32
16	93	23	166	7.22	46	4.43	0	0	46.00	0	46.00
1	94	23	118	5.13	27	3.66	0	0	27.00	0	27.00
12	95	22	120	5.45	33.5	4.47	0	10	33.50	2.99	32.50
23	96	22	109	4.95	44.5	6.53	0	0	44.50	8.99	40.50

Table 5. Response to Fetilizers in Flathead County in 1963.

Treatment Number	4 Plot Average Response: Set No/Hill	Size Oz/Tuber	% Hollow	Discolored	Sorted Yield in Lbs. from 90 sq. ft.: Rep.1	Rep.2	Rep.3	Rep.4	Total	(1.21) Cwt/A
24	6.32	6.36	2.5	0	34.04	45.00	59.50	60.50	199.04	240.84
23	6.57	5.93	0	2.5	59.00	41.00	55.00	40.50	195.50	236.56
9	6.14	6.24	10	0	44.48	36.35	54.24	55.50	190.57	230.59
13	6.46	5.39	0	7.5	45.09	42.07	46.00	53.00	186.16	225.25
11	6.09	5.54	2.5	5	45.50	38.50	51.50	49.00	184.50	223.25
21	6.38	5.66	5.0	2.5	52.94	34.00	46.50	48.18	181.62	219.76
7	6.35	5.06	0	0	45.47	41.00	37.50	55.50	179.47	217.16
5	5.75	6.19	7.5	0	42.27	28.02	56.50	48.50	175.29	212.10
18	6.35	5.46	0	2.5	44.50	34.43	48.50	46.00	173.43	209.85
22	6.31	5.06	0	5.0	49.00	40.00	41.93	41.43	172.36	208.56
20	5.62	5.89	2.5	7.5	34.50	39.50	44.00	53.00	171.00	206.91
3	5.95	5.51	2.5	7.5	45.44	32.00	47.50	35.00	159.94	193.53
8	6.09	4.76	0	0	41.00	33.00	42.25	36.92	153.17	185.34
12	5.42	5.25	2.5	0	49.64	24.00	42.66	32.50	148.80	180.05
15	5.55	5.10	0	2.5	35.57	32.00	37.83	41.00	146.40	177.14
4	5.89	5.12	0	2.5	43.00	25.50	35.76	41.72	145.98	176.64
14	5.42	5.10	0	2.5	45.50	29.76	27.50	43.00	145.76	176.37
16	5.93	5.19	2.5	0	30.39	35.76	33.00	46.00	145.15	175.63
2	5.96	4.66	0	0	38.96	19.78	48.00	35.71	141.45	171.15
17	5.42	4.94	0	0	44.00	29.50	34.50	34.43	142.43	172.34
19	4.92	5.17	0	0	37.96	30.60	31.50	34.50	134.56	162.82
10	5.19	4.16	0	0	26.26	19.22	37.00	30.32	128.80	155.85
6	5.05	4.34	0	2.5	28.00	24.52	31.77	29.00	113.29	137.08
1	4.15	3.84	0	0	20.79	17.00	20.50	27.00	85.29	103.20

Table 6. Potato Response to Fertilizer in Lake County in 1963
Soil Test: B oz. Ph. 6.6 Cond. 0.4 O.M. 2.4 P_2O_5 330

	Treatment in Lb/Acre											
	N		P_2O_5	K_2O			%		Size	Blight	Cwt/A	
No.	A.N.	A.S.		Cl.	S	Minor	Hollow	Set/H	Ozs.	Rank	Sorted	
9	180		180	180			2.5	8.5	5.6	2	342.12	
11	220		120	120			2.5	8.7	5.55	1	339.72	
5	180		180	60			0	8.3	5.7	1	328.88	
7	180		60	180			0	9.3	5.3	3	324.00	
24	60	60	120	120		+B	7.5	8.1	5.9	4	321.04	
18	180		180		60		7.5	8.6	5.5	1	314.56	
15	120		120	220			0	9.1	5.0	5	313.23	
21	60	60	120		120		0	8.0	5.8	4	310.68	
20	180		180		150		7.5	8.4	5.2	2	308.97	
13	120		220	120			2.5	8.1	5.1	5	307.23	
14	120		120	20			7.5	8.0	5.55	4	306.05	
22	60	60	120	120			2.5	8.6	5.1	6	301.83	
23	60	60	120	120		-B	2.5	8.0	5.1	6	290.24	
3	180		60	60			0	8.4	5.0	3	285.79	
16	120		120	120			0	8.7	4.7	4	284.89	
19	60		180		180		5.0	8.5	5.0	7	280.26	
8	60		180	180			5.0	8.8	4.2	7	277.97	
6	60		60	180			0	8.1	4.5	8	270.50	
4	60		180	60			0	8.9	4.1	8	268.09	
12	120		20	120			0	7.3	4.4	4	248.86	
2	60		60	60			0	8.1	4.1	9	244.00	
10	20		120	120			5.0	8.2	3.8	8	225.07	
17	60		180		60		7.5	6.7	4.7	8	224.88	
1	0		0	0			0	7.0	3.3	10	158.66	

Co. Lab: K_2O 660

Duncan's Multiple Range Analysis

Table 7. Potato response to Fertilizers in Flathead County in 1963
Soil Test: B oz. Ph. 7.8 Cond. 0.5 O.M. 2.6 P_2O_5 300

	Treatment in Lbs/Acre									
	N		P_2O_5	K_2O			%		Size	Cwt/A
No.	A.N.	A.S.		Cl.	S	Minor	Hollow	Set/H	Ozs.	Sorted
24	60	60	120	120		+B	2.5	6.3	6.4	240.84
23	60	60	120	120		-B	0	6.6	5.9	236.56
9	180		180	180			10	6.1	6.2	230.59
13	120		220	120			0	6.5	5.4	225.25
11	220		120	120			2.5	6.1	5.5	223.25
21	60	60	120		120		5.0	6.4	5.7	219.76
7	180		60	180			0	6.4	5.1	217.16
5	180		180	60			7.5	5.8	6.2	212.10
18	180		180		60		0	6.4	5.5	209.85
22	60	60	120	120			0	6.3	5.1	208.56
20	180		180		180		2.5	5.6	5.9	206.91
3	180		60	60			2.5	6.0	5.5	193.53
8	60		180	180			0	6.1	4.8	185.34
12	120		20	120			2.5	5.4	5.3	180.05
15	120		120	220			0	5.6	5.1	177.14
4	60		180	60			0	5.9	5.1	176.64
14	120		120	20			0	5.4	5.1	176.37
16	120		120	120			2.5	5.9	5.2	175.63
2	60		60	60			0	6.0	4.7	172.37
17	60		180		60		0	5.4	4.9	172.34
19	60		180		180		0	4.9	5.2	162.82
6	60		60	180			0	5.1	4.3	137.08
10	20		120	120			0	5.2	4.2	136.49
1	0		0	0			0	4.2	3.8	103.20

Co. Lab: K_2O 300

Duncan's Multiple Range Analysis

FERTILIZERS (con't) 5020

Fertilizers on Pastures:

Pasture plots seeded in 1960 were again treated with scheduled annual rates of nitrogen and phosphorus. Nine treatments were applied to three mixtures each having four replicates.

Yield was determined by clipping a portion of each plot prior to grazing with sheep. After grazing the entire plot area was clipped. A different plot portion was harvested for yield each of four times at 4 to 6 week intervals.

Tables 8, 9 and 10 present the 1963 yield data by cuttings. Table 11 is based on four plot average yields.

A comparison of mixtures show Orchard-Alfalfa to be above others in all cuttings on the average but not ahead of all mixtures for all cuttings and treatments. Orchard-Trefoil and Orchard-Ladino were about a stand off for seasons yields under all treatments, with the Ladino mixture ahead the first and fourth cuttings. This could have been a moisture response. It will be noted that second cutting yields were down in relation to the first and third cuttings and this is thought to be due to delayed irrigation. Orchard-Alfalfa produced as much for the season when treated with forty pounds P_2O_5 annually as did Orchard-Trefoil and Orchard-Ladino when treated with 50-40-0 annually. Check yields were lower and heavy treatment yields higher for Orchard-Ladino than for Orchard-Trefoil.

A comparison of seasons yields for all mixtures shows yields to be greatest for 100-80, nearly double check yields, followed closely by 50-80, 100-40 and 50-40, then by the phosphorus treatments, and finally by the nitrogen treatments. Here again moisture may have been a factor and the response to nitrogen may have been greater under more favorable moisture. Under the existing conditions one mixture produced less with 100 nitrogen than with 50. The greatest Nitrogen response when used alone came from the Orchard-Trefoil mixture, .56T from 50 pounds and .98T from 100 pounds over unfertilized checks. The greatest phosphorus response came from the Orchard-Ladino mixture, .95T from 40 pounds, and 1.54T from 80 pounds over unfertilized checks. In combinations the greatest increase per pound of nitrogen came from use of 50 N in addition to 40 P_2O_5 on the Orchard-Alfalfa mixture, .83T per acre. However, the three mixture average increase was .56T per acre when 50 N was used in addition to 80 P_2O_5, .50T per acre when 50 N was used in addition to 40 P_2O_5.

Table 8. Yield in Tons per Acre by cuttings in 1963 of Orchard-Trefoil pasture clippings with nine fertilizer treatments applied annually in early spring. (12% moisture)

Treatments No.	N	P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
1	50	40	1	5/20	.68	1.27	1.14	.93	4.02	1.01	
			2	6/17	.51	.59	.55	.64	2.29	.57	
			3	7/19	.55	.85	.89	.93	3.22	.81	
			4	8/30	.42	.34	.34	.34	1.44	.36	
			Season		2.16	3.05	2.92	2.84	10.97		2.74
2	100	40	1		.51	1.19	.97	.59	3.26	.82	
			2		.34	.64	.51	.54	2.03	.51	
			3		.59	.85	1.06	.72	3.22	.81	
			4		.38	.38	.25	.30	1.31	.33	
			Season		1.82	3.06	2.79	2.15	9.82		2.46
3	0	40	1		.42	.68	1.02	1.10	3.22	.81	
			2		.51	.42	.76	.51	2.20	.55	
			3		.72	.55	.89	.64	2.80	.70	
			4		.47	.42	.30	.42	1.61	.40	
			Season		2.12	2.07	2.97	2.67	9.83		2.46
4	100	0	1		.55	.93	.89	1.06	3.43	.88	
			2		.38	1.02	.47	.34	2.21	.55	
			3		.59	.97	1.19	.80	3.55	.89	
			4		.55	.42	.42	.21	1.60	.40	
			Season		2.07	3.34	2.97	2.41	10.79		2.70
5	0	80	1		.51	.72	.59	.76	2.58	.65	
			2		.55	.34	.34	.34	1.57	.39	
			3		.55	.68	.76	.68	2.67	.67	
			4		.34	.42	.38	.42	1.56	.39	
			Season		1.95	2.16	2.07	2.20	8.38		2.10

Table 8 (con't)

No.	Treatments N	Treatments P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
6	100	80	1		.34	.76	1.61	.68	3.39	.85	
			2		.51	.51	.76	.64	2.42	.61	
			3		.72	.51	1.02	.80	3.05	.76	
			4		.42	.17	.51	.38	1.48	.37	
			Season		1.99	1.95	3.90	2.50	10.34		2.59
7	50	80	1		.59	1.10	.97	1.19	3.85	.96	
			2		.59	.55	.55	.64	2.33	.58	
			3		.72	.59	1.02	.72	3.05	.76	
			4		.42	.51	.34	.42	1.69	.42	
			Season		2.32	2.75	2.88	2.97	10.92		2.73
8	50	0	1		.42	.47	1.02	.80	2.71	.68	
			2		.59	.38	.68	.47	2.12	.53	
			3		.59	.68	.72	.93	2.92	.73	
			4		.34	.34	.34	.34	1.36	.34	
			Season		1.94	1.87	2.76	2.54	9.11		2.28
9	0	0	1		.21	.55	.85	.38	1.99	.49	
			2		.34	.64	.42	.34	1.74	.44	
			3		.30	.72	.59	.59	2.20	.55	
			4		.21	.17	.30	.25	.93	.23	
			Season		1.06	2.08	2.16	1.56	6.86		1.72

Analysis of Variance

Source		D.F.	Mean Square	F.
Replications		3	1.20280	8.20
Varieties	N	2	.96864	6.60**
	P	2	.33548	2.29
	NxP	4	.27779	1.89
Error		24	.14672	
Total		35		

$\bar{x}$..... 2.42
S.E.$\bar{x}$..... .19152
L.S.D.(.05) .558
C.V.%..... 7.92

Table 9. Yield in tons per acre by cuttings in 1963 of Orchard-Ladino pasture clippings with nine fertilizer treatments applied annually in early spring. (12% moisture)

No.	Treatments N	Treatments P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
1	50	40	1	5/20	1.02	1.02	1.19	.93	4.16	1.04	
			2	6/17	.47	.59	.59	.34	1.99	.50	
			3	7/19	.64	.68	.51	.76	2.59	.65	
			4	8/30	.34	.51	.34	.47	1.66	.42	
			Season		2.47	2.80	2.63	2.50	10.40		2.60
2	100	40	1		1.02	1.19	1.27	.93	4.41	1.10	
			2		.68	.68	.72	.55	2.63	.66	
			3		.72	.93	.89	1.02	3.56	.89	
			4		.68	.51	.68	.59	2.46	.62	
			Season		3.10	3.31	3.56	3.09	13.06		3.27
3	0	40	1		.34	.25	.85	.68	2.12	.53	
			2		.51	.38	.38	.38	1.65	.41	
			3		.80	.68	.76	.68	2.92	.73	
			4		.59	.34	.51	.34	1.78	.45	
			Season		2.24	1.65	2.50	2.08	8.47		2.12
4	100	0	1		.25	.76	.51	.51	2.03	.51	
			2		.17	.64	.64	.25	1.70	.43	
			3		.38	.59	.76	.68	2.41	.60	
			4		.25	.59	.25	.25	1.34	.34	
			Season		1.05	2.58	2.16	1.69	7.48		1.87
5	0	80	1		.34	1.27	1.27	.93	3.81	.95	
			2		.30	.68	.64	.59	2.21	.55	
			3		.51	.93	.85	.80	3.09	.77	
			4		.25	.72	.34	.42	1.73	.43	
			Season		1.40	3.60	3.10	2.74	10.84		2.71

Table 9 (con't)

No.	Treatments N	Treatments P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
6	100	80	1		1.02	1.44	2.03	1.44	5.93	1.48	
			2		.59	.68	.64	.51	2.42	.61	
			3		.76	1.10	.85	.80	3.51	.88	
			4		.42	.59	.42	.25	1.68	.42	
			Season		2.79	3.81	3.94	3.00	13.54		3.39
7	50	80	1		.93	1.10	1.52	1.69	5.24	1.31	
			2		.51	.72	.64	.64	2.51	.63	
			3		.85	.89	.76	.68	3.18	.79	
			4		.59	.59	.51	.51	2.20	.55	
			Season		2.88	3.30	3.43	3.52	13.13		3.28
8	50	0	1		.17	.25	.25	.25	.92	.23	
			2		.21	.51	.34	.13	1.19	.30	
			3		.42	.42	.55	.47	1.86	.46	
			4		.25	.30	.42	.21	1.18	.30	
			Season		1.05	1.48	1.56	1.06	5.15		1.29
9	0	0	1		.17	.42	.17	.17	.93	.23	
			2		.30	.42	.25	.17	1.14	.28	
			3		.34	.47	.51	.47	1.79	.45	
			4		.13	.34	.17	.17	.81	.20	
			Season		.94	1.65	1.10	.98	4.67		1.17

Analysis of Variance

Source		D.F.	Mean Square	F.
Replications		3	.98955	7.08**
Varieties	N	2	2.12861	15.22**
	P	2	9.07802	64.91**
	NxP	4	.14665	1.05**
Error		24	.13986	
Total		35		

$\bar{x}$.....	2.41
S.E.$\bar{x}$.....	.18699
L.S.D.(.05)	.5447
L.S.D.(.01)	.7404
C.V.%.....	7.76

Table 10. Yields in ton per acre by cuttings in 1963 of Orchard-Alfalfa pasture clippings eith nine fertilizer treatments applied annually in early spring. (12% moisture)

No.	Treatments N	Treatments P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
1	50	40	1	5/20	1.23	1.48	1.02	1.36	5.09	1.27	
			2	6/17	.72	.72	.72	.85	3.01	.75	
			3	7/19	.85	.80	.97	.80	3.42	.86	
			4	8/30	.68	.68	1.10	.76	3.22	.81	
			Season		3.48	3.68	3.81	3.77	14.74		3.69
2	100	40	1		1.10	1.44	1.44	1.48	5.46	1.37	
			2		.85	.89	.80	.51	3.05	.76	
			3		.72	.76	.89	.76	3.13	.78	
			4		.59	.72	.59	.34	2.24	.56	
			Season		3.26	3.81	3.72	3.09	13.88		3.47
3	0	40	1		.51	1.02	1.02	1.14	3.69	.92	
			2		.68	.64	.42	.47	2.21	.55	
			3		.59	.68	.68	.93	2.88	.72	
			4		.85	.59	.64	.59	2.67	.67	
			Season		2.63	2.93	2.76	3.13	11.45		2.86
4	100	0	1		.59	.64	1.06	.38	2.67	.67	
			2		.55	.55	.55	.42	2.07	.52	
			3		.64	.59	.85	.51	2.59	.65	
			4		.72	.80	.34	.42	2.28	.57	
			Season		2.50	2.58	2.80	1.73	9.61		2.40
5	0	80	1		.89	.72	.85	1.19	3.65	.91	
			2		.51	.72	.59	.64	2.46	.62	
			3		.93	.55	.85	.76	3.09	.77	
			4		.76	.72	.42	.55	2.45	.61	
			Season		3.09	2.71	2.71	3.14	11.65		2.91

Table 10 (con't)

No.	Treatments N	Treatments P_2O_5	Cutting	Date	Rep.1	Rep.2	Rep.3	Rep.4	Total	Average	
6	100	80	1		1.02	1.44	1.19	1.69	5.34	1.34	
			2		.89	.68	.85	.72	3.14	.79	
			3		.80	.93	1.06	.97	3.76	.94	
			4		.42	.85	1.10	.47	2.84	.71	
			Season		3.13	3.90	4.20	3.85	15.08		3.77
7	50	80	1		1.19	1.23	1.02	1.44	4.88	1.22	
			2		.64	.76	.74	.85	2.99	.75	
			3		.89	.72	.85	.85	3.31	.83	
			4		.55	.72	.42	.76	2.45	.61	
			Season		3.27	3.43	3.03	3.90	13.63		3.41
8	50	0	1		1.27	1.27	1.19	.42	4.15	1.04	
			2		.64	.85	.59	.34	2.42	.61	
			3		.72	.93	.72	.51	2.88	.72	
			4		.72	.68	.59	.34	2.33	.58	
			Season		3.35	3.73	3.09	1.61	11.78		2.95
9	0	0	1		.38	.76	.59	.76	2.49	.62	
			2		.51	.51	.34	.59	1.95	.49	
			3		.76	.59	.51	.64	2.50	.63	
			4		.47	.64	.34	.42	1.87	.47	
			Season		2.12	2.50	1.78	2.41	8.81		2.20

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.16294	.81
Varieties	8	1.21182	6.03**
Error	24	.20093	
Total	35		

$\bar{x}$.....	3.07
S.E.$\bar{x}$.....	.22412
L.S.D.(.05)	.653
L.S.D.(.01)	.8876
C.V.%.....	7.29

Table 11. Four plot average in 1963. Seasons yields for three mixtures and nine fertilizer treatments.

Treatments		Tons per Acre				
N	P_2O_5	Orchard Trefoil	Orchard Ladino	Orchard Alfalfa	Total	Average
50	40	2.74*	2.60**	3.69**	9.03	3.01
100	40	2.46*	3.27**	3.47**	9.20	3.07
0	40	2.46*	2.12**	2.86*	7.44	2.48
100	0	2.70*	1.87*	2.40	6.97	2.32
0	80	2.10	2.71**	2.91*	7.72	2.57
100	80	2.59*	3.39**	3.77**	9.75	3.25
50	80	2.73*	3.29**	3.41**	9.43	3.14
50	0	2.28*	1.29	2.95*	6.52	2.17
0	0	1.72	1.17	2.20	5.09	1.70
		21.78	21.71	27.66	71.15	

FERTILIZERS (con't) 5020

Miscellaneous Fertilizer Work:

A report coming from the Flathead County Soil Laboratory indicated that soil in a Lincoln County meadow near Rexford was very deficient in potash. Arrangement was made through the county agent to apply fertilizers to a portion of the meadow that was to be seeded to a grass legume mixture. Four treatments were used on three replicates of 10 x 90 ft. plots. Good stands and growth were obtained. Observations made August 29th, indicated that growth was particularly good and legume percentage best where all materials were used. Harvest for yield is planned for 1964.

Treatment Plan

Materials			Plot Numbers		
N	P_2O_5	K_2O			
0	0	0	1	6	11
0	0	80	2	8	12
0	80	80	3	5	9
80	80	80	4	7	10

POTATO INVESTIGATIONS 5027

Work under this project includes testing of 76 Montana potato seedlings in two locations for scab resistance, evaluation of early red selections in three locations, and study of potato rotations. In addition to this two detailed studies of potato response to 24 fertilizer treatments were made and reported under Project 5020.

Montana Potato Seedlings:

White tuber potato seedlings were grown on the Northwestern Montana Branch Station and on the Harold Small farm. On the station a randomized and replicated single hill planting was made with hills three feet apart in forty inch rows. At Small's each seedling was planted in a short continuous row varying from two to twenty-three hills depending on the seed available. Yields are reported in pounds per hill, a four hill average for the station and an average of whatever number of hills were grown at Smalls. Very light to quite heavy scab was found on the seedlings grown on the station, much less or none on those grown at Smalls. Homer Metcalf made detailed observations of vine characteristics of the station hill plantings and these have been made a part of the station report.

Samples of each seedling grown at Smalls were sent to Montana State College for official scab readings, specific gravity determination or other evaluation.

Seedlings with only light scab on the station, none at Smalls, and for which this seasons evaluations indicate good production potential are the following:

N. W. Number	M.S.C. Number	N. W. Number	M.S.C. Number
9	6152-15	40	6191-18
12	6167- 7	41	6128- 6
23	6167- 5	49	6124-20
32	6124-17	56	6127-18
33	6119-14	68	6192-27
37	6127- 3	70	6146

POTATO INVESTIGATIONS (con't) 5027

Evaluation of Early Red Selections:

Three early red selections from several grown in 1962 were planted in a garden trial of response to early seeding and in a replicated plot trial on the station, in a duplicate plot planting on the Western Branch Station and by a Vo Ag student at Columbia Falls for observation.

Response to planting April 12th in the garden was favorable, as shown by yield and size data which follows:

Selection	M.S.C. Number	Single Hill Samples			
		August 18,1963		September 1,1963	
		Set	Average Size Oz.	Set	Average Size Oz.
1	5913-2	8	2	7	3.5
2	5903-4	7	4.6	10	4.0
3	5903-6	10	3.5	13	5.0

(Selection 2 would appear to be the earliest)

When planted in replicated plots May 26th in 198 square feet plots with Norland as a check variety, yields did not exceed those of Norland. Neither did there appear to be scab resistance greater than for Norland since there was considerable scab on all varieties.

Selection	Yield Data in 1963 for Selections in Lbs.					
	Rep.1	Rep.2	Rep.3	Rep.4	Total	Cwt/Acre
1	112	118	122	120	472	260
2	125	88	145	142	500	275
3	102	125	132	139	498	274
Norland	116	124	119	136	495	272

Yield data was not received from off station plantings. These grown at Western Branch were said to be free of scab and of good quality. Those grown at Columbia Falls were said to be scabby and hollow.

POTATO INVESTIGATIONS (con't) 5027

Potato Rotations:

Five potato rotations on single plots are being studied over a period of years. Rotations were planned so that potatoes would be grown on all plots once every sixth year for direct comparison under identical climatic conditions.

Crop sequence:

Plot 1 - Alternate soybeans and potatoes
Plot 2 - Grain and sweetclover, fallow, potatoes
Plot 3 - Wheat, barley, potatoes (manure for potatoes)
Plot 4 - Barley, 2. red clover, 3. potatoes
Plot 5 - Barley and alfalfa. Alfalfa 4 potatoes

In 1963 potatoes were grown on Plot 1 only. Yield of netted gem potatoes, computed from four rows, was 163.5 Cwt per acre and quite likely would have been better with an additional irrigation. Norland potatoes, grown to check rotation effects on scab, were slightly scabby. Grain yields were light due to hail on plots two and three, where barley on plot two produced at the rate of 32 bushel per acre, wheat on plot 3, 25 bushel per acre. Red Clover hay on plot four was heavy, yielding 5.2 tons per acre in two cuttings. Alfalfa in plot five was very light yielding 1.5 ton per acre in two cuttings and indicating very serious phosphorus deficiency.

FARM FLOCK

FARM FLOCK 5029

1963 Report:

On January 1, 1963 there were 54 ewes in the flock. Forty were one year and over, fourteen were ewe lambs born February 11 to March 16, 1962. Of the total 17 were Registered Columbias, 12 were purebred Columbia, subject to registration, 10 were grade Columbia and 15 were Dorcet Columbia crosses.

The flock was sheared February 14, prior to lambing, 695.97 lbs. sold at $53.83 or $374.64 gross, net $364.68.

Seventy-three lambs were born, seventy were weaned. This is 175% based on ewes over one year, 130% of all females.

Receipts from sheep and wool in 1963:

Wool	$ 364.68
Wool payments	124.54
Lambs	757.85
Ewes	285.00
Total	$1532.07
Reduction in Inv.	30.00
Gross	$1502.07

Receipts per ewe (54) $27.65

On hand January 1, 1964 are 18 Registered Columbia ewes, 6 grade Columbia ewes, 10 crossbred ewes and 18 ewe lambs or a total of 52 ewes and 2 rams.

Selection:

Again this year ewes removed from the flock equal the number of ewe lambs kept. Age, unsoundness, poor production records, or undesireable fleece or body characteristics are considered when culling. The average three year wool equivalent index for those in the flock with three years of record (wool + ½ of weaned lamb ÷ 3) is 27.2.

Correlation studies were undertaken, using available data, between lamb fleece length measured at weaning time and yearling fleece weights, and between yearling fleece weight and three year index. (Total lbs. of wool + ½ of pounds of weaned lamb ÷ 3) A correlation of .496 in the first instance and of .327 in the second would seem to indicate that keeping desirable ewe lambs with better than average staple length and culling yearling ewes that fail to produce substantial first fleeces would tend to place in the flock those with best production potential.

Selection (con't):

Plans for the coming year call for placing somewhat greater emphasis on improvement of the Registered flock while continuing the cross breeding program with grade, crossbred, or less desirable Columbia ewes, and feeding wether lambs, both Columbia and crossbred. The feed lot gain of wether lambs may well be one of the best criteria for selection of ewes for the Registered flock.

Correlation of lamb fleece length with yearling fleece weight.

Lamb Fleece length	Yearling Grease weight	Lamb Fleece length	Yearling Grease weight
5.7	8.0	9.3	12.5
5.4	7.5	6.5	10.0
6.8	10.5	6.2	7.5
5.9	8.5	7.0	9.0
6.8	9.5	6.3	8.0
6.7	9.5	7.0	7.0
7.1	9.0	6.5	9.5
4.4	7.0	8.6	8.5
5.1	7.0	6.2	7.5
4.0	6.5	7.8	9.0
5.1	8.0	6.1	7.0
4.5	7.0	6.8	8.0
3.3	7.0	7.2	7.0
4.1	7.5	6.6	7.5
5.1	7.0	6.4	7.5
5.0	7.0	5.9	6.5
Totals		195.4	258.5
		$\bar{x}$ = 6.106279	$\bar{y}$ = 8.07813

$$r = \frac{1614.20 - 195.4\ (8.07813)}{\sqrt{(1245.56 - (195.4)(6.10627)(2143.75 - 258.5(8.07013}}$$

$$= \frac{1614.20 - 1587.46602}{\sqrt{(1245.56 - 1193.16516)(2143.75 - 2088.19661}}$$

$$= \frac{26.73398}{\sqrt{(52.39484)(55.55339)}}$$

$$r = \frac{26.73398}{\sqrt{2910.71098}}$$

$$= \frac{26.73398}{53.95101} \quad + .496^{**}$$

$$r = + .496^{**}$$

Correlation - Fleece length to Grease weight as a yearling

Selection (con't)

Correlation of yearling fleece weight with three year index

Ear Tag Number	Yearling Fleece Weight	3 Year Index	Ear Tag Number	Yearling Fleece Weight	3 Year Index
171	8.0	30.2	105	13.0	34.8
178	9.0	15.4	127	9.5	25.5
28	9.5	33.0	133	13.0	30.7
27	10.0	32.7	128	9.0	31.9
56	8.5	23.9	192	12.0	23.9
43	12.5	35.8	169	14.0	38.0
53	10.5	39.8	238	9.5	24.8
57	9.0	21.1	196	9.0	33.1
58	11.5	29.8	233	5.0	23.8
59	10.5	31.0	189	9.0	31.5
69	12.0	41.1	137	11.5	20.9
72	9.0	20.5	110	13.0	31.3
83	11.5	20.6	108	9.0	24.1
85	12.0	28.8	152	14.5	27.3
76	10.0	24.1	154	10.5	27.2
81	12.0	29.5	202	8.5	33.1
87	11.5	36.8	232	8.0	25.7
88	12.0	36.5	103	10.0	32.3
180	10.0	29.6			

$s(x) = 387.0 \qquad s(y)\ 1080.1 \quad \bar{y} = 29.2$

$$\frac{s(xy) - s(x)\bar{y}}{\sqrt{(s(x^2) - s(x)\bar{x})\ (s(y^2) - s(y)\bar{y})}} = \frac{(11,450.95) - (387.0)\ 29.2}{\sqrt{(4184.50-4047.7878)\ (32,803.37-31,538.92)}}$$

$$= \frac{11450.95 - 11300.4}{\sqrt{(138.1622)(1264.45)}} = \frac{136.7122}{\sqrt{174699.19379}}$$

$$r = \frac{136.7122}{417.97032} = .327^{*}$$

$$r = .327^{+*}$$

FARM FLOCK (con't) 5029

Lamb Feeding 1963:

Thirty-six lambs were weaned July 15th and placed on a self-fed ration consisting of equal parts by weight of whole barley, whole oats, and dry beet pulp, plus long alfalfa hay and salt. (1) Shade and fresh water was available at all times. No attempt was made to bring lambs up to full feed gradually, they were simply taken away from the ewes, weighed and turned to feeders containing several days supply of the grain ration. When the supply ran low it was replenished. No bloat or other digestive disturbance was noted and no lambs were lost. Fifteen lambs were sold to John R. Daly, Missoula, on September 9th at which time they averaged 103 each. The remaining 21 sold September 24th when they averaged 85.8. All weights are normal full weights less 3%. This corresponded almost exactly with sale weights in Missoula.

Lambs on feed	36		36
Lamb days on feed	840 + 1491		2331
Weight in (full less 3%)			2002.9
Weight out (full less 3%)			3355.5
Gain			1352.6
Gain per lamb per day			.58
Feed consumed:		grain	6962
		hay	1110
		salt	36
	Total		8108
Feed consumed per lamb per day			3.48 lbs.

Feed Cost:

Grain(2) equal parts whole oats, whole barley & dry beet pulp

Grain	2.05 Cwt.		$ 142.02
Hay	20.00 T		11.10
Salt	2.00		.72
		Total feed cost	$ 153.84
		Feed cost per lamb per day	.066
		Feed cost per pound gain	.1137

(1) Ration by Dr. O. O. Thomas
(2) Barley $1.85 Cwt., Oats $2.30 Cwt., Dry Pulp $2.00 Cwt.

FARM FLOCK (con't) 5029

Lamb Weights and Gains in 1963:

Number	Weight In 7/15	Weight Out 9/9	Weight Out 9/24	Days on Feed	Gain	Gain per Day	Breeding
3- 5	52.4		85.4	71	33	.465	½D
3- 6	73.7	111.6		56	37.9	.677	½D
3- 7	67.9	104.8		56	36.9	.659	½D
3-10	67.9	98.9		56	31	.554	½D
3-13	66.9	95.1		56	28.2	.504	Col.
3-14	66	111.6		56	45.6	.814	½D
3-19	77.6	120.3		56	42.7	.763	Col.
3-20	59.2		86.3	71	27.1	.382	Col.
3-22	62.1	95.1		56	33	.589	Col.
3-23	56.3		75.7	71	19.4	.273	Col.
3- 24	51.4		94.1	71	42.7	.601	Col.
3-25	39.8		77.6	71	37.8	.532	Col.
3-28	51.4		94.1	71	42.7	.601	3/4D
3-33	52.4		93.1	71	40.7	.573	½D
3-34	56.3	98.9		56	42.6	.761	½D
3-37	60.1		93.1	71	33	.465	Col.
3-38	62.1	99.9		56	37.8	.675	Col.
3-39	37.8		81.5	71	43.7	.615	½D
3-41	60.1	92.2		56	32.1	.573	3/4D
3-42	60.1	104.8		56	44.7	.798	½D
3-43	59.2		83.4	71	24.2	.341	½D
3-44	51.4		84.4	71	33	.465	Col.
3-45	60.1	103.8		56	43.7	.78	Col.
3-46	51.4	102.8		56	51.4	.912	½D
3-51	55.3		98	71	42.7	.601	Col.
3-52	44.6		79.5	71	34.9	.492	½D
3-54	40.7		81.5	71	40.8	.575	½D
3-55	80.5	119.3		56	38.8	.693	Col.
3-57	53.3		92.1	71	38.8	.546	½D
3-59	42.7		75.7	71	33	.465	3/4D
3-61	54.3	95.1		56	40.8	.729	½D
3-64	39.8		75.7	71	35.9	.506	Col.
3-65	47.5		94.1	71	46.6	.656	½D
3-68	47.5		90.2	71	42.7	.601	Col.
3-69	41.7		72.7	71	31.0	.437	Col.
3-70	51.4		93.1	71	41.7	.587	3/4D
	2002.9	1554.2	1801.3				

FARM FLOCK (con't) 5029

Comparison of Columbias with Dorcet - Columbia Crosses

Columbia ewes were divided into two flocks, comparable in age, production and other characteristics. One flock was bred to a Registered Columbia ram, the other to a Poled Dorcet ram. From then on thru weaning the two flocks were handled as one. Identity was maintained by use of metal ear tags. After weaning wether lambs were placed on feed in the same feed lot and individual gains determined. (Ewes lambing after April 5th, or not producing live lambs, were eliminated from the comparison)

		Columbia Sire		Dorset Sire
No. of ewes bred:		13		13
No. of lambs born:		21		25
Birth wt. of lambs: twins	(16)	9.12	(24)	9.35
singles	(5)	10.9	1	11
Weaning wt. of lambs:				
twins	(14)	56.9	22	57.3
singles	(6)	63.7	2	77.5
Lbs. lamb weaned per ewe	13	90.7	13	108.8
Ave. daily gain in feed lot	16	.554	12	.645

Half blood Dorcet-Columbia ewes were kept in the flock to determine the extent of their off-season breeding habit and relative merits as breeding ewes.

Two year old cross breds sheared an average of 10.2 pounds per fleece compared to 12.7 for two year Columbias. Yearling crossbreds sheared 7.5 lbs. compared to 8.7 for yearling Columbias.

As mothers the Dorcet-Columbia cross ewes were fully equal to Columbia ewes of the same age when bred to the same Columbia ram. Two year Columbia ewes weaned an average of 63.1 lbs. of lamb. Two year crossbreds weaned an average 65.4 lbs. of lamb. Yearling Columbia ewes weaned an average of 51 lbs., while yearling crossbreds weaned an average of 55.3 lbs. Feed lot average daily gain of four lambs from these Columbia ewes averaged .563 lbs. and from four lambs from these crossbred ewes the feed lot gain average .606 lbs.

Crossbred ewes bred to their own sire to produce 3/4 Dorcets had smaller lambs at birth and at weaning time than similar ewes bred to a Columbis sire. One notable exception was a 12 lb. single that was sold as a 4-H lamb weighing 57 lbs. when 59 days old.

Two Dorcet Columbia cross ewes bred by White and secured from O'Connell lambed in November of 1962 but failed to repeat the performance in 1963. Their lambs were no larger September 9, 1963 than lambs born in April of 1963.

Other work with crossbreds at Creston includes use of Columbia-Suffolk whiteface yearling ewes secured from O'Connell in a three-bred crossbred comparison with two breed crossbreds. The first lambs of the three breed cross are due to arrive in March of 1964.

PART II

Annual Research Report

Northwestern Montana Branch

of the

Montana Agricultural Experiment Station

Kalispell, Montana

by

Vern R. Stewart

Associate Agronomist

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

The cooperation with other station staff members and other agricultural agencies has made 1963 a productive and interesting research year at the Northwestern Montana Branch Station.

Cooperative work with the Regional Cereal Disease Control Laboratory at Pullman, Washington has aided in our dwarf bunt research program. Special thanks are due Drs. J. A. Hoffmann, E. L. Kendrick and L. H. Purdy.

Dr. E. R. Hehn has been a great aid in the winter wheat research program in Western Montana, giving much of his time to our problems in Western Montana.

To Mr. C. W. Roath, Superintendent, the author expresses his appreciation for help, council and careful administration of the total station research program.

Recognition is given to Mrs. Jeanette Calbick, Secretary, and Mr. Paul Boss, Farm Foreman, for their friendly and able assistance during 1963.

INTRODUCTION

The 1963 Research Report will contain the result of research from five different research areas or projects. Namely 5020 - Fertilizers; 5021 - Weed Investigations; 5022 - Forage Investigations; 5023 - Small Grain Investigations; and 5028 - New Crops Research.

Part of the above research was conducted both on and off-station. The one exception being the Corn Silage work (5028) conducted at the Western Montana Branch Station at Corvallis.

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

In the year 1963 the author attended and or had part in the following activities listed herein.

Date	Activity	Place
January 8	Agricultural Council Meeting	Kalispell, Montana
" 29	Crop Quality Council	Minneapolis, Minn.
" 30-31	Spring Wheat Workers Conference	St. Paul, Minn.
February 4-5	County Agents Up Dating Meeting	Kalispell, Montana
February 6	Station Advisory Council	Station
" 12	Agricultural Council Meeting	Kalispell, Montana
" 15-16	Agricultural Credit Conference	Bozeman, Montana
March 4	Dealer Fertilizer School	Kalispell, Montana
" 6-8	Annual Planning Conference	Bozeman, Montana
" 11	Dealers Fertilizer School	Kalispell, Montana
" 12	Agriucltural Council Meeting	Kalispell, Montana
" 18	Conservation Program	Eureka, Montana
" 18	Conservation Program	Fortine, Montana
" 18	Dealers Fertilizer School	Kalispell, Montana

Date	Activity	Place
March 19	Conservation Program	Libby, Montana
" 20	Conservation Program	Troy, Montana
" 25	Sugar Beet Weed Research Planning	Missoula, Montana
" 25	Dealers Fertilizer School	Kalispell, Montana
" 27	Conservation Day	Eureka, Montana
April 1	Fertilizer Dealers School	Kalispell, Montana
" 8	Fertilizer Dealers School	Kalispell, Montana
" 9	Agricultural Council	Kalispell, Montana
June 27-28-29	Summer Staff Conference	Billings, Montana Huntley, Montana
July 31	Attend Open House at Western Mont. Br.St.	Corvallis, Montana
August 1	Lake County delegation toured Station	Station
October 8	Agricultural Council Meeting	Kalispell, Montana
" 15-18	Division of Agricultural Annual Conf.	Bozeman, Montana
November 12	Agricultural Council Meeting	Kalispell, Montana
" 14	Flathead County High School Science Club	Kalispell, Montana
" 18-21	National American Society of Agronomy	Denver, Colorado
December 6	ASCP Meeting	Ronan, Montana
" 9	Fertilizer School Meeting	Kalispell, Montana

The following individuals visited the station in 1963:

Date	Name	Representing	Place
Jan. 3	Ross Pease	Farmers Union Central Exchange	Fairfield,Mont.
Mar. 14	Don Merkley	Western Montana Branch Station	Corvallis, Mont.
" 15	C.L. Miller	Cherry Growers Assoc.	Kalispell, Mont.
April 9	Phil Donally	Cominco	Spokane, Wn.
" 9	Homer Turner	Simplot	Dillon, Mont.
" 23	Ken Dunster	Amchem Corp.	Bozeman, Mont.
May 9	Carroll Shannon	International Harvestor	Spokane, Wn.
" 11	Bob Stroud	Dow Chemical Co.	Seattle, Wn.
" 29	F. H. McNeal	USDA ARS	Bozeman, Mont.
" 29	E. L. Sharp	Montana Ag. Experiment St.	Bozeman, Mont.
July 9	J. A. Asleson	Montana Ag. Experiment St.	Bozeman, Mont.
" 9	A. H. Post	Montana Ag. Experiment St.	Bozeman, Mont.
" 30	E. R. Hehn	Montana Ag. Experiment St.	Bozeman, Mont.
" 30	R. F. Eslick	Montana Ag. Experiment St.	Bozeman, Mont.
" 30	R. L. Warden	Dow Chemical Co.	Minneapolis,Minn.
" 30	Wm Coulter	Dow Chemical Co.	Midland, Mich.
" 30	Bob Strand	Dow Chemical Co.	Seattle, Wn.
Aug. 1	Group Lake Co.	Farmers	Lake, County
" 13	R. J. Marrase	Diamond Alkali	Cleveland, Ohio
" 15	A. F. Shaw	Mont. Extension Service	Bozeman, Mont.
Sept. 13	Harold Knutson etal	Indian Agency	Charlo, Mont.
" 13	Allen Nelson	Extension Service	Kalispell, Mont.
" 13	Lewis Fuller	SCS	Kalispell, Mont.
" 16	E. R. Hehn	Montana Ag. Experiment St.	Bozeman, Mont.
" 17	E. R. Hehn	Montana Ag. Experiment St.	Bozeman, Mont.
Oct. 31	Ken Dunster	Amchem Corp.	Bozeman, Mont.
Nov. 12	W. W. Mauritson	Conrad National Bank	Kalispell, Mont.
Dec. 27	Dave Leisle	Canadian Government Dept. of Ag.	Winnipeg, Manatoba

CLIMATE

The moisture pattern was quite different in 1963 from 1962. In 1962 there was 3.41 inches of precipitation in June, July and August, in 1963, 8.54 inches fell during the same period. Even with the high moisture in the fore mentioned months the total for the crop year was still below the long term average. Table I.

Yield of spring and winter grains were above average, due largely to the June rainfall. Some winter wheat varieties were low in yield because of sever stripe rust infestations in some areas of Western Montana.

A hail storm at about 5 P.M., August 24th, did considerable damage to crops on the station. This is the first time in the history of the station that crops were damaged to the point of making cereal nursery plots non-usable. Field oat losses were from 80 to 90%. Spring Barley and oat nurseries were not harvested for yield. Some damage was done to the potatoes, but they recovered some.

The growing season was 119 days or 12 days longer than the long term mean. A temperature of 32 was recorded Sept. 18, 1963, but no damage was done to gardens on this date. Thus, in reality, the growing season did not terminate until the first part of October, making this one of the longest seasons on record.

Table I, is a summary of 1963 climatic data and the period 1949-1962.

Table I. Summary of climatic data by months for the 1962-1963 crop year (September to August) and averages for the period, 1949 - 1963, at the Agricultural Experiment Station, Creston, Montana.

	MONTH												TOTAL or AVERAGE
	Sept. 1962	Oct. 1962	Nov. 1962	Dec. 1962	Jan. 1963	Feb. 1963	Mar. 1963	Apr. 1963	May 1963	June 1963	July 1963	Aug. 1963	Growing Season
Precipitation (inches)													
Current year	.58	1.85	1.31	.91	1.69	1.21	.85	1.07	.57	5.00	1.44	2.10	18.58
Average 1949 to 1962-63	1.32	1.66	1.57	1.56	1.58	1.30	1.06	1.31	2.11	2.68	1.19	1.50	18.84
Mean temperature (°F)													
Current year	54.7	44.7	38.0	32.5	11.8	33.1	38.7	43.2	51.4	59.4	63.0	75.7	45.5
Average 1949 to 1962-63	53.9	43.8	32.6	27.0	20.7	27.5	32.2	43.2	51.8	58.5	64.3	64.3	43.3

Last killing frost in spring* 1963	May 22 (32°)
Ave. 1949-1963	May 28 (30.5°)
First killing frost in fall* 1963	Sept. 18 (32°)
Ave. 1949-1963	Sept. 12 (29.9°)
Frost free period 1963	119 Days
Ave. 1949-1963	107 Days
Maximum summer temperature	94° on Aug. 9, 1963
Minimum winter temperature	24° below zero on Jan. 30, 1963

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

TITLE: Fertilizer Investigations

PROJECT NUMBER: 5020

PERSONNEL: Leader - Vern R. Stewart
Cooperator - C. W. Roath

FUNDS: State - $940.00

LOCATION: Dryland lease (Rotation - R) and off-station locations in four northwestern Montana Counties.

DURATION: Indefinite

OBJECTIVES:

1. To determine the effect of nitrogen and phosphorus on yield of small grains and the protein content of winter wheat.
2. To determine how different soil types influence the effect of these fertilizers.
3. To determine the effect of manganese on oats.
4. To obtain information from which sound fertilizer recommendations can be made.

EXPERIMENTAL DATA:

INTRODUCTION

Fertilizer research was conducted on winter wheat and spring barley in 1963. Studies were of two types on winter wheat; (1) the small plot carefully controlled, and (2) large field plots using field machinery for seeding and harvesting.

Plots were located in Lake, Sanders, Flathead and Missoula Counties.

MATERIALS AND METHODS

Where a soil survey was available the soils are described. Soil samples were obtained at 0 - 6 inches from each check plot and analyzed for N, P, K and pH.

Research plots were four rows eighteen feet long. Seeding rate for wheat was sixty pounds per acre and barley was seventy pounds per acre. Seeding was done with a four row belt seeder. The fertilizer was put in the soil first with the shoes set 2" deep. The cereal crop was seeded about one inch above the fertilizer by going over the plot a second time with the same seeder. Seeding for large plots was done with a large IHC grain drill with a fertilizer attachment. Manganese applications were made with a weed "spray rig".

In the small plots, three nitrogen and two phosphorus levels in all possible combinations were used. In the large field plots several formulations of commercially mixed fertilizers were used.

The barley study was designed to determine in a preliminary way the needs and levels of K_2O needed in potassium in different areas. Two levels of N, two levels of P and four of K were used in this study.

Harvesting of small research plots was done with a small fine-mower-harvester and threshed with a Vogel Thresher. The field plots were harvested with a self propelled combine. The entire field was harvested and weight plots measured and yield calculated for the entire field.

The variance analysis tecnique was used to analyze the data from the small research plots. Protein data was obtained for winter wheat studies and are made a part of this report.

RESULTS AND DISCUSSION

Winter Wheat

Three off-station fertilizer studies on winter wheat were seeded in the fall of 1962. They were located in Sanders, Lake and Ravalli Counties.

Sanders County - Only a portion of this nursery was harvested. Most of the stand was lost during the winter because of water washing out much of the stand in mid-February of 1963. Enough seed was obtained from each treatment to obtain a protein test. The protein data and soil test results are found in Table II. Phosphorus did not materially affect protein percentages, wheras Nitrogen resulted in a linear relationship to the amount applied.

Lake County - Fertilizer response was highly significant in the Lake Co. study. The soils test indicated that a response would be obtained from both N and P. The result validated the indications of the soil test. These data indicate the 40 P_2O_5 was equal to 80 P_2O_5 and that 15 pounds of N was equal to 45 this season. Thus, we find in 1963 that 15 N and 40 P_2O_5 were equal to the 45 N, 40 P_2O_5. See Table III.

Table IV gives the economic data calculated for this study.

Ravalli County - The fertility study in Ravalli County located on the L. B. McFadgen farm was not harvested because of very uneven soil conditions. Erosion through the center of the study destroyed some of the plots.

Spring Barley

Significant yield increase over the check was obtained in the barley study grown on the Lazy N Ranch, with 60 N - 26 P - 30 K and 60 N - 26 P - 33 K. There appears to be a potassium response but only when in combination with N and P. Postassium when used alone or at low rates did not materially increase the yield. High test weights were obtained from 26 P and 50 pounds of K, Table V. The soil analysis indicates low availability of all elements with the exception of the O.M. which was fair.

Field Plots

In 1963 wheat yields were higher than the 1962 yields, however protein percentages were very similar to 1962. Spring applications to R-5 were made, using 33 pounds of N per acre. Two hundred pounds of 16-20 were applied at seeding time. All other fertilizers were applied in the fall. Higher yields of Gaines and Delmar were obtained in R-5 than those for Westmont. Stripe rust may have been a contributing cause to this somewhat lower yield. Protein percentages were lower for the 22-96-0 than for other treatments. This was found to be true in 1962 also.

Dwarf Essex rape was reduced in stand because of very dry conditions in the fall of 1962. Approximately one-third of the three acre field was harvested. Table VI.

These data illustrate the need for an approximate one to one ratio of N to P_2O_5 in a fertility program on winter wheat to obtain maximum yields and a respectable protein level.

Spring Oats

The application of Manganese to Park oats to control "grey speck" disease was made early in the growing season. Close observation of these plots during the growing season indicate no apparent difference in "grey speck" disease. A hail storm on August 24th destroyed these plots and no yield data was obtained. A copy of the field plan is made a part of this report.

Fertilizer Plan: 5020 - 1963

Title: Effect of Manganese on Park Oats

Location: Field Numbers; X-5 Old D-5 on Station

Plot Size: 10 x 100 - 1000 square feet

Treatment Manganese #/Acre	Material per Plot of Sequestrene	Plot Number I	II
.25	21.7 g.	1	6
.50	43.4 g.	2	5
.75	65.1 g.	3	8
1.00	86.8 g.	4	7

Table II. Protein and soil test data from fertilizer study on Westmont winter wheat grown on the Sidney Cross ranch, Camas Prairie, Montana, in 1963.

Planted: September 18, 1962 Harvested: August 16, 1963

Treatment in lbs. per Acre N	P_2O_5	Protein in %
15	0	15.8
30	0	17.1
15	40	14.7
30	40	14.8
45	40	15.1
15	80	12.5
30	80	15.1
45	80	17.3
0	40	14.0
0	80	14.2
0	0	12.1
45	0	15.0

Soil Analysis

O.M.	3.1%	fair
P_2O_5	75#/A	very low
K_2O	1128#/A	good
pH	6.9	

Table III. Effect of nitrogen and phosphorus fertilizers on Westmont winter wheat grown on the Glen Vergerant farm, Polson, Montana in 1963. Four row plots, four replications.

Date Seeded: 9/19/62 Date Harvested: 8/5/63 Size of Plot: 28 sq.ft.

Treatment #/A N	Treatment #/A P_2O_5	Plot Yields in Grams I	II	III	IV	Total Grams	Yield Bu/Acre	Bu. Wt. in Lbs.	Protein
45	40	545	579	671	635	2430	34.7a	62.0	11.7
15	80	486	590	474	695	2245	32.1a	62.2	10.7
30	80	575	545	520	597	2237	32.0a	61.9	10.6
45	80	581	565	715	295	2156	30.8a	61.9	12.6
15	40	518	499	412	565	1994	28.5ab	61.5	11.0
30	40	505	540	415	415	1875	26.8abc	—	11.8
0	40	429	395	352	345	1521	21.7 bcd	—	10.4
0	80	530	335	295	360	1520	21.7 bcd	—	10.5
30	0	200	387	400	376	1363	19.5 cd	—	13.7
45	0	340	365	305	315	1325	18.9 d	—	14.4
15	0	250	310	290	425	1275	18.2 d	—	12.5
0	0	305	300	250	295	1150	16.4 d	—	11.6

$\bar{x}$..... 25.1
S.E.$\bar{x}$..... 2.45026
C.V.%..... 9.75

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	1420.85333	-
Nitrogen (N)	3	46573.6866	6.34*
Phosphorus (P_2O_5)	2	174105.395	23.68*
N x P	6	10563.89666	1.40
Error	33	7350.23303	
Total	47		

Soil Test

O.M..... 3.4% fair
P_2O_5..... 60#/A very low
K_2O..... 625#/A fair
pH..... 6.3 OK

Table IV. Yield and economic data from fertilizer study on Westmont winter wheat grown on the Glen Vergerant farm, Polson, Montana in 1963.

Date Planted: 9/19/62 Date Harvested: 8/5/63

Treatment Lbs./Acre N	P_2O_5	Yield Bushel per Acre	Protein %	Price 12/18/63	Gross return per Acre	Fertilizer Cost per Acre	Return per/Acre less Fertilizer Cost
45	40	34.7	11.7	$1.95	$67.67	$9.90	$57.77
15	80	32.1	10.7	1.93	61.95	9.30	52.65
30	80	32.0	10.6	1.93	61.76	11.40	50.27
45	80	30.8	12.6	1.98	60.98	13.50	47.48
15	40	28.5	11.0	1.94	55.29	5.70	49.59
30	40	26.8	11.8	1.95	52.26	7.80	44.46
0	40	21.7	10.4	1.93	41.88	3.60	38.28
0	80	21.7	10.5	1.93	41.88	7.20	34.68
30	0	19.5	13.7	2.01	39.20	4.20	35.00
45	0	18.9	14.4	2.03	38.37	6.30	32.07
15	0	18.2	12.5	1.98	36.04	2.10	33.94
0	0	16.4	11.6	1.95	31.98	0.00	31.98

[1] P_2O_5 @ 9¢ per Lb.
N @ 14¢ per Lb.

$\bar{x}$ 25.1

Table V. Yield data from fertilizer study grown in Flathead County on the Lazy N Ranch, Somers, Montana in 1963. Four row plots, four replications.

Date Planted: 5/3/63 Date Harvested: 8/27/63 Size of Plot: 32 sq.ft.

Treatment Rates In Pounds N	P	K	I	II	III	IV	Total Grams	Yield in Bushel per Acre	Bushel Weight in Lbs.
60	26	50	1155	999	1020	1130	4304	67.3*	48.7
60	26	33	1061	906	1130	835	3932	61.5*	50.3
60	26	0	644	924	1160	835	3563	55.7	46.5
0	26	0	726	801	900	950	3377	52.8	52.1
0	0	0	739	826	748	1000	3313	51.8	48.2
60	26	17	799	715	650	974	3138	49.1	47.7
0	0	50	581	629	763	1015	2988	46.7	52.5
60	0	0	685	686	709	781	2861	44.7	47.9

NOTE: Treatments yielding significant more than 0-0-0 (5%)

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	35185.50	2.06
Treatments	7	59081.9285	3.46*
Error	21	17074.92857	
Total	31		

$\bar{x}$ 53.7
S.E.$\bar{x}$..... 4.08478
L.S.D.(.05)12.0
C.V.%..... 7.61

O.M. ..... 4.8% good
P_2O_5 ..... 106 #/A poor
K_2O ..... 150 #/A poor
pH ..... 7.8 OK

Table VI. Yield data from Dryland Lease in 1963, using Winter Annuals. Grown at Creston, Montana 1962-63.

Crop	Variety	Field No.	Acres	N	P_2O_5	K_2O	Total Bushels	Yield/Bu. per/acre	Bu. Wt. in lbs.	Protein in %
Wheat	Westmont	R-1a	2.48	0	0	0	96.7	40.0	59.0	13.2
Wheat	Westmont	R-2a	2.54	32	40	0	119	46.9	60.0	12.4
Wheat	Westmont	R-3a	3.12	0	0	0	129	41.3	60.0	12.3
Wheat	Gaines	R-4a	3.0	0	0	0	128	32.0	63.0	—
Wheat	Westmont	R-5a	1.12	64	40	0	38.8	34.6	60.0	12.8
Wheat	Gaines	R-5a	1.23	64	40	0	67.5	54.9	63.0	—
Wheat	Delmar	R-5a	.61	64	40	0	33.3	54.6	60.0	—
Winter Barley	Olympia	R-6a	3.12	22	96	0	128.2	41.0	49	—
Rape	Dwarf Essex	R-7a	3.3	39	39	39	2980	903 #/a	—	—
Wheat	Westmont	R-8a	3.3	22	96	0	122	37.0	60	10.8

TITLE: Weed Investigations

PROJECT NUMBER: 5021

PERSONNEL: Leader - Vern R. Stewart
Consultants - Members of the Weed Research Committee and Industry Research personnel.

FUNDS: State - $1555.00
Commercial - 300.00

LOCATIONS: Station and off-station

PROBABLE DURATION: Indefinite

OBJECTIVES:

1. To find a herbicide that will effectively and economically control Lithospernum arvense in winter wheat, with little or no deleterious effect on wheat yields.
2. Study several herbicides, new and approved, and in combination as to their effectiveness in the control of various weed species in spring wheat.
3. To determine what herbicides will effectively control weeds in sugar beets and further measure the effect of these herbicides on the sugar beet plant.

EXPERIMENTAL DATA:

INTRODUCTION

The main emphasis of weed control in 1963 was on the use of herbicides in farm crops. Twenty-two herbicides were evaluated on eight legumes, sugar beets, winter wheat and spring wheat. Five herbicides were used on field bindweed and leafy spurge. A general discussion on technique and procedure will be found under materials and methods. A total of seven experiments were conducted or observed in 1963.

This season the research spray rig was remodled and mounted on the Cub tractor. The boom is 10 feet with nozzles spaced 20 inches apart. This sprayer maybe used for variable rate plots or uniform applications. A stainless steel tank was added to the machine later in the season, which holds 10 gallons of liquid.

MATERIAL AND METHODS

Plots established in 1963 were logarithmic plots. Generally they were 10 feet wide and 60 feet long with a half distance rate of 20 feet.

All materials were applied in a water solution with the research type sprayer discribed above. When required, materials were incorporated with a tandem disk harrow.

RESULTS AND DISCUSSION

Chemical control of Field Gromwell (Lithospernum arvense) in Winter Wheat.

This study was located in two areas to obtain a uniform weed population. One replication was located on the station in rotation R, the other on the Tom Ambrose farm, south of the Creston store. The weed population was very high on the Ambrose farm (Location II). In rotation R the gromwell was some what lower in population (Location I). The herbicide was applied to an established stand of winter wheat and a natural infestation of field gromwell. Applications were made when the field gromwell was in the early bloom stage.

Yield data was obtained by harvesting a given area (Table VII) at two, twenty, forty and sixty foot points in the plot. An estimate of weed control was made using a score of 1 to 10, where 1 equals no control and 10 complete control.

Herbicides used in this study were, Dacamine, 2,4-D amine, ACP-177A (Centrol), Tordon and Banvel D. The rates used and combinations of chemicals used are found in Table VII.

The low volatile ester of 2,4-D at 3 to 1½ pounds per acre was the most effective in controlling field gromwell. Some control was obtained with Dacamine and 2,4-D amine at 3 to 1½ pounds per acre. Banvel D caused stunting and lodging of winter wheat and also in combination with 2,4-D. Tordon was not effective in control of gromwell. In Location II yields were reduced at the 2 foot point in all treatments. Table VII gives the complete data on this study.

Effect of Tordon on Spring Wheat.

Tordon is a new compound developed by the Dow Chemical Company. A low rate, 3 ounces per acre, was used as a starting rate.

Weed control rates were not recorded but the effect of Tordon on the wheat plant was noted. In all treatments, with the 3 ounces starting rate, a reduction in plant vigor was noted, also a reduction in plant height. As the rate reduced across the plot the wheat was taller and more vigorous. In the Tordon, 2,4-D combination treatments, with Tordon at the rate of 1 ounce constant and the 2,4-D variable starting at 1 pound, and 2,4-D eight ounces constant and three ounces Tordon variable, the wheat plants were shorter at the 50 and 60 foot points than at the starting rate.

Generally, the yields increased in a linear manner in all treatments from the 2 foot point to 40 foot point with some exceptions noted, but these differences are not too great. In Table VIII are the recorded data obtained from this study.

Effects of certain herbicides on Centana Spring Wheat.

This study was a cooperative study with other station workers. The weed population in this study was not very high, thus a weed score was not obtained. When apparent visible effects on the wheat plant were noted they were recorded, Table IX.

Yields of grain by treatments were obtained. Yields increased in a linear manner from the 2 foot point to the 40 foot point. Thus, as the rate of herbicides decreased the yield increased.

Banvel D in combination with 2,4-D amine and Tordon caused more damage to the wheat plant than any of the herbicides used. These treatments caused early lodging, reduced the number of heads per plot and reduced the plant height at the higher rates of application. Banvel D caused a rosetting of the wheat plant following application. Table IX.

Chemical Weed Control in Sugar Beets.

Fifteen treatments and eleven herbicides were used in a sugar beet study conducted in Missoula County. Treatments, rate per acre, time of application and if incorporated or non-incorporated are found in Table X.

Amchen's 215-A(Pyramin) was the most outstanding product in this study. It gave fair to good weed control up to 20 feet or at 4 pounds per acre. This was true only when the material was incorporated in the soil before seeding. DuPont 634 when incorporated, controlled lambs quarter, but not pig weed. Beets were retarded by this herbicide.

T.D.282 and 283 were quite effective on pig weed, not too effective on lambs quarter. Some sugar beet damage was noted with both herbicides. Avadex plus CP22819 and CP32179 were not effective on any of the weeds in this study. Found under remarks in Table X, is a discription of the results of each herbicide used in the study.

Sugar content of four treatments, was secured and are found in Table XI. Sugar content in the Tilliam plots at the 20 foot point was the highest, some two percent above the check. These beets were also much smaller in size. Sugar content was higher for Amchem 62-215A(Pyramin) at the eight pound rate than the four pound rate of application.

Use of Herbicides to Control Weeds in New Legume Seedings.

The results presented here are a follow-up of 1962 work when herbicides were studied as to their effects on new legume seedings. Details of this study are found on page 58 of the 1958 Annual Research Report of the Northwestern Montana Branch Station. Presented in Table XII, in tabular form is the percentage of stand of each legume used in the study. Avadex and Eptam treatments reduced the stand of white dutch clover below the check. Avadex, Eptam, Dacthal, Avadex BW and Butoxone(ester) reduced the stand of birdsfoot trefoil below the check. In the case of Avadex and Avadex BW it is possible that weed populations may have had the major effect in the reduction of stand. The 1963 weed control scores are included in Table XII.

Leafy Spurge (Euphorbia esula).

Observation of this study in 1963, which was established in 1962 (see 1962 annual report) showed some regrowth in the plots treated with Weedone 638. Emulsamine E-3 gave better control of leafy spurge than the Weedone 638.

Field Bindweed (Convalvulus arvensis).

The 1963 observations of the field bindweed study established in 1962 are found in Table XIII. Tryben 200 was the most effective of the compounds used, giving a 100 percent control. 2,4-D LV (Diamond) was relatively effective where a weed score of eight was obtained.

Table VII. The effect of certain herbicides on Field Gromwell (Lithospernium arvenses) in winter wheat, grown at Creston, Montana in 1963.

Date Applied: Location I, April 26, 1963
Location II, April 29, 1963

Date Harvested: August 13, 1963

Size of Plot: Location I- 8.16662 sq.ft.
Location II- 7 sq.ft.

LOCATION I

Chemical	Starting Rate per Acre	Yield Bushel/Acre				Estimated Weed Control 1-10[1]				Notes
		2	20	40	60	2	20	40	60	
Dacamine	3 lbs	66.6	149.9	94.1	82.1	9.5	10.0	9.0	9.0	Control to 20 ft.
% of Check		110	128	148	117	190	143	113	129	
2,4-D amine	3 lbs	50.0	118.6	57.8	71.5	9.5	9.0	8.0	8.0	Control to 20 ft.
% of Check		83	101	91	102	190	129	100	114	
ACP 62-177A	2 lbs	46.1	95.1	59.8	48.0	9.5	10.0	7.0	8.5	Some control to 10 ft.
% of Check		76	81	94	69	190	143	88	121	
Tordon	3 oz	57.8	109.8	57.8	70.9	4.0	4.0	6.0	4.0	No control
% of Check		95	93	91	101	80	57	75	57	
Banvel D	3 lbs	21.6	53.9	34.3	63.3	10.0	9.5	7.0	5.0	Stunted growth of wheat
% of Check		36	46	54	90	200	136	88	71	control to 30 feet.
2,4-D ester	3 lbs	51.0	81.3	55.9	79.4	9.0	10.0	6.0	5.0	Control to 25 ft.
% of Check		84	69	88	113	180	143	75	71	
Banvel D	6oz constant	65.7	107.8	49.0	63.7	8.0	7.0	7.0	9.0	Control to 5 ft.
2,4-D amine	2 lbs	108	92	77	91	160	100	88	129	
% of Check										
2,4-D amine	6oz constant	32.3	68.6	37.2	71.5	9.0	10.0	8.5	9.0	Control to 10 ft.
Banvel D	2 lbs	53	58	58	102	180	143	106	129	
% of Check										
Check		60.6	117.6	63.7	70.0	5	7	8	7	No control

Table VII (con't)

LOCATION II

Chemical	Starting Rate per Acre	Yield Bushel/Acre 2	20	40	60	Estimated Weed Control 1-10[1] 2	20	40	60	Notes
Dacamine	3 lbs	29.7	44.6	41.4	26.3	10.0	8.0	6.0	2.0	Control to 10 feet.
% of Check		76	126	172	286	1000	800	600	200	
2,4-D amine	3 lbs	29.7	32.0	36.8	30.9	10.0	7.0	1.0	1.0	Control to 12 feet.
% of Check		76	90	153	336	1000	700	100	100	
ACP 62-177A	2 lbs	24.0	22.9	26.3	32.9	10.0	2.0	1.0	1.0	Some control to 2 feet.
% of Check		61	65	110	358	1000	200	100	100	
Tordon	3 oz	28.4	24.0	54.9	28.8	1.0	1.0	1.0	1.0	No control
% of Check		72	68	228	313	100	100	100	100	
Banvel D	3 lbs	37.7	25.2	32.0	40.0	10.0	5.0	5.0	4.0	Some control to 8 feet.
% of Check		96	71	133	435	1000	500	500	400	
2,4-D ester	3 lbs	37.0	35.2	26.3	30.9	10.0	9.8	8.0	6.0	Effective control to 20 ft.
% of Check		94	99	110	336	1000	980	800	600	
Banvel D	6oz constant	30.9	28.6	34.3	36.6	9.8	9.0	7.0	6.0	Stunted growth of wheat
2,4-D amine	2 lbs	79	81	143	398	980	900	700	600	some control to 20 ft.
% of Check										
2,4-D amine	6oz constant	20.6	26.3	42.3	43.2	9.8	8.0	9.0	9.0	Control to 20 ft., less
Banvel D	2 lbs	52	74	176	470	980	800	900	900	control to 40 ft.
% of Check										
Check		39.3	35.4	24.0	9.2	1	1	1	1	

1-10[1] This score placed on the population of weeds found in a harvested bundle of wheat.

1 - Large number of weeds in a bundle
10 - No weeds found in a bundle (Weed referes to field gromwell)

Table VIII. Yield data from Tordon study on Centana Spring Wheat grown at Creston, Montana in 1963. Field No. Y-8

Date Planted: 5/8/63 Date Harvested: 10/2/63 Size of Plot: 8 sq. ft.
Herbicide Applied: 6/11/63

Herbicide	Starting rate/Acre	Replication	Grams per Plot 2ft.	20ft.	40ft.	60ft.	Notes
Tordon	3 oz	1	150	90	200	160	High rates
		2	140	185	250	260	tended to
		3	140	215	215	180	cause lodging
		T	430	490	665	600	& retarded
		$\bar{x}$ bu/a	28.7	32.7	44.3	40.0	growth servere-
		% of Check	86	80	109	92	ly.
2,4-D	2oz constant	1	145	190	230	140	Reduction in
Tordon	3 oz	2	129	140	325	300	plant vigor at
		3	200	180	160	170	high rates and
		T	474	510	715	610	lodging.
		$\bar{x}$ bu/a	31.6	34.0	47.7	40.7	
		% of Check	95	84	117	94	
2,4-D	4oz constant	1	50	205	155	255	Same as above.
Tordon	3oz	2	85	225	240	255	
		3	114	230	188	190	
		T	249	660	583	700	
		$\bar{x}$ bu/a	16.6	44.0	33.5	46.7	
		% of Check	49.9	108	82	107	
2,4-D	8oz constant	1	130	135	155	165	Plants were
Tordon	3 oz	2	120	215	120	180	more severely
		3	189	215	180	235	retarded at the
		T	439	565	455	580	lower rate of
		$\bar{x}$ bu/a	29.3	37.7	30.0	38.7	Tordon.
		% of Check	88	93	74	89	
Tordon	1oz constant	1	175	135	200	180	Plants were
2,4-D	1 lb	2	111	215	180	228	more severely
		3	195	125	165	162	retarded at the
		T	481	475	545	570	lower rate of
		$\bar{x}$ bu/a	32.1	31.7	36.3	38.0	Tordon.
		% of Check	96	78	89	87	
2,4-D amine	3 lbs	1	50	180	215	210	No adverse ef-
		2	15	140	241	270	fects visible.
		3	80	175	210	205	
		T	145	495	666	685	
		$\bar{x}$ bu/a	9.7	33.0	44.4	45.7	
		% of Check	29	81	109	105	
Check		1	180	270	155	228	
		2	130	250	201	165	
		3	190	90	255	260	
		T	500	610	611	653	
		$\bar{x}$ bu/a	33.3	40.7	40.7	43.5	
		%	100	100	100	100	

Table IX. Yield data from broadleaf annual weed control in Centana Spring Wheat grown at Creston, Montana in 1963. Field No. Y-8

Date Planted: 5/8/63 Date Harvested: 10/1/63 Size of Plot: 8 sq.ft.

Chemical	Starting rate/Acre	Replication	Grams per Plot 2ft.	20ft.	40ft.	60ft.	Notes
Dacamine[1]	3 lbs	1	—	75	202	84	Plant retarded at
		2	95	194	265	205	high rates.
		3	—	—	185	189	
		T	95	269	652	478	
		$\bar{x}$ bu/a	19.0	26.9	43.5	31.9	
		% of Check	69	73	95	84	
2,4-D amine[1]	3 lbs	1	120	140	181	125	No visible effect
		2	130	89	173	150	on plants.
		3	130	275	250	260	
		T	380	504	604	535	
		$\bar{x}$ bu/a	25.3	33.6	40.3	35.7	
		% of Check	91	91	88	94	
ACP 62-177A	2 lbs	1	—	60	85	199	
		2	125	160	175	215	
		3	140	176	165	200	
		T	355	396	425	614	
		$\bar{x}$ bu/a	23.7	26.4	28.3	40.9	
		% of Check	86	71	62	108	
Tordon K-22	3 oz	1	140	65	175	195	Caused lodging &
		2	155	150	250	170	high rates, re-
		3	85	251	205	175	duced number of
		T	380	466	630	540	heads per plot, re-
		$\bar{x}$ bu/a	25.3	31.1	42.0	36.0	duced height of
		% of Check	91	84	91	95	plant at high rates.
Tordon 2530	3 oz	1	120	75	160	210	Same as above.
		2	155	194	245	150	
		3	55	119	250	200	
		T	330	388	655	560	
		$\bar{x}$ bu/a	22.0	25.9	43.7	37.0	
		% of Check	79	70	95	97	
Dacamine	3 lbs	1	130	118	210	130	Same reduction in
		2	130	180	200	179	plant vigor.
		3	125	130	55	135	
		T	385	428	465	444	
		$\bar{x}$ bu/a	25.7	28.5	31.0	29.6	
		% of Check	93	77	67	79	

Table IX. (con't)

Chemical	Starting rate/Acre	Replication	Grams per Plot 2ft.	20ft.	40ft.	60ft.	Notes
2,4-D ester	3 lbs	1	190	65	174	181	No visible effects on wheat plant.
		2	85	170	235	165	
		3	165	180	223	239	
		T	440	415	632	585	
		$\bar{x}$ bu/a	29.3	27.7	42.1	39.0	
		% of Check	106	75	92	103	
2,4-D amine	3 lbs	1	145	98	185	180	No visible effects on wheat plant.
		2	150	115	121	175	
		3	55	145	175	190	
		T	350	358	481	545	
		$\bar{x}$ bu/a	23.3	23.9	32.1	36.3	
		% of Check	84	65	70	96	
Banvel D & 2,4-D amine	6oz constant 2 lbs	1	50	160	180	205	Considerable damage to wheat. # of heads reduced. Plant tended to lodge & rosett following treatment.
		2	125	80	49	145	
		3	140	125	175	225	
		T	315	365	404	575	
		$\bar{x}$ bu/a	21.0	24.3	26.9	38.3	
		% of Check	76	66	58	101	
2,4-D & Banvel D	6oz constant 2 lbs	1	130	120	125	144	Same as above.
		2	102	175	155	210	
		3	99	160	119	155	
		T	331	455	399	509	
		$\bar{x}$ bu/a	22.1	30.3	26.6	33.9	
		% of Check	80	82	58	89	
Check		1	80	140	280	185	
		2	150	175	239	190	
		3	185	240	171	195	
		T	415	555	690	570	
		$\bar{x}$ bu/a	27.7	37.0	46.0	38.0	
		%	100	100	100	100	

1/ Herbicide applied when the wheat was in the three leaf stage, May 27, 1963 Other treatment made when wheat was in the five leaf stage, June 11, 1963

Table X. Data from weed control study on sugar beets grown on the Robert Edwards Jr. farm, Missoula, Montana in 1963.

Date Planted: 4/24/63 Plot Size: 10 x 60 feet

Chemical	Starting Rate	Replication	Weed control from start to (in ft.)	Remarks
Tilliam[1]	8#/a	1	18	Beets retarded. Beets wilted due to lack of moisture.
		2	15	Fair control, beets retarded some
		3	15	Fair control, beets were retarded
R-1910[1]	8#/a	1	12	No control of lambs quarter
		2	--	No control evident
		3	12	Some control to 12ft., very poor in general weed control
DuPont 634[1]	4#/a	1	48	Controlled lambs quarter, no control of pig weed
		2	42	Some reduction in plant vigor, more effective on lambs quarter than pig weed but retarded beets
		3	18	Reduced stand, fair weed control
Amchem 62-215A[1]	8#/a	1	--	No evidence of any control
		2	20	Some control of all weeds to 45 ft. Beets very vigorous, best control to 20 ft.
		3	15	Good control to 15ft., next 50ft. fair control, vigorous beets
CP 32179[1]	6#/a	1	21	Some Weed control to 21ft., but very little
		2		No control
		3		No control
Avadex + CP 22819[1]	1# constant 8#/a	1		Controlled fan weed to 20 feet
		2		No control
		3		No control
DuPont 634[2]	4#/a	1		No control, beets retarded
		2		No control
		3		Some reduction in fan weed, 1st 12 ft. Poor beet vigor.
Check, cultivated		1		
		2		
		3		
Check, hand weeded		1		
		2		
		3		

Table X. (con't)

Chemical	Starting Rate	Replication	Weed control, from start to (in ft.)	Remarks
R 4752[1]	8#/a	1	21	A degree of weed control to 21 ft. Lambs quarter not controlled.
		2	6	Controlled fan weed & pig weed, 6 ft. No control of lambs quarter.
		3	18	Some control to 18ft., beets fair in vigor.
T.D. 282[1]	10#/a	1	24	Controlled pig weed at all rates, lambs quarter not too well controlled.
		2		Not too effective on lambs quarter good control of pig weed, beet retarded, but good vigor.
		3	42	Beets damaged severly 1st 20ft, reduced stand, good to fair weed control.
T.D. 283[1]	10#/a	1	20	Good weed control, not too good on lambs quarter.
		2	27	Controlled all weeds present except lambs quarter.
		3	18	Controlled fan weed to 18ft, reduced beet vigor.
DuPont 634[3]	4#/a	1		No control.
		2		No control.
		3		Severe beet damage, some weed control to 15ft, none beyond that.
Amchem 62-215A[3]	8#/a	1		No control, however reduction in stand to 12 feet.
		2		Some control to 10ft, not very effective.
		3		Reduction in weed stand and growth to 20 feet.
Amchem 62-215A	8#/a	1		No control.
		2		No control.
		3		Reduction in beet vigor, decrease in weed growth 1st 12ft, no evidence of control beyond this point.

1 Applied pre-plant and incorporated in the soil, April 24, 1963
2 Applied post emergence of beets in three leaf stage, May 21, 1963
3 Applied pre emergence following seeding, April 24, 1963

Table XI. Sugar content of sugar beets from selected plots, treated with certain herbicides. Grown on the Robert Edwards, Jr. farm, Missoula, Montana in 1963.

Treatment	Rate #/Acre	Distance in Feet	Sugar Content in Percent				
			Replication				
			I	II	III	Total	Mean
Cultivated, Handweeded	0	20	14.2	13.5	16.2	43.9	14.6
Tilliam	4	20	15.3	16.8	16.1	48.2	16.1
Amchem 62-215A (Pyramin)	8	0	14.8	16.5	16.2	47.5	15.8
Amchem 62-215A (Pyramin)	4	20	13.5	12.5	15.9	41.9	14.0

Table XII. The effect of seven herbicides on the stand of eight legumes the following season after application.

Treatment		1963		Legume Species							
Chemical	Rate #/A	Score 1-10	Replication	Alfalfa (Ranger)	Alfalfa (Lodak)	Yellow Sweet-Clover	White Dutch-Clover	Birdsfoot Trefoil (Tana)	Sanfoin	Alsika	Red Clover (Kendland)
Check	0.0	0	1	100	100	50	50	50	100	20	100
		0	2	100	100	100	100	100	100	100	100
		0	3	100	100	100	70	95	95	60	100
		0	$\bar{x}$	100	100	83	82	82	98	60	100
Avadex	1.0	0	1	100	100	100	50	50	90	40	100
		0	2	100	100	75	55	80	65	30	100
		0	3	100	100	100	95	70	95	65	95
		0	$\bar{x}$	100	100	92	67	67	83	45	98
Eptam	3.0	0	1	100	100	90	30	70	100	65	100
		0	2	100	100	100	40	30	95	70	100
		3	3	100	100	100	100	100	100	85	100
		1	$\bar{x}$	100	100	97	57	57	98	73	100
Dacthal	6	7	1	100	100	100	75	90	85	90	100
		6	2	100	100	95	70	50	100	70	100
		4	3	100	100	100	95	50	100	90	100
		6	$\bar{x}$	100	100	98	80	63	95	83	100
Trifluralin	2	8	1	100	100	100	70	100	60	95	100
		9	2	100	100	100	100	100	100	100	100
		9	3	100	100	100	90	95	95	95	100
		9	$\bar{x}$	100	100	100	87	98	85	97	100
Avadex BW	1.0	0	1	100	100	95	60	50	80	70	90
		0	2	100	100	100	100	85	100	100	100
		0	3	90	95	100	85	30	95	95	100
		0	$\bar{x}$	97	98	98	82	55	92	88	97

Table XII. (con't)

Treatment		1963		Legume Species							
Chemical	Rate #/A	Score 1-10[1]	Replication	Alfalfa (Ranger)	Alfalfa (Lodak)	Yellow Sweet-Clover	White Dutch-Clover	Birdsfoot Trefoil (Tana)	Sanfoin	Alsika	Red Clover (Kendland)
Butoxone amine	1.0	9	1	100	100	100	95	80	80	100	95
		9	2	100	100	100	100	70	95	100	100
		7	3	100	100	35	100	100	90	60	85
		8	$\bar{x}$	100	100	78	98	83	88	86	93
Butoxone ester	1.0	8	1	100	100	100	100	100	100	100	100
		6	2	100	100	100	100	70	95	100	100
		8	3	100	100	50	70	45	75	60	60
		7	$\bar{x}$	100	100	83	90	72	90	87	87

[1] Weed Score
0 - no control
10 - complete control

Table XIII. Effect of certain herbicides on field bindweed (Convalvulus arvensis), Creston, Montana in 1962 - 1963.

Herbicide	Rate #/A Acid	1962 Observation	1963, 1-10[1] Weed Score
Tryben 200 (T.B.A.)	15	Evidence of good control	10
2,4-D amine	4	Little evidence of control	1
2,4-DLV (2-Ethyl-hexylester 2,4-dichlorophenoxyacetic acid)	4	Evidence of some control, some plants still green	8
Weedone 638	4	Browning of plants, some green plants still evident	1
Emulsamine E-3 (2,4-dichlorophenoxy-acetic acid, tertiary dodecyl primary amine salt)	4	Where stand of bindweed is heavy plants are brown, some green plants are evident also	1

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

TITLE: Forage Investigations (Annual)

PROJECT NO: 5022

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

FUNDS: State $877.00

LOCATION: Western Montana Branch Station, Corvallis, Montana
Tutvedt farm, Kalispell, Montana

DURATION: Indefinite

OBJECTIVES: To determine the adaptability of certain commercial corn varieties.

EXPERIMENTAL DATA:

INTRODUCTION

Corn for silage was the only annual forage studied this season. Two sorghums were included in the silage study this season. Yield plots were located on the Western Montana Branch Station and large field studies on the Tutvedt brothers farm.

The growing season in the Bitterroot was one of the longest in history. Silage was harvested September 24, 1963, and there had not been any frost up to that date.

MATERIALS AND METHODS

Fourteen entries were included in the research plots, two of which were sorghums. The sorghum entries were not included in the field study.

The research plots were 2 row plots, 18 feet long. Planting rate was 35,000 seeds per acre. The study was replicated four times. Fifty pounds per acre of nitrogen was side dressed after seeding. On June 19, 60 pounds of nitrogen was side dressed. Moisture was poor at seeding time, and the nursery was "irrigated up". Seven irrigations were made during the growing season. Dates were as follows; May 19, June 20, July 9, 12, 25, August 3, 12 and September 10. The plots were cultivated twice during the growing season.

Plots were harvested by hand and each one weighed. A population count was made at harvest time.

Data was analyzed using the variance analysis technique and the Duncan's Multiple Range Test used to determine statistical differences.

The field studies were planted with a grain drill. Rows were approximately ½ mile long and spaced 35 inches. Yields were obtained by harvesting an entire row with a field chopper. The entire row was weighed and yields calculated from this information.

RESULTS AND DISCUSSION

Research Plots

DeKalb 633, G and R High Sugar #4, and DeKalb 441 were the highest yielding lines. They were significantly higher in yield than the other entries. Two of them were in the 110-119 day maturity range, namely G and R High Sugar #4 and DeKalb 441. DeKalb 633 is in the 120-140 day range. Stands were very good in all entries. There were no lines with any degree of maturity. Table XIV, gives details of this study.

Field Study

In the field study located at Tutvedt Brothers Farm, moisture percentages were in the 80 to 90 per cent range. When adjusted to 70 per cent moisture the 120-140 day maturity range group averaged about one ton to the acre more than the 110-119 day maturity range. The 120-140 maturity range yield was 4.7 tons per acre and 110-119 day, 3.8 tons per acre. See Table XV.

Table XIV. Agronomic data from corn nursery grown in Ravalli County on the Western Montana Branch Station. Two row plots, four replications.

Date Planted: 5/16/63 Date Harvested: 9/24/63 Size of Plot: 112 square feet

Variety or Cross	Maturity Stage [1] at Range	Harvest	Tons per Acre adjusted to 70% Moisture I	II	III	IV	Total	Tons/A Average	Alfalfa Hay equivalent Tons/Acre	Moisture Content @ Harvest %	Plant population in Plants/Acre
Dekalb 633	120-140	M	20.9	21.7	21.6	20.3	84.5	21.1a	7.2	71.59	34906
G & R High Sugar #4	100-119	M	20.1	22.1	17.6	24.2	84.0	21.0ab	7.2	73.15	33350
DeKalb 441	100-119	B	19.5	21.9	20.1	19.3	80.8	20.2abc	6.9	70.00	34517
P.A.G. S x 29	120-140	M	19.3	19.6	19.3	17.3	75.7	18.9 bcd	6.4	77.08	36948
DeKalb XL 45	100-119	M	16.6	18.2	20.6	20.3	75.5	18.9 bcd	6.4	66.35	33836
DeKalb XL 361	120-140	B-M	18.0	17.9	20.4	17.9	74.2	18.6 cd	6.3	75.00	36948
N.K. KT 652	120-140	M	20.2	19.4	18.0	16.6	74.2	18.6 cd	6.3	76.67	34128
N.K. KE 497	100-119	B	17.5	18.2	18.9	15.6	70.2	17.6 de	6.0	69.32	31795
P.A.G. 323	120-140	B	15.5	17.7	17.0	18.8	69.0	17.3 de	5.9	76.47	35684
N.K. KT 632	120-140	M	17.7	14.6	16.8	16.1	65.2	16.3 ef	5.6	77.08	33545
P.A.G. Suchow 35	Sorghum	[2]	16.4	16.5	15.9	16.2	65.0	16.3 ef	5.6	71.06	No Count
N.K. - KM 558	100-119	M	16.5	16.3	15.3	16.6	64.7	16.2 efg	5.5	73.61	33156
N.K. - KM 589	100-119	M	15.0	14.8	11.7	14.7	56.2	14.1 fg	4.8	78.17	30531
P.A.G. Suchow I	Sorghum	[2]	13.1	14.7	14.5	12.9	55.2	13.8 g	4.7	75.00	No Count

[1] B - Blister
M - Milk
SD - Soft Dough

[2] - 60% headed

$\bar{x}$ . . . . . 17.8 tons/A
S.E. $\bar{x}$ 72136
C.V. % 4.05

Analysis of Variance

Source	D.F.	Mean Square	F
Replication	3	.81762	
Varieties	13	21.01439	10.10*
Error	39	2.08146	
Total	55		

Table XV. Corn silage data from corn demonstration grown in Flathead County on the Tutvedt Bros. Farm. Kalispell, Mont. 1963.

Date Seeded: 9/11 & 12/63 Date Harvested: 5/31/63

Size of Sample: 6221 square feet.

Variety or Cross	Maturity Range	% Moisture at Harvest	Tons per Acre			
			Green	Dry	Adjusted to 70% Moisture	Alfalfa Equivalent
DeKelb XL 45	100-119	87.50	16.2	2.03	3.5	1.2
DeKalb 441	"	88.75	14.3	1.61	2.7	.9
Northrup King KE 497	"	83.75	13.9	2.26	3.8	1.3
" " KM 558	"	83.75	16.6	2.71	4.6	1.6
" " KM 589	"	86.25	14.4	1.98	3.4	1.2
G & R High Sugar #4	"	85.00	19.0	2.85	4.9	1.7
DeKalb XL 361	120-140	83.75	15.6	2.53	4.3	1.5
" XL 633	"	85.00	17.5	2.62	4.5	1.5
Physters P.A.G. 323	"	82.50	17.4	3.05	5.2	1.7
" P.A.G. Sx29	"	86.25	18.7	2.57	4.4	1.5
Northrup King KT 632	"	85.00	13.3	1.99	3.4	1.2
" " KT 652	"	82.50	17.3	3.02	5.1	1.8
" " KC 3		81.25	17.0	3.17	5.4	1.8
" " GD-36		82.50	17.7	3.10	5.3	1.8

TITLE: Spring Grain Investigations

PROJECT NO: 5023 (Spring Barley)

PERSONNEL: Leader - Vern R. Stewart
Cooperators - R. F. Eslick
E. A. Hockett

FUNDS: State $875.00

LOCATION: Northwestern Montana Branch Station - Field #; Y-2, A1-b and off-station locations.

DURATION: Indefinite

OBJECTIVE:

1. To determine the adaptation of new and introduced barley varieties and selections.
2. To aid the plant breeding program.

EXPERIMENTAL DATA:

INTRODUCTION

Varietal testing and two genetic studies made up the spring barley work on the station. Three off-station nurseries were grown in Lake, Missoula and Ravalli Counties.

Only the off-station nurseries were harvested for yield because of a hail storm August 24, 1963, which destroyed the greater part of the station nurseries.

MATERIALS AND METHODS

A complete description of procedures and design for variety testing and seed production are found on page seventy of the 1961 Annual Research Report of the Northwestern Montana Branch Station.

The irrigated intrastate and station yield nursery contained 22 entries, the off-station nurseries 11 entries. Two special nurseries consisted of the Nupana nursery and a two-six row isogenic barley yield nursery.

RESULTS AND DISCUSSION

Intrastate Nursery

The intrastate and station yield nursery is designed for irrigated land, but is grown under non-irrigated conditions at Creston. In most seasons we have equal yields with no irrigation when compared to some of the irrigated stations. A hail storm on August 24, 1963 did considerable damage to this nursery. Thus no yield data was obtained. Test weights were higher than the USDA Standard for most entries. The per cent plumps was above 90% for all entries, see Table XVI.

Off-Station Nurseries

Three off-station nurseries containing eleven entries were seeded in 1963. They were located in Missoula, Ravalli and Lake Counties. They were grown in single rod row plots, replicated four times.

Ravalli County - Yields in this nursery were very high. Ingrid is used as the check variety. Only one entry, Glacier x Compana Moc 75 was significantly lower in yield than the check. Bushel weights were equal to or above USDA Standards. See Table XVII.

Missoula County - Because of the high rain fall, the cooperator did not irrigate this nursery. The yields are relatively good for the area. The two-row entries were all higher in yield than any of the six-row entries. Ingrid had the highest test weight in the study. Table XVIII, shows the tabulated data for this study.

Lake County - Yields were good in this study. Here we find some of the six-row entries quite high in yield. Traill is the highest yielding entry. Test weights of all entries were higher than USDA Standards. Ingrid is fifth in yield, but is not significantly different from Traill. See Table XIX.

Nupana Nurseries

The Nupana nurseries were grown under both dryland and irrigated conditions. The design was a split plot, latin square.

Observations were made as to the type of seedling emergence. No differences were noted in either nursery.

Because of the hail storm no yield data was obtained from either nursery. Heading dates are recorded for both the dryland and irrigated nurseries. Height and lodging data are recorded for the dryland nursery.

Threshability and bushel weight data were compiled by Dr. E. A. Hockett. Data for the dryland study is found in Table XX, and irrigated data in Table XXI.

Two-six row Isogenic Nurseries

The isogenic nurseries were grown under both dryland and irrigated conditions. Heading date, kernel size and test weight were obtained for both nurseries, in addition lodging and height were recorded for the dryland study. The irrigated nursery was all lodged and no differentiation could be made between entries.

As would be expected the six-row types have a lower percent of plump kernels, than the two row types.

Test weights were higher on an average under irrigation than under dryland conditions. Test weights for two row types under dryland conditions were 46.6 pounds per bushel, for the six row types 45.8 pounds per bushel. Under irrigated conditions the differences were greater between the two row and six row type. Two row 47.3, six row 45.4 pounds per bushel. Table XXII, gives the dryland data, Table XXIII, irrigated data.

Table XVI. Agronomic data from the Irrigated Intrastate and Station Yield Barley Nursery, Creston, Montana in 1963. Four row plots. Field No. Y-2.

Date Planted: 5/7/63 Date Harvested: 8/28/63

Variety or Cross	C. I. N. No.	Heading Date	Height in Inches	Lodging %	I		II		III		Average		Bushel Weight
					Plump	Thin	Plump	Thin	Plump	Thin	Plump	Thin	
Foma	11333	7- 6	31	10	96	4	98	2	95	5	96.3	3.7	52.1
Glacier x Mars	58-5926	6-29	35	7	97	3	99	1	96	4	97.3	2.7	46.0
Unitan	10421	6-28	33	30	94	6	94	6	95	5	94.3	5.7	48.5
Compana	5438	6-30	30	93	98	2	98	2	98	2	98.0	2.0	50.1
Hafnia		7- 6	31	12	99	1	98	2	99	1	98.7	1.3	51.0
Glacier x Manchuria	58-5614	6-21	28	7	94	6	95	5	--	-	94.5	5.5	45.0
Glacier x Mars	58-6076	6-29	37	5	99	1	99	1	96	4	98.0	2.0	46.1
Domen x Breuna Wisa	62-2979	7- 6	38	10	99	1	99	1	98	2	98.7	1.3	51.4
Glacier x Manchuria	58-5724	6-29	39	12	96	4	95	5	94	6	95.0	5.0	48.1
Trophy	10647	6-29	34	45	94	6	95	5	94	6	94.3	5.7	50.0
Glacier x Manchuria	11346	6-29	37	25	96	4	95	5	95	5	95.3	4.7	47.4
Jubilee	Can.268	7- 1	35	12	90	10	90	10	90	10	90.0	10.0	50.1
Larker	10648	6-27	33	35	96	4	96	4	96	4	96.0	4.0	50.5
Betzes	10871	7- 2	31	22	96	4	99	1	96	4	97.0	3.0	52.5
Domen x Breuns Wisa	68-2988	6- 6	35	8	99	1	99	1	99	1	99.0	1.0	52.1
Palliser	10860	7- 4	32	42	99	1	99	1	97	3	98.3	1.7	49.5
Lico x Ogalitsu	56-7569-7	6-26	35	8	99	1	95	5	99	1	97.7	2.3	----
Piroline	9558	7- 2	31	7	99	1	96	4	99	1	98.0	2.0	53.4
Betzes	6398	7- 2	35	37	97	3	96	4	97	3	96.7	3.3	52.6
Lico x Ogalitsu	56-7570-5	6-25	35	28	99	1	96	4	96	4	97.0	3.0	47.0
Glacier x Compana	Moc.75	6-29	36	12	99	1	99	1	98	2	98.7	1.3	50.0
Freja	7130	7- 2	28	33	98	2	99	1	99	1	98.7	1.3	52.1

Table XVI. (con't)

Variety or Cross	C. I. N. No.	Heading Date	Height in Inches	Lodging %	I Plump	I Thin	II Plump	II Thin	V Plump	V Thin	Average Plump	Average Thin	Bushel Weight
Lico x Ogalitsu	11345	6-21	33	30	94	6	95	5	89	11	92.7	7.3	----
Ingrid	10083	7- 6	32	23	99	1	98	2	99	1	98.7	1.3	53.3
Traill	9538	6-29	33	27	95	5	94	6	88	12	92.3	7.7	48.4
Gem	7243	6-23	32	10	98	2	98	2	98	2	98.0	2.0	44.9
Lico x Ogalitsu	56-7570-9	6-26	36	35	99	1	99	1	98	2	98.7	1.3	47.3
Vantage	7324	7- 2	36	13	98	2	95	5	94	6	95.7	4.3	49.6
Isaria		7--2	30	5	99	1	99	1	99	1	99.0	1.0	52.2
Glacier x Manchuria	58-5725	6-29	38	18	96	4	95	5	94	6	95.0	5.0	47.9
Glacier x Manchuria	58-5726	6-29	37	17	97	3	99	1	96	4	97.3	2.7	46.4

Table XVII. Agronomic data from irrigated off-station spring barley nursery grown in Ravalli County on the Western Montana Branch Station, Corvallis, Montana in 1963. Single row plots, four replications.

Date Planted: 4/30/63 Date Harvested: 8/21/63 Size of Plot: 16 square feet.

Variety or Cross	C. I. or N. No.	Heading Date	Height in Inches	Lodging %	I	II	III	IV	Total Grams	Yield Bushel 1 Acre	Bushel Weight in Lbs.
Betzes	6398	6-26	30	38	984	1080	840	686	3590	112.2	52.7
Traill	9538	6-20	30	15	720	919	750	865	3254	101.7	49.1
Betzes Erectoidies	10871	6-20	29	15	937	726	797	790	3250	101.6	52.8
Ingrid	10083	6-26	28	2	915	785	604	746	3050	95.3	53.2
Trophy	10647	6-20	31	35	791	740	670	785	2986	93.3	49.7
Freja	7130	6-26	25	5	680	820	816	634	2950	92.2	52.5
Larker	10648	6-20	30	30	645	720	656	855	2876	89.9	48.7
Unitan	10421	6-20	29	25	766[1]	740	720	635	2861	89.4	48.0
Palliser	10860	6-26	30	40	794	626	595	835	2850	89.1	49.7
Piroline	9558	6-20	35	5	750	616	625	715	2706	84.6	52.5
Glacier x Compana	Moc. 75	6-20	31	5	730	431	590	480	2231	69.7*	49.9

Note Ingrid used as a check in this nursery
* Varieties yielding significantly less than the check (5%)
[1] Calculated missing plot

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	17308.90666	1.57
Varieties	10	30026.25	2.72*
Error	29	11008.09586	
Total	42		

$\bar{x}$.....	92.7
S.E.$\bar{x}$.....	6.5596
L.S.D.(.05)..	18.9
C.V.%.....	7.08

Table XVIII. Agronomic data from an irrigated off-station spring barley nursery in Missoula County on the Al Goodan Farm, Missoula, Montana in 1963. Single row plots, four replications.

Date Planted: 5/1/63 Date Harvested: 8/29/63 Size of Plot: 16 sq. ft.

Variety or Cross	C. I. or N. No.	Height in Inches	I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in lbs.
Betzes	6398	19	385	494	479	395	1753	54.8	49.9
Freja	7130	19	320	427	510	327	1584	49.5	49.1
Ingrid	10083	20	312	440	490	274	1516	47.4	51.8
Glacier x Compana	Moc.75	23	381	410	459	262	1512	47.3	48.7
Larker	10648	22	260	426	325	484	1495	46.7	49.2
Piroline	9558	20	349	440	405	272	1466	45.8	50.6
Betezes Erectodies	10871	21	275	420	435	300	1430	44.7	50.0
Palliser	10860	24	240	445	345	384	1414	44.2	49.5
Traill	9538	21	220	300	295	219	1034	32.3**	48.0
Trophy	10647	22	215	285	295	219	1014	31.7**	47.2
Unitan	10421	18	185	290	302	235	1012	31.6**	46.7

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

$\bar{x}$	43.3
S.E.$\bar{x}$	3.27926
L.S.D.(.05)	9.5
L.S.D.(.01)	12.8
C.V.%	7.58

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	[illegible]	15.67**
Varieties	10	15745.269	5.72**
Error	30	2751.14067	
Total	43		

Table XIX. Agronomic data from an irrigated off-station spring barley nursery grown in Lake County on the Walter Mangles farm, Polson, Montana in 1963. Single row plots, four replications.

Date Planted: 5/1/63 Date Harvested: 8/20/63 Size of Plot: 16 sq. ft.

Variety or Cross	C. I. or N. No.	Height in Inches	Grams per Plot I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in lbs.
Traill	9538	19	349	489	620	835	2293	71.7	50.2
Piroline	9558	17	356	410	555	916	2237	69.9	52.5
Betzes	6398	19	365	480	555	810	2210	69.1	51.3
Freja	7130	20	374	520	565	694	2153	67.3	51.9
Ingrid	10083	17	330	603	581	626	2140	66.9	52.6
Betzes Erectodies	10871	18	385	386	501	626	1898	59.3	50.5
Trophy	10647	21	310	402	380	704	1796	56.1	50.3
Larker	10648	20	294	345	438	675	1752	54.8	50.2
Glacier & Compana	Moc.75	22	320	310	265	735	1630	51.0*	49.6
Palliser	10860	25	370	405	410	444	1629	50.9*	49.3
Unitan	10421	20	330	401	390	500	1621	50.7*	49.1

Note: Ingrid is used as a check in this nursery.
* Varieties yielding significantly less than the check.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	234187.72	33.27
Varieties	10	18087.005	2.57*
Error	30	7039.51966	
Total	43		

$\bar{x}$	60.7
S. E. $\bar{x}$	5.24405
L.S.D.(.05) . . .	15.2
C.V.%	8.64

TITLE: Small Grain Investigations

PROJECT NUMBER: 5023 (Winter Barley)

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

FUNDS: State $386.50

LOCATION: Northwestern Montana Branch Station, field numbers R-6 and in several off-station locations.

DURATION: Indefinite

OBJECTIVES:

1. To obtain the information necessary for making varietal recommendations and for evaluating new varieties and selections.
2. To produce a seed source of a recommended variety.

EXPERIMENTAL DATA:

INTRODUCTION

There was no new material made available for work in 1962-1963. Therefore, only off-station nurseries were seeded in the fall of 1962.

MATERIAL AND METHODS

A complete description of techniques and procedures in small grain research can be found on page seventy of the 1961 Annual Research Report of the Northwestern Montana Branch Station.

Winter barley research in 1962-1963 consisted of five off-station seedings. These nurseries contained 10 entries each. Location of each nursery will be found under Results and Discussion.

A three and three tenths acre seed block was grown. This was handled with commercial machinery. This is not a research project but is reported here for the record.

RESULTS AND DISCUSSION

These nurseries will be discussed by counties.

Missoula - The nursery was located on the Carl Hartwig farm west of Missoula. This was planted in a dry gravelly area, and emergence was poor. During the winter, the entire nursery winter killed.

Lake - Located on the Glen Vergerant farm west of Polson, this nursery did emerge in the fall with fairly good stands. Very few plants came through the winter and no data was obtained from this study.

Sanders - This nursery was located on the Sidney Cross farm near Camas Prairie. Fall emergene was good. Warm weather in February caused this area to be flooded. As a result the entire stand was killed.

Mineral - Located on the Charles Frey farm near Tarkio, this nursery was the only off-station nursery from which data was obtained. Fall emergence was good, and fair stands were obtained in some entries. Alpine is the highest yielding entry significantly higher than Olympia which is used as a check. Spelts, much later in maturity than any of the barley varieties, was second in yield in this nursery. See Table XXIV, for details.

Lincoln - This nursery located on the Dick Bretten farm was destroyed with a field cultivation.

Olympia barley was grown for seed in Rotation R. One hundred-twenty-eight bushels were produced on 3.12 acre for an average yield of 41.0 bushels per acre.

Table XX. Agronomic data from dryland Nupana nursery grown at Creston, Montana in 1963. Field No. 4-1b.

Date Planted: 5/7/63 Date Harvested: 8/26/63 Hail Storm: 8/24/63

Designation	Heading Date	Height in Ins.	Lodging %	Threshability in Percent - Replications									Test Wt. lbs/Bu.
				1	2	3	4	5	6	7	Total	Mean	
62-Nupana I	6-26	26	64	90.2	91.1	92.4	97.0	92.1	93.9	92.3	649.0	92.7	56.5
62-Nupana II	6-27	26	74	90.3	87.9	95.3	91.9	95.6	93.9	84.7	639.6	91.4	56.0
62-Nupana III	6-26	25	62	91.9	94.8	93.7	97.0	89.8	92.8	96.5	656.5	93.8	57.5
62-Nupana IV	6-27	26	61	92.0	95.0	91.2	96.5	88.9	92.4	86.6	642.6	91.8	55.5
62-Nupana V	6-27	27	70	93.8	93.6	96.9	95.4	92.7	92.1	78.6	643.1	91.9	55.2
62-Nupana VI	6-27	26	76	91.8	93.2	89.4	95.1	82.7	74.5	91.9	618.6	88.4	55.4
Compana	6-27	26	58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0

Analysis of Variance for Threshability

Source	D.F.	Mean Square	F.
Replications	6	32.96	1.714
Treatments	5	23.23	1.208
Error	30	19.22	
Total	41	21.72	

Table XXI. Agronomic data from irrigated Nupana Nursery grown at Creston, Montana in 1963. Field No. Y-2

Date Planted: 5/7/63 Date Harvested: 8/26/63 Hail Storm: 8/24/63

Designation	Heading Date	Lodging %	Threshability in Percent Replications 1	2	3	4	5	6	7	Total	Mean	Test Wt. lbs/Bu.
62-Nupana I	6-26	100	87.1	94.2	94.2	87.3	89.4	88.7	87.3	628.2	89.7	54.6
62-Nupana II	6-29	100	89.6	90.0	85.2	87.5	91.0	94.1	91.4	628.8	89.8	55.0
62-Nupana III	6-28	100	88.2	88.3	84.7	79.0	87.8	94.4	92.2	614.6	87.8	55.9
62-Nupana IV	6-26	100	92.6	92.0	92.9	80.0	88.7	90.6	95.0	631.8	90.2	55.4
62-Nupana V	6-29	100	91.4	94.0	90.0	91.6	82.2	94.2	93.0	636.4	90.9	55.4
62-Nupana VI	6-28	100	88.2	94.5	91.2	81.7	86.6	84.8	94.9	621.9	88.8	55.9
Compana[1]	6-28	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.3
Stamm			97.4							97.4	97.4	60.4

[1] Represents a mixture in Compana

Analysis of Variance for Threshability

Source	D.F.	Mean Square	F.
Replications	6	46.01	3.650
Treatment	5	8.45	.670
Error	30	12.61	
Total	41	16.99	

Table XXII. Heading Date, Lodging and Kernel Size Data from the Dryland Two-Six Row Isogenic Barley Yield Nursery grown at Creston, Montana in 1963. Field No. A1-6.

Date Planted: 5/7/63 Date Harvested: 8/27/63

Treatment	Heading Date	Height in Inches	Lodging %	I % Plump	I % Thin	II % Plump	II % Thin	III % Plump	III % Thin	Ave. % Plump	Ave. % Thin	Bushel Weight in Lbs.
Glacier x Munsing, early, 2 row	6-18	22	-	100	0	100	0	99	1	99.7	.3	44.0
Glacier x Munsing, early, 6 row	6-18	21	2	96	4	95	5	95	5	95.3	4.7	43.6
Glacier x Munsing, late, 2 row	6-19	23	7	100	0	98	2	99	1	99.0	1.0	44.5
Glacier x Munsing, late, 6 row	6-18	22	13	99	1	94	6	91	9	94.7	5.3	44.5
Glacier	6-17	27	2	99	1	100	0	99	1	99.3	.7	45.2
Munsing	6-22	22	72	94	6	94	6	95	5	94.3	5.7	50.9
Compana	6-27	24	53	96	4	97	3	96	4	96.3	3.7	49.4
Glacier	6-14	24	5	100	0	99	1	99	1	99.3	.7	45.0
Glacier x Compana, late, 6 row	6-29	23		79	21	80	20	76	24	78.3	21.7	45.4
Glacier x Compana, late, 2 row	6-30	27	20	99	1	100	0	100	0	99.6	.4	49.0
Glacier x Compana, early, 2 row	6-26	26	2	98	2	100	0	99	1	99.0	1.0	47.6
Glacier x Compana, early, 6 row	6-17	22	4	84	16	85	15	85	15	84.7	15.3	47.6
Munsing x Titan, late, 2 row	6-28	29	7	99	1	99	1	99	1	99.0	1.0	47.9
Munsing x Titan, late, 6 row	6-27	23	17	80	20	86	14	85	15	83.7	16.3	48.0
Titan	6-25	32	30	89	11	90	10	89	11	89.3	11.7	46.9
Munsing	6-22	23	55	94	6	94	6	85	15	91.0	9.0	50.2
Munsing x Titan, early, 6 row	6-19	27	13	80	20	85	15	83	17	82.7	17.3	----
Munsing x Titan, early, 2 row	6-19	26	12	99	1	99	1	99	1	99.0	1.0	----

Table XXIII. Heading Date and Kernel Size Data from Irrigated Two-Six Row Isogenic Barley Yield Nursery grown at Creston, Montana in 1963. Field No. Y-2.

Date Planted: 5/6/63 Date Harvested: 8/27/63

Treatment	Heading Date	I % Plumps	I % Thins	II % Plumps	II % Thins	III % Plumps	III % Thins	Average % Plumps	Average % Thins	Bushel Weight in lbs.
Glacier x Munsing, early, 2 row	6-19	99	1	99	1	99	1	99.0	1.0	47.0
Glacier x Munsing, early, 6 row	6-19	98	2	95	5	99	1	97.3	2.7	44.0
Glacier x Munsing, Late, 2 row	6-23	99	1	99	1	99	1	99.0	1.0	45.0
Glacier x Munsing, late, 6 row	6-23	90	10	90	10	94	6	91.3	8.7	43.3
Glacier	6-21	99	1	99	1	99	1	99.0	1.0	47.2
Munsing	6-25	94	6	93	7	89	11	92.0	8.0	49.6
Compana	6-27	99	1	98	2	95	5	97.3	2.7	49.1
Glacier	6-23	99	1	99	1	99	1	99.0	1.0	44.9
Glacier x Compana, late, 6 row	6-29	80	20	80	20	81	19	80.3	19.7	45.5
Glacier x Compana, late, 2 row	6-31	100	0	100	0	100	0	100.0	0.0	48.1
Glacier x Compana, early, 2 row	6-25	99	1	99	1	100	0	99.3	.7	49.4
Glacier x Compana, early, 6 row	6-21	85	15	84	16	81	19	83.3	16.7	47.8
Musing x Titan, late, 2 row	6-30	99	1	98	2	99	1	98.7	1.3	47.1
Musing x Titan, late, 6 row	6-26	70	30	75	25	85	15	76.7	23.3	46.5
Titan	6-30	89	11	89	11	90	10	89.3	10.7	47.5
Munsing	6-29	95	5	90	10	89	11	91.3	8.7	49.9
Munsing x Titan, early, 6 row	6-22	75	25	82	18	78	22	78.3	21.7	49.2
Munsing x Titan, early, 2 row	6-22	95	5	95	5	99	1	96.3	3.7	---

Table XXIV. Agronomic data from dryland off-station winter barley nursery grown in Mineral County on the Charles Frey ranch, Superior, Montana in 1963. Single row plots, four replications.

Date Planted: 9/18/63 Date Harvested: 7/26/63 Size of Plot: 12 square feet

Variety or Cross	C.I.No.	Height in Inches	% Stand	I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in lbs.
Alpine	9578	27	73.3	230	200	395	220	1045	43.6**	44.5
Spelts		40	73.3	205	170	296	225	896	37.3**	30.0
Ohio Winter	7072	29	43.3	211	181	210	145	747	31.1	44.5
Boz. cc x 242	9176	26	41.7	115	105	376	130	726	30.3	—
Chase (Nebr. 52434)	9581	25	60.0	185	160	265	105	715	29.8	—
Ellis	9529	28	48.3	115	175	151	245	686	28.6	45.6
Va. 59-37-3	10658	24	56.7	195	105	285	75	660	27.5	—
Boz. cc x 349-9		26	60.0	201	105	130	215	651	27.1	—
Svalof 42-7	7187	25	46.7	60	125	126	270	581	24.2	—
Olympia	6107	23	30.0	70	189	185	104	548	22.8	—
Kty. 56-74	10542	25	40.0	110	120	165	120	515	21.5	—
Boz. cc x 54-3		26	63.3	141	140	140	80	501	20.9	—
Kearney	7580	25	43.3	80	65	130	205	480	20.0	—
Dicktoo		28	33.3	30	90	90	50	260	10.8	—

NOTE: Olympia is used as a check in this nursery.

** Varieties yielding significantly more than the check 1%.

$\bar{x}$..... 26.8
S.E.$\bar{x}$..... 2.962
L.S.D.(.05)..... 8.5
L.S.D.(.01)..... 11.3
C.V.%..... 11.04

Analysis of Variance

Source	D.F.	Mean Square	F.
Replication	3	16165.018	12.80**
Varieties	13	91033.3107	72.10**
Error	39	1262.56912	
Total	55		

TITLE: Small Grain Investigations

PROJECT NUMBER: 5023 (Oats)

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

FUND: State - $387.50

LOCATION: Northwestern Montana Branch Station, Field No. Y-2 and three off-station locations.

DURATION: Indefinite

OBJECTIVES:

1. To determine the adaptation of new and introduced oat varieties and selections by comparison with recommended varieties.

EXPERIMENTAL DATA:

INTRODUCTION

The production of oats in Montana needs to be increased to meet the demand in the area. In past years oats have been high in production but this production has declined in recent years. More concentrated effort should be put forth on this crop.

MATERIAL & METHODS

A complete description of techniques and procedures in small grain research is found on page seventy of the 1961 Annual Research Report of the Northwestern Montana Branch Station.

Twenty-seven entries were included in the Regional Dryland oat nursery. Six of the entries were Montana varieties or selections.

Three off-station irrigated oat nurseries were seeded in Missoula, Ravalli and Lake Counties. These contained ten entries.

RESULTS & DISCUSSION

The Regional Nursery was about 90 percent destroyed by a hail storm on August 24, 1963. Therefore, the only data from this nursery recorded is heading date, lodging and height in inches. See Table XXV.

The off-station nurseries will be discussed by counties.

Missoula - Grown on the Al Goodan farm west of Missoula this nursery had a mean yield of 630 bushels per acre. Overland was the only variety significantly lower in yield than Park, which is used as a check. See Table XXVI, for detailed data.

Ravalli - This nursery was grown on the Western Montana Branch Station. Yields were very high in this study with a mean of 154.2 bushels per acre. Test weights were all above the U.S.D.A. standard. R.L.2123.66 was significantly higher in yield than Park. See Table XXVII.

Lake - This nursery was grown on the Walter Mangle's farm near Polson. The data obtained from this study were non-significant. Part of this was due to the date of harvest which was to early. This is reflected in the test weights of all entries. Table XXVIII.

Table XXV. Agronomic Data from the Northwest Regional Dryland Oat Nursery grown at Creston, Montana in 1963. Four row plots, three replications. Field No. Y-2

Date Seeded: 5/7/63

Variety	C.I. No.	Heading Date	Lodging %	Height in Inches
Clinton	4259	7- 1	5	38
Markton	2053	7- 6	49	45
Park	6611	7- 9	25	41
Victory	1145	7-11	35	48
59 AB 2781	7572	7- 9	10	44
Bannock	2592	7- 9	50	44
58 AB 2782	7573	7- 9	10	44
58 AB 2784	7575	7- 9	5	41
58 AB 2773	7588	7- 9	28	43
58 AB 2777	7591	7- 9	10	43
58 AB 2787	7578	7- 9	5	42
58 AB 2786	7577	7- 9	5	41
58 AB 2779	7593	7- 9	5	44
Overland	4181	7- 5	0	37
Russell	7557	7- 6	35	44
Zanster	7476	7- 6	33	44
RL 212310	7955	7- 7	55	43
RL 2306	7959	7-12	45	51
(Sauk x Simcoe)	7461	7- 1	50	44
59 AB 7018	7961	7- 7	35	47
59 AB 7061		7- 7	35	49
Basin*	5346	7- 8	10	41
Rodney*	6661	7- 8	55	47
Garry*	6662	7- 8	23	46
Bridger*	2611	7-11	55	51
Mission*	2588	7- 5	18	44
Gopher*	2027	7- 4	28	39

* Montana entries.

NOTE: Hail storm August 24, 1963 destroyed the yield of this nursery.

Table XXVI. Agronomic data from an irrigated off-station spring oat nursery grown in Missoula County on The A. Goodan farm, Missoula, Montana in 1963. Single Row Plots, Four Replications.

Date Planted: 5/1/63 Date Harvested: 8/29/63 Sixe of Plot: 16 square feet.

Variety or Cross	C.I.No.	Height in Inches	Plot Yields in Grams I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in Lbs.
Bridger	2611	40	454	390	451	280	1575	73.9	32.5
R.L. 2123.66	New Entry	26	440	350	376	296	1462	68.6	31.0
Park	6611	32	454	385	320	235	1394	65.4	33.2
58 AB 2777	7591	27	331	390	386	282	1389	65.1	31.9
58 AB 2787	7578	28	360	365	312	290	1327	62.2	31.5
58 AB 2782	7573	30	431	325	301	265	1322	62.0	31.8
Basin	5346	32	374	336	301	298	1309	61.4	31.5
58 AB 2786	7577	28	430	306	285	270	1291	60.5	32.3
Gopher	2027	29	350	270	335	306	1261	59.1	33.0
Overland	4181	30	290	301	245	260	1096	51.4*	32.0

NOTE: Park used as a check in this nursery.
* Varieties yielding significantly less than the check .05.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	21553.96966	12.99**
Varieties	9	4027.51111	2.43*
Error	27	1659.83703	
Total	39		

$\bar{x}$.....	63.0
S.E.$\bar{x}$.....	3.8207
L.D.S.(.05).....	11.1
C.V.%.....	6.07

Table XXVII. Agronomic data from an irrigated off-station oat nursery grown in Ravalli County on the Western Montana Branch Station, Corvallis, Montana in 1963. Single row plot, four replications.

Date Planted: 4/30/63 Date Harvested: 8/21/63 Size of Plot: 16 square feet.

Variety or Cross	C.I.No.	Heading Date	Height in Inches	Plot Yield in Grams I	II	III	IV	Total Grams	Yield Bushels per Acre	Bushel Weight in Lbs.
R.L. 2123.66	New Entry	7- 8	44	916	854	1094	845	3709	173.9*	35.9
58 AB 2777	7591	7- 8	39	950	884	914	926	3674	172.3	33.9
Bridger	2611	7- 8	51	951	840	855	801	3447	161.6	36.9
Park	6611	7- 8	38	901	880	834	751	3366	157.8	35.1
58 AB 2787	7578	7- 8	41	896	810	843	730	3279	153.8	33.1
58 AB 2786	7577	7- 8	44	835	885	735	725	3180	149.1	34.0
Basin	5346	7- 1	40	860	749	809	729	3147	147.6	35.4
Gopher	2027	6-26	43	782	735	786	816	3119	146.3	37.2
58 AB 2782	7573	7- 8	40	850	716	742	755	3063	143.6	34.1
Overland	4181	7- 1	36	785	675	736	706	2902	136.1	36.1

NOTE: Park used as a check in this nursery.
* Variety yielding significantly more than the check .05.

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	16645.7	5.46*
Varieties	9	17150.1777	5.62*
Error	27	3049.94074	
Total	39		

$\bar{x}$.....	154.2
S.E.$\bar{x}$.....	5.17912
L.S.D.(.05)..	14.8
L.S.D.(.01)..	20.1
C.V.%.....	3.36

Table XXVIII. Agronomic data from an irrigated off-station spring oat nursery grown in Lake County on the Walter Mangles farm, Polson, Montana in 1963. Single row plots, four replications.

Date Planted: 5/1/63 Date Harvested: 8/20/63 Size of Plot: 16 square feet.

Variety or Cross	C.I.No.	Height in Inches	Plot Yield in Grams I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in Lbs.
Bridger	2611	41	391	726	504	790	2411	113.1	33.8
R.L. 2123.66	New Entry	31	375	419	470	642	1906	89.4	31.6
Basin	5346	30	310	479	785	312	1886	88.4	30.7
58 AB 2786	7577	29	295	435	439	560	1729	81.1	30.6
58 AB 2777	7591	29	345	516	385	435	1681	78.8	29.1
58 AB 2782	7573	30	390	426	293	478	1587	74.4	29.8
Park	6611	30	245	581	324	424	1574	73.9	30.4
Overland	4181	29	365	400	355	389	1509	70.8	28.4
58 AB 2787	7578	29	384	415	295	315	1409	66.1	29.0
Gopher	2027	30	290	281	360	424	1355	63.5	29.8

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	39773.0933	3.22*
Varieties	9	23676.8366	1.92
Error	27	12352.03592	
Total	39		

$\bar{x}$.....	79.9
S.E.$\bar{x}$.....	10.42268
L.S.D.....	N.S.
C.V.%.....	13.04

TITLE: Small Grain Investigations

PROJECT NUMBER: 5023 (Spring Wheat)

PERSONNEL: Leader - Vern R. Stewart
Cooperator - F. H. McNeal

FUNDS: State $775.00

LOCATION: Northwestern Montana Branch Station, Field No. Y-2
Three off-station locations

DURATION: Indefinite

OBJECTIVES:

1. To determine the adaptation of new and introduced spring wheat varieties and selections by comparison with recommended varieties.
2. To evaluate materials from spring wheat breeding program in Montana and other stations.

EXPERIMENTAL DATA:

INTRODUCTION

Spring wheat yields in 1963 were above average. This was due in part to the 5 to 6 inch rainfall in June. Considerable stripe rust was found in the variety Centana.

Two station nurseries and three off-station nurseries were grown in 1963. The off-station nurseries were grown under irrigation.

MATERIALS AND METHODS

The advance yield nursery contained 27 entries, the western regional white spring wheat nursery contained 22 entries. The three off-station nurseries each had 12 entries. Thatcher is used as a check in the advanced yield nursery, Idaed 59 in the white wheats, and Centana in the off-station nurseries.

RESULTS AND DISCUSSION

The effect of stripe rust was noted in the yield reduction in varieties that usually have relative high yields in this area. Rescue, a history of low yield in this area was the highest yielding entry in 1963. The lower yielding entries also have a high stripe rust coefficients. Some hail damage was sustained on August 24th, and perhaps accounts in part for the lower yields than anticipated in this nursery. Test weights are below USDA standards in most varieties. See Table XXIX, for details of the data.

The mean yield of the white wheat nursery was lower than the hard red, as has been found to be true in past seasons. Examination of the data in Table XXX, will reveal the effect that stripe rust had on yields. In most cases, as the rust coefficient increased the yield decreased. Idaed 59 had a higher rust coefficient than would have been expected.

The off-station nurseries will be discussed by counties in which they are located.

Missoula - Yields from the spring wheat nursery grown on the Al Goodan farm west of Missoula were fair, with a mean yield of 30.3 bushels per acre. C.I. 13641 was the most outstanding entry, with a yield of 47.5 bushels per acre, which is significantly higher in yield than Centana. The durm entries are all found at the bottom of the yield list. See Table XXXI.

Ravalli - The mean yield of the nursery grown at the Western Montana Branch Station was 51.1 bushels per acre. C.I. 13641 was highest in yield with 65.3 bushels per acre, Centana second with 59.8 bushels per acre. See Table XXXII.

Lake - The data from this nursery is found in Table XXXIII. This study was grown on the Walter Mangle's farm near Polson. Yields were quite low as were test weights. The mean yield was 21.3 bushels per acre. Centana was second in yield, with C.I. 13641 third.

Table XXIX. Agronomic data from advance yield spring wheat nursery at Creston, Montana in 1963. Four row plot, four replications, Field No. Y-2.

Date Planted: 5/7/63 Date Harvested: 9/11/63 Size of Plot: 12 square feet.

Variety or Cross	C. I. or N. No.	Heading Date	Height in Inches	Lodging in %	Stripe Rust 0-4	Stripe Rust %	Stripe Rust Coefficient	Grams per Plot I	II	III	IV	Total Grams	Yield Bushel per Acre	Bushel Weight in Lbs.
Rescue	12435	7-3	47	—	1	1	.2	315	460	560	350	1685	56.2**	58.2
Sawtana	13304	7-5	48	—	0	5	.5	365	350	349	380	1444	48.1**	58.8
B49-102 x K.F. 338 B61-18	13762	7-5	47	—	0	T	.1	340	381	289	282	1392	46.4**	59.0
Centana x B49-102	B60-68	7-4	48	—	2	20	8	327	374	345[1]	330	1376	45.9**	58.5
Rescue x N 2389	B60-99	7-5	47	—	0	T	.1	349	325	316	381	1371	45.7**	57.4
II-50-17 x Pilot	B60-82	7-3	43	10	0	T	.1	275	344	480	260	1359	45.3**	59.5
Thatcher[5] x Rescue	B60-106	7-3	46	—	0	10	1	355	330	300	335	1320	44.0**	58.3
B49-102 x N 2389 B60-92	13591	7-5	48	—	2	20	8	275	350	265	380	1270	42.3*	59.2
Justin	13462	7-5	41	—	0	T	.1	230	333	390	311	1264	42.1*	57.8
Selkirk	13100	7-4	45	—	0	T	.1	310	327	305	265[1]	1207	40.2	57.0
Thatcher[5] x Rescue	B60-109	7-5	47	—	0	1	.1	305	329	210	346[1]	1190	39.7	—
K338 x Lee, B61-88	13772	7-2	46	—	1	10	2	290	285	275	312	1162	38.7	58.9
Lakota (Durum)	13335	7-5	46	—	3	50	40	276	310	298	235	1119	37.3	57.5
II-50-17 x Pilot Shrinden	13586	7-3	49	—	1	T	.2	245	301	285	275	1106	36.9	60.1
Norin 10 Bvr x Centana	B60-19	7-4	33	—	3	60	48	272	250	250	280	1052	35.1	56.9
Cypress	13344	7-5	47	—	0	T	.1	239	235	260	310	1044	34.8	59.2
Thatcher	10003	7-3	44	—	0	10	1	235	280	235	291	1041	34.7	57.5
Centana	12974	7-5	48	—	3	35	28	230	245	299	255	1029	34.3	58.0
Wells (Durum)	13333	7-5	44	35	3	60	48	240	305	220	245	1010	33.7	58.3
Lee[2] x K.F.R.L. 2938	13463	7-1	41	—	2	25	10	265[1]	281	180	230	956	31.9	—
Langdon (Durum)	13165	7-5	45	—	3	50	40	252[1]	210	245	240	947	31.6	—
Nrn 10-Bur-14 x Centana B59-3	13587	7-5	39	—	3	70	56	160	235	211	305	911	30.3	—
N 2211 x Centana	B60-86	7-1	44	—	3	35	28	219	230	249	206	904	30.1	—
Chinnok	13220	7-5	48	8	0	5	.5	219	210	220	240	889	29.6	—
Mindum (Durum)	5296	7-6	56	—	3	50	40	215	271	190	200	876	29.2	—
Ceres	6900	7-5	47	—	3	25	20	205	225	186	227	843	28.1	—
Minn II-53-404	13465	7-1	46	—	2	40	16	234	215	155	221	825	27.5	—

Table XXIX. (con't)

1/ Calculated missing plot
NOTE: Thatcher is used as a check in this nursery
* Varieties yielding significantly more than the check (.05)
** Varieties yielding significantly more than the check (.01)

$\bar{x}$.....	37.7
S.E.$\bar{x}$.....	2.25109
L.S.D.(.05).....	6.3
L.S.D.(.01).....	8.4
C.V.%.....	5.96

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	3515.827	3.08
Varieties	26	11901.49003	10.44**
Error	75	1139.71358	
Total	104		

Table XXX. Agronomic data from uniform western regional white spring wheat nursery at Creston, Montana in 1963. Four row plot, four replications, Field No. Y-8.

Date Planted: 5/7/63 Date Harvested: 9/11/63 Size of Plot: 12 square feet.

Variety or Cross	C. I. or N. No.	Heading Date	Height in Inches	Stripe Rust 0-4	Stripe Rust %	Stripe Rust Coefficient	Grams per Plot I	Grams per Plot II	Grams per Plot III	Grams per Plot IV	Total Grams	Yield Bushel per Acre	Bushel Weight in Lbs.
Burt x K.F. 57-70136	13641	7-10	47	0	T	.1	340	344	335	355	1374	45.8**	58.5
Gabo x Idaed^3	13637	7- 6	39	2	35	14	285	320	331	319	1255	41.8**	58.0
Eureka x Lemhi x Idd^2	13636	7- 3	39	0	5	.5	325	395	285	232	1237	41.2**	57.6
Burt x K.F. 58-2025	13736	7-11	35	1	5	1	256	315	315	336	1222	40.7**	57.6
Svenno x Lee - W Semidwarf	13730	7- 4	31	2	50	20	289	289	290	285	1153	38.4**	57.0
Karn x Henry Sel 90	13735	7- 6	44	0	T	.1	224	315	280	315	1134	37.8**	58.9
Thatcher	10003	7- 4	42	0	10	1	215	266	309	265	1055	35.2*	58.0
Burt x K.F. 58-2479	13640	7- 5	40	2	30	12	240	251	310	235	1036	34.5	58.0
Onas	6221	7- 1	40	1,2	30	18	236	283	274	215	1008	33.6	58.5
Premier x Federation	13732	7- 4	40	2	10	4	200	245	279	245	969	32.3	58.0
Idaed 59	13631	7- 1	38	1	30	6	205	224	203	240	872	29.1	59.5
Premier x Federation	13733	7- 4	39	2	50	20	190	230	210	240	870	29.0	58.0
Idaed	11706	7- 2	39	2	40	16	211	231	140	234	816	27.2	58.0
Idaed x Burt 42-5	13722	7- 4	33	1	35	7	175	220	229	180	804	26.8	--
Premier x Federation	13734	7- 9	41	3	50	40	181	205	200	215	801	26.7	--
Onas 52 x Idaed 18-1	13721	7- 6	39	3	60	48	174	199	180	170	723	24.1	--
Premier x Federation	13731	7- 8	41	2	50	20	175	160	160	199	694	23.1	--
Baart	1697	7- 4	40	4	75	75	99	132	266	156	653	21.8	--
Federation	4734	7- 7	37	4	75	75	131	165	165	176	637	21.2	--
Lemhi 62	13435	7- 7	39	4	80	80	110	131	110	110	461	15.4	--
Lemhi 53	13258	7- 6	36	4	80	80	51	55	60	76	242	8.1	--
Lemhi	11415	7- 6	37	4	80	80	40	40	50	55	185	6.2	--

NOTE: Idaed 59 is used as a check in this nursery

* Varieties yielding significantly more than the check (.05)

** Varieties yielding significantly more than the check (.01)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	4280.28533	4.78**
Varieties	21	24975.78457	27.92**
Error	63	894.56171	
Total	87		

$\bar{x}$.....	29.1
S.E.$\bar{x}$.....	1.99435
L.S.D.(.05)..	5.6
L.S.D.(.01)..	7.5
C.V.%.....	6.85

Table XXXI. Agronomic data from irrigated off-station spring wheat nursery grown in Missoula County on the Al Goodan farm, Missoula, Mont. in 1963. Single row plots, four replications.

Date Planted: 5/1/63 Date Harvested: 8/29/63 Size of Plot: 16 sq.ft.

Variety or Cross	C.I. or N.No.	Height in Inches	Grams per Plot I	II	III	IV	Total Grams	Yield Bushel per A.	Bushel Weight in Lbs.
Burt x Kenya Farmer	13641	38	659	465	420	355	1899	47.5**	60.4
II-50-17 x Pilot	13586	37	375	389	420	390	1574	39.4	60.5
K.338 x Lee, B61-88	13772	36	423	301	365	380	1469	36.7	59.9
Centana	12974	36	430	310	460	260	1460	36.5	59.9
Idaed 59	13631	31	335	296	295	270	1196	29.9	59.9
Ceres	6900	37	330	311	245	285	1171	29.3	60.0
Thatcher	10003	37	330	345	260	209	1144	28.6	59.0
Minn. II-53-404	13465	36	295	300	255	234	1084	27.1	59.2
Mindum (Durum)	5296	42	315	225	166	266	972	24.3	60.5
Wells (Durum)	13333	35	299	235	200	216	950	23.8	60.0
Lakota (Durum)	13335	36	220	277	210	186	893	22.3	58.5
Langdon (Durum)	13165	37	215	170	170	180	735	18.4	—

NOTE: Centana used as a check in this nursery
* Varieties yielding significantly more than the check (.05)
** Varieties yielding significantly more than the check (.01)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replication	3	15032.412	5.70**
Varieties	11	27478.27909	10.42**
Error	33	2638.37921	
Total	47		

$\bar{x}$.....	30.3
S.E.$\bar{x}$.....	2.56826
L.S.D.(.05)..	7.4
L.S.D.(.01)..	9.9
C.V.%.....	8.47

Table XXXII. Agronomic data from irrigated off-station Wheat Nursery grown in Ravalli County on the Western Montana Branch Station, Corvallis, Montana, in 1963. Single row plot, four replications.

Date Planted: 4/30/63 Date Harvested: 9/6/63 Size Plot: 16 sq. ft.

Variety or Cross	C. I. or N. No.	Heading Date	I	II	III	IV	Total Grams	Yield Bushel 1 Acre	Bushel Weight in Lbs.
Burt x Kenya Farmer	13641	7- 8	630	715	630	635	2610	65.3	57.6
Centana	12974	7- 8	684	596	495	615	2390	59.8	59.0
II-50-17 x Pilot B61-95	13586	6-26	553	585	644	500	2282	57.1	60.5
Lakota (Durum)	13335	6-26	506	564	566	485	2121	53.0	59.8
Wells (Durum)	13333	6-26	545	551	496	525	2117	52.9	60.6
Thatcher	10003	6-26	537	553	494	494	2078	52.0	58.6
Mindum (Durum)	5296	7- 1	460	612	520	430	2022	50.6	61.9
Ceres	6900	6-26	600	455	448	472	1975	49.9	59.4
K.338 x Lee B61-88	13772	6-20	492	435	424	536	1887	47.2	58.9
Minn II-53-404	13465	6-26	465	470	515	410	1860	46.5	58.2
Langdon	13165	6-26	448	466	330	391	1635	40.9	60.1
Idaed 59	13631	6-20	405	455	330	344	1534	38.4	59.0

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	7984.07666	2.93*
Varieties	11	22732.65727	8.35**
Error	33	2721.68242	
Total	47		

$\bar{x}$.....	51.1
S.E.$\bar{x}$.....	2.60849
L.S.D.(.05)...	7.5
L.S.D.(.0)...	10.2
C.V. %.....	5.11

Table XXXIII. Agronomic data from irrigated off-station Spring Wheat Nursery grown in Lake County on the Walt Mangles farm, Polson, Montana, in 1963. Single row plot, four replications.

Date Planted: 5/1/63 Date Harvested: 8/20/63 Size Plot: 16 sq. ft.

Variety or Cross	C. I. or N. No.	Height in Inches	I	II	III	IV	Total Grams	Yield Bushel 1 Acre	Bushel Weight in Lbs.
K.338 x Lee, B61-88	13772	31	305	375	280	280	1240	31.0	54.0
Centana	12974	34	245	306	295	240	1086	27.2	57.2
Burt x Kenya Farmer	13641	33	265	275	270	245	1055	26.4	58.5
Ceres	6900	31	210	244	225	290	969	24.2	58.2
Thatcher	10003	31	210	325	206	205	946	23.7	57.8
Idaed 59	13631	26	205	235	295	150	885	22.1	59.5
II-50-17 x Pilot B61-95	13586	34	201	233	181	250	865	21.6	58.5
Minn II-53-404	13465	33	199	199	200	185	783	19.6	--
Wells (Durum)	13333	29	165	200	190	162	717	17.9	--
Lakota (Durum)	13335	32	180	205	145	140	670	16.8	--
Mindum (Durum)	5296	34	155	155	135	176	621	15.5	--
Langdon	13165	31	110	140	95	75	420	10.5	--

Analysis of Variance

Source	D. F.	Mean Square	F
Replication	3	4176.24533	4.24*
Varieties	11	12870.37	13.05**
Error	33	985.92467	
Total	47		

$\bar{x}$.....	21.3
S.E.$\bar{x}$.....	1.56997
L.S.D.(.05)..	4.5
L.S.D.(.01)..	6.0
C.V. %.....	7.35

TITLE: Small Grain Investigations

PROJECT NUMBER: 5023 (Winter Wheat)

PERSONNEL: Leader - Vern R. Stewart
Cooperators - E. R. Hehn, J. A. Hoffman*, E. L. Kendrick*, L. H. Purdy* (* USDA, ARS)

FUNDS: State - $3509.00

LOCATION: Northwestern Montana Branch Station, Field No. E-3, R-rotation and several off-station locations.

PROBABLE DURATION: Indefinite

OBJECTIVES:

1. To obtain the information necessary for making varietal recommendations and for evaluating new varieties and selections.
2. To conduct a breeding program in Northwestern Montana designed to produce high yielding varieties with particular emphasis on acceptable quality and resistance to dwarf smut and stripe rust. Other agronomic characteristics such as straw strength, winter hardiness, etc., will be evaluated in this program.
3. To determine the effect of seeding date, seeding depth and variety on the incidence of dwarf smut.
4. To determine the effectiveness of fungicides in the control of stripe rust.
5. To maintain a pure genetic varietal seed source of recommended winter wheat.

EXPERIMENTAL DATA:

INTRODUCTION

Research in 1962-1963 has been directed to finding a solution or solutions to two major problems in winter wheat production in western Montana. The problems are dwarf bunt and stripe rust. Of the two,stripe rust is causing more yield losses throughout the area.

The winter wheat research program in 1962-1963 consisted of; variety testing a breeding program, cultural studies, and a cooperative program with the Regional Disease Control Laboratory in Pullman, Washington.

MATERIALS AND METHODS

A complete description of procedures and designs are found on page seventy of the 1961 Annual Research Report of the Northwestern Montana Branch Station.

Three nurseries were seeded in the fall of 1962, two located on the station and one off-station in the dwarf bunt area, northwest of Kalispell. Six off-station nurseries were seeded in September of 1961 with one each being located in Missoula, Ravalli, Lake, Sanders, Mineral and Lincoln Counties.

Thirty entries were included in the intrastate hard red winter wheat nursery and it was grown in field E-3. The western regional white wheat nursery contained 25 entries and was also grown in field E-3. In the dwarf bunt area, Northwest of Kalispell, the regional hard red winter wheat nursery was grown on the Lance Claridge farm. The foregoing nurseries were grown in four row plots and replicated four times.

The six off-station nurseries contained 14 entries and were grown in single row plots, replicated four times. The location and grower are found in the tabulated data from each of the studies.

The breeding plots were located on the Lance Claridge farm and a duplicate planting on the station in field number E-3. A discription of materials in the breeding program is found under Results and Discussion.

Pathology studies were carried on by the Regional Disease Control Laboratory. Report of this work will be made in the annual report of the Disease Control Laboratory.

Fungicide studies for control of stripe rust were conducted on a field basis and plot basis. Fungicides in the field plots were applied with an air craft. Two applications were made during the growing season. An eighteen acre field was used in the study. Two varieties were used, namely Westmont and Gaines. The field was divided into three equal parts. Yields from this study were obtained by harvesting the entire treated area. The small plots were located on the Leonard Marshell farm, in the variety, Westmont. The fungicide was applied using a small research type "spray rig". Plots were 60 feet long and ten feet wide. Four random samples were obtained from each treatment. Two treatments were made 16 days apart.

RESULTS AND DISCUSSION

Each nursery will be discussed separately in this report.

Intrastate Hard Red

The majority of the entries in this nursery were from selections made from Burt x P.I. 178383 material. The yields on most of these selections were superior to Westmont but many of them were late in maturity and lodged severly. Gaines was the highest yielding entry in the nursery.

Stripe rust infections were very high in the susceptable lines. Four of the Burt x P.I. 178383 entries had immuned reactions to stripe rust. No dwarf bunt was found in this nursery. Table XXXIV, shows complete results of this study.

Western Regional White

Gaines is used as a check in this nursery and only one entry is higher in yield but not significantly. Stripe rust infestation was quite high in this nursery. The mean of the nursery was 57.0 bushels per acre, 7.4 per acre less than the hard red nursery which was adjacent to this nursery. Table XXXV, shows complete data for this nursery.

Western Regional Hard Red

Severe winter weather in January 1963 caused considerable damage in this nursery. Temperatures had been holding in the mid-thirties for several days, there was very light snow cover, then on January 9, 1963, a rapid drop in temperature and high winds caused a loss in some fields of 100 percent of the winter wheat stands. Some entries in this nursery were completely killed, others were injured to a lessor extent. Stripe rust was quite severe on the more susceptible entries.

Rego is the highest yielding entry, but not significantly higher than Westmont.

Dwarf bunt was not a significant factor in this area in 1963. See Table XXXVI, for complete data.

Off-station

Growing conditions, results and other information about each nursery will be discussed under the individual county heading.

Missoula County - Stands in the fall were very poor and severe winter conditions reduced the stand still more. Because of the erratic stands within a variety, this study was not harvested.

Ravalli County - Good emergence of all varieties was obtained in the fall of 1962. In February of 1963 a rapid warming trend caused severe erosion by melting snow water in this nursery. Some rows were completely destroyed.

Clay spots in the nursery also caused erratic growth rates and stands. Because of these conditions this nursery was not harvested in 1963.

Lake County - Results from the study on Glen Vergerants, Table XXXVII, were non-significant when analyzed statistically. The high C.V. points out the large amount of variation found in this nursery, which is due in part to stand.

Proteins are variable among the different varieties. Delmar (14.0%) is the highest and Tendoy with (10.7%) is the lowest.

Sanders County - Melting snow in February caused flooding of this nursery and all but one replication was partically or completely destroyed. Cheyenne and Tendoy are the highest yielding lines on a single plot basis. This has been the pattern of these two varieties over the past three years. Proteins are variable and it should be noted that both Cheyenne and Tendoy have low protein percentages, Table XXXVIII.

Mineral County - Yields were very good for this area of Montana in 1963. Dwarf smut and stripe rust were not to great of a problem. This, no doubt, accounts for the superior yield of Westmont. The reliability of this study maybe open to question, because of the high C.V. The white wheats were poorer in yield than the hard red wheats. The data for this study is found in Table XXXIX.

Lincoln County - Shortly after seeding, a field cultivator was pulled through this nursery, destroying it.

Breeding Material

Sixty-eight selections were made from a Bunt x P.I. 178383 cross in 1962, for seeding in the fall. In addition nine selections from material provided by Konzack and Fitzgerald were selected and seeded in the fall of 1962. From breeding material grown in 1962, 207 individual plants were selected. Plantings were made on the station of the bulk group and also at Havre and Bozeman. The individual plant selections were grown at Creston in Field No. E-3 and on the Claridge farm.

Itana, Westmont x P.I. 178383 backcross material was grown on the Claridge farm. Seventy-six lines were included in this group. Pope from Idaho also supplied material from several of his selections. In this group there were 17 lines.

From the above listed material selections were made in the fall of 1963.

(a) Eight selections from bulk rows, Burt x P.I. 178383

(b) One selection from bulk rows, $\frac{\text{Im 462 N\#10 x Itana 684}^{16}}{\text{P.I. 178383 \#9 x OAV 25}}$

(c) Seventeen selections from plant rows.

(d) Four selections from Popes material.

A complete listing of crosses is found in Table XL.

Data for all lines on Popes material is found in Table XLI.

Pathology

Dwarf bunt infestation was not to high in the varietal resistance study, and readings were not made in this nursery.

The use of a fungicide for the control of stripe rust in Westmont winter wheat was conducted under both small plot and field conditions. The product used was Dithane S-31, containing Manganese ethylene bis dithiocarbarmate 53%; Nickle sulfate, anhydrous 19%; Metallic manganese equivalent 10%; and Metallic nickle equivalent 7.2%.

In the study on the Marshell farm no evidence of any control was noted. When the data was analyzed statistically no significant differences were found between treatments. Protein data did not vary because of treatments, Table XLIII, shows the data from this study.

The large field study in which Gaines and Westmont were grown differed in yield. The average yield of Westmont was 30.6 bushels per acre, whereas the average yield of Gaines was 58.7 bushels per acre.

One application was no different for yield than two applications of Dithane S-31. In Table XLIII, there is a 4.4 bushel increase between one application of the fungicide and the check in the variety Westmont and 4.5 bushels in the variety Gaines. These differences are not economical when the cost of the fungicide and application costs are calculated.

Cultural Study

This study was designed to determine the effects seeding dates and seeding depths have on the incidence of dwarf smut. Earlier work by Hoffman has shown that seeding date and seeding depth is a factor in dwarf bunt infection.

Four commercial varieties were used in the study, five dates of seeding and a shallow and deep seeding depth.

Plots were 18 feet long, four rows and replicated four times. Thirty-two square feet from the two center rows were harvested for yield. The data was analyzed using the variance analysis technique.

Data secured in 1963 were, yield, heading date, bushel weight in pounds and protein percentages.

Emergence was poor in the shallow seeding because of the dry soil conditions at the time of seeding. The last seeding on October 17th gave very poor stands in both shallow and deep seeding. Because of the conditions and poor stands, the shallow seeded plots and the October 17th seeded plots, were not harvested for yield.

An analysis of these data show that the yield difference was due to the date of seeding and no significant difference was found because of varieties. Thus these data indicate that September 13th was the best planting date in 1962.

Protein percentage was the highest on material seeded September 28. Also, Delmar had a little higher protein than the varieties Cheyenne and Westmont. Table XLIV, shows the data from this study.

Table XXXIV. Agronomic data from the intrastate winter wheat nursery grown at Creston, Montana in 1962-1963. Four row plots, four replications. Field No. E-3.

Date Planted: 9/21/62 Date Harvested: 8/8/63 Size of Plot: 16 square feet

Variety or Cross	C.I.No.	Heading Date	Lodging %	Stripe Rust 0-4	Stripe Rust %	Stripe Rust Coefficient	Grams per Plot I	II	III	IV	Total Grams	Yield Bushel per A.	Bushel Weight in Lbs.
Gaines	13448	6-11	0	3.0	12	9.3	925	889	905	950	3669	91.7**	62.0
Vogel-11 (61-Bulk)	C61-11	6- 9	100	.3	4	.6	795	950	960	665	3370	84.3**	60.6
Vogel-9 (61-Bulk)	C61- 9	6- 7	85	0	3	.3	755	840	722	745	3062	76.6**	60.6
Vogel-91 (62-Bulk)	C62-13	6-11	100	0	12	1.2	730	830	670	690	2920	73.0**	60.5
Vogel-3 (61-Bulk)	C61- 3	6- 6	75	2.7	35	27.0	710	865	735	605	2915	72.8**	58.3
Neb. Sel.No.391-56-D8		6- 3	5	1.7	4	1.4	758	720	705	730	2913	72.8**	61.4
Vogel-92 (62-Bulk)	C62-14	6-10	100	0	3	.3	698	755	720	715	2888	72.2**	60.0
Delmar	13442	6-10	60	3.7	58	44.0	646	610	810	805	2871	71.8**	61.0
Vogel-113(62-Bulk)	C62-22	6-11	67.5	i	0	0	685	870	664	610	2829	70.7**	59.5
Vogel-24 (61-Bulk)	C61-24	6-10	100	i	0	0	654	695	900	565	2814	70.4**	60.1
Vogel-98 (62-Bulk)	C62-17	6-10	100	i	0	0	755	725	685	560	2725	68.1**	59.7
Vogel-110(62-Bulk)	C62-20	6- 7	100	i	0	0	661	744	625	680	2710	67.8**	61.0
Vogel-60 (62-Bulk)	C62- 6	6- 8	100	.3	4	1.0	607	785	608	685	2685	67.1**	60.5
Vogel-90 (62-Bulk)	C62-12	6- 5	100	1.3	10	6.0	760	660	610	649	2679	67.0**	57.0
Vogel-26 (61-Bulk)	C61-26	6- 8	100	4.0	90	90.0	642	723	640	595	2600	65.0**	59.0
Rex X Rio X Cheyenne^2 X Turkey^2		6- 6	100	1.7	37	14.3	606	582	575	745	2508	62.7**	59.5
Tendoy	13426	6- 7	97.5	3.0	32	21.2	670	615	606	595	2486	62.2**	61.0
Cheyenne	8885	6- 8	85	2.3	15	9.0	590	635	692	560	2477	61.9**	61.6
Vogel-22 (61-Bulk)	C61-22	6- 6	100	4.0	75	81.7	525	649	635	651	2460	61.5**	58.5
Rego	13181	6- 6	100	1.0	25	6.3	636	670	520	580	2406	60.2*	58.5
Vogel-85 (62-Bulk)	C62-11	6- 5	100	4.0	25	22.3	650	575	600	570	2395	59.9*	58.9
P80 X Comanche^3 (Pope)	C61-1	6- 7	100	i	0	0	524	565	544	615	2248	56.2	61.0
Vogel-2 (61-Bulk)	C61-2	6- 7	55	.7	7	1.7	686	463	627	460	2236	55.9	59.9
Vogel-93 (62-Bulk)	C62-15	6-11	100	2.7	70	48	520	525	670	481	2196	54.9	58.6
Itana	12933	6- 7	72.5	4.0	100	100	550	559	484	585	2178	54.5	59.0
Vogel-109(62-Bulk)	C62-19	6- 6	100	0	5	.2	481	565	665	430	2141	53.5	57.6
Vogel-78 (62-Bulk)	C62-10	6- 5	100	3.0	78	62.7	520	415	569	590	2094	52.4	57.5
(Alicel-Rex,P80) x Cheyenne^2, Sel.4		6-12	100	1.3	20	7.6	431	532	670	405	2038	51.0	61.5
Rex x Rio X Cheyenne^5		6-11	100	1.0	6	2.8	470	506	425	510	1911	47.8	59.7
Westmont	12930	6- 4	85	4.0	100	100	415	635	450	324	1824	45.6	56.5

Table XXXIV. (con't)

NOTE: Westmont is the check variety used in this nursery.
* Varieties yielding significantly less than the check (.05)
** Varieties yielding significantly less than the check (.01)

$\bar{x}$.....	64.4
S.E.$\bar{x}$.....	3.95251
L.S.D.(.05).....	11.1
L.S.D.(.01).....	14.8
C.V.%.....	6.14

Analysis of Variance

Source	D. F.	Mean Square	F.
Replications	3	20452.59	3.27*
Varieties	29	44126.4644	7.06**
Error	87	6248.94517	
Total	119		

Table XXXV. Agronomic data from Western Regional White Winter Wheat Nursery at Creston, Montana in 1963. Four row plots, four replications.

Date Planted: 9/21/62 Date Harvested: 8/8/63 Size of Plot: 16 square feet

Variety or Cross	C. I. or N. No.	Heading Date	Lodging %	Stripe Rust 0-4	Stripe Rust %	Stripe Rust Coefficient	Grams per Plot I	II	III	IV	Total Grams	Yield Bushel 1 Acre	Bushel Weight in Lbs.
Omar x 1834 Sel-12	13646	6-13	25	1	10	2	644	885	809	805	3143	78.6	59.0
Gaines	13448	6-11	-	1.2	40	24	694	775	805	709	2983	74.6	60.5
[-(Elgin19xElmar)-111] x 18113 Sel 4	13645	6-12	10	3	30	24	675	681	735	735	2826	70.7	57.3
Burt Mutant	13728	6-11	5	2	60	24	700	715	694	700	2809	70.2	61.2
(27-15 x Rio-Rex,53) x Elgin 11	13725	6-10	10	-	25	2.5	670	605	735	742	2752	68.8	61.4
(27-15 x Rio-Rex,53) x Elgin-4	13726	6-10	5	2	35	14	676	700	710	645	2731	68.3	61.0
Brevor	12385	6-12	98	2	10	4	578	550	681	660	2469	61.7**	61.1
Burt	12696	6-10	20	2.3	40	24	610	549	605	583	2347	58.7**	61.0
Hussar-Hohenheimer x Triplet[5]	13649	6-11	93	3.4	80	48	640	550	570	530	2290	57.2**	62.1
White Coin (Emil Luft)	13729	6-10	100	1	5	1	615	476	679	480	2250	56.3**	58.5
Kharkof	1442	6-10	100	2	10	4	558	482	490	475	2005	50.1**	59.8
Triplet	5408	6- 9	90	3	70	56	430	540	525	496	1991	49.8**	62.5
Omar Mutant	13737	6-13	73	4	100	100	499	614	465	399	1977	49.4**	58.5
Burt x Kenya F.57-70136	13641	6- 4	85	2.3	20	18	473	503	605	340	1921	48.0**	60.0
(Fed.41M x Golden4)x(Rio x Golden4)Sel.B-59	13648	6-11	100	3	10	8	505	595	410	240	1750	43.8**	59.5
Golden	10063	6-12	100	3	50	40	495	421	460	365	1741	43.5**	59.6
Elgin	11755	6-12	88	4	100	100	494	425	418	325	1662	41.6**	57.5
Omar	13072	6-11	98	4	90	90	360	400	355	325	1440	36.0**	57.5

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

Analysis of Variance

Source	D.F.	Mean Square	F
Replications	3	14528.48333	3.18*
Varieties	17	63573.3617	13.91**
Error	51	4571.48627	
Total	71		

$\bar{x}$..... 57.0
S.E.$\bar{x}$..... 3.38064
L.S.D.(.05).. 9.6
L.S.D.(.01).. 12.8
C.V. %..... 5.92

Table XXXVI. Agronomic data from the western regional hard red winter wheat nursery grown on the Lance Claridge farm, Route 3, Kalispell, Montana in 1962 - 1963.

Date Planted: 9/13/62 Date Harvested: 8/9/63 Size of Plot: 16 square feet.

Variety or Cross	C. I. or N. No.	Heading Date	Height in Inches	Stand %	Stripe Rust 0-4	Stripe Rust %	Stripe Rust Coefficient	Grams per Plot I	Grams per Plot II	Grams per Plot III	Grams per Plot IV	Total Grams	Yield Bushel per A.
Rego	13181	6-11	27	100	0	5	.5	115	225	180	285	805	20.1
Burt x P.I. 178383	C61- 9	6-16	24	100	0	T	.1	165	190	136[1]	170	711	17.8
Burt x P.I. 178383	C61-24	6-16	23	82	0	5	.5	176	255	110	145	686	17.2
Westmont	12930	6- 8	27	98	4	90	90	165	210	100	200	675	16.8
Rex - Rio x Cheyenne[5]	13675	6-13	23	90	2	T	.4	105	205	200	150	660	16.5
Gaines	13448	6-17	21	90	1	10	2	112	190	205	111	618	15.5
Tendoy	13426	6-13	26	98	0	T	.1	85	176	165	175	601	15.0
Kharkof	1442	6-15	24	78	2	10	4	40	209	175	175	599	15.0
Columbia	12928	6- 8	24	96	4	90	90	65	180	150	200	595	14.9
(Wasatch x Kharkof)-17-1-8-5	13691	6-16	26	80	0	5	5	130	95	120	220	565	14.1
(Rex x Rio x Cheyenne[2]) x Turkey[2]	13674	6-11	26	100	1	10	2	90	145	134	195	564	14.1
Burt x Itana Sel 160	13694	6-13	22	98	0	T	.1	100	105	165	190	560	14.0
Rio	10061	6-13	23	78	1	5	1	50	181	135	193	559	14.0
(Itana x Kharkof-17)-1-26-1	13692	6-13	26	95	1	T	.2	90	145	145	130	510	12.8
Burt x Itana Sel 7	13693	6-14	23	78	3	30	40	85	120	176	126	507	12.7
Delmar	13442	6-13	24	85	1,3	40	24	55	140	162	140	497	12.4
Cheyenne	8885	6-14	25	85	1	10	2	70	235	60	125	490	12.3
Burt x P.I. N78383	C61-22	6-15	35	37	3	25	20	130	130	110	111	481	12.0
Itana	12933	6-11	26	96	4	90	90	55	125	185	111	476	11.9
(Alicel-Rex-P-80) x Commanche	13695	6- 9	22	55	2	5	2	90	105	75	105	375	9.4*
(Alicel-Rex,P80) x Cheyenne[2], Sel. 4	13676	6-17	18	95	0	T	.1	90	95	75	90	350	8.8*
Burt x P.I. 178383	C61- 2	6-16	24	33	0	T	.1	115	50	85	70	320	8.0*

NOTE: Westmont used as a check in this nursery

1 Calculated missing plot

* Varieties yielding significantly less than the check (.05)

$\bar{x}$..... 13.9
S.E.$\bar{x}$..... 2.09731
L.S.D.(.05).. 5.9
C.V.%..... 15.12

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	16816.57866	9.56
Varieties	21	3482.71904	1.97*
Error	62	1759.48812	
Total	86		

Table XXXVII. Agronomic data from dryland off-station winter wheat nursery grown in Lake County on the Glen Vergerant farm, Polson, Montana in 1963. Single row plots, four replications.

Date Seeded: 9/19/62 Date Harvested: 8/5/63 Size of Plot: 12 square feet.

Variety or Cross	C.I.No.	Height in Inches	Stand %	Plot yield in Grams I	II	III	IV	Total Grams	Yield Bushel per A.	% Protein
Tendoy	13426	34	70	289	205	280	170	944	31.5	10.7
Yogo/Wasatch-3 x Cheyenne 56-6-5		36	73	160	145	255	263	823	27.4	11.0
Wasatch x Karkof-17, Sel. 18-5	13691	40	88	190	175½	170	245	780	26.0	11.2
Cheyenne	8885	39	83	125	157½	290	190	762	25.4	11.8
Westmont	12930	38	95	153	126	215	194½	688	22.9	12.7
Wasatch	11925	41	83	155	175½	105	180	615	20.5	13.8
Delmar	13442	39	85	215	118½	95	180	608	20.3	14.0
Itana	13933	37	60	150	123	211	94	578	19.3	12.8
Gaines	13448	25	65	135	80	136	220	571	19.0	—
Itana 6 x K-17, Sel.1-26-1	13692	36	43	45	140	232	145	562	18.7	12.8
Triplet	5408	35	80	95	75	181	174	525	17.5	—
(14 x 50-3) x Burt, Sel.101	13438	28	83	130	120	70	150	470	15.7	—
Burt	12696	31	55	120	54	65	215	454	15.1	—
Omar	13072	31	70	230	25	44	79	378	12.6	—

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	8179.7383	2.40
Varieties	13	6182.33523	1.81
Error	36	3411.71625	
Total	52		

$\bar{x}$.....	20.9
S.E.$\bar{x}$.....	3.89506
L.S.D.....	N.S.
C.V.%.....	18.67

Table XXXVIII. Stand and protein data from an off-station dryland wheat nursery grown in Sanders County on the Sidney Cross farm, Camas Praire, Montana in 1963. Single row plots, four replications.

Date Planted: 9/18/62 Date Harvested: 8/16/63 Size Plot: 16 sq.ft.

Variety	C.I. No.	% Stand	Grams	Yield Bu. per Acre	Protein
Westmont	12930	28	55	7.3	12.3
Wasatch	11925	35	69	9.2	12.2
Delmar	13442	5	15	2.0	13.6
Gaines	13448	10	10	1.3	--
(14 x 50-3) x Burt Sel. 101	13438	23	--	--	--
Omar	13072	5	15	2.0	--
Cheyenne	8885	60	145	19.3	9.7
Tendoy	13426	85	150	20.0	9.2
Itana	13933	28	75	10.0	9.8
Triplet	5408	27	65	8.7	--
Burt	12696	43	75	10.0	--
Yogo/Wasatch-3X Cheyenne 56-6-5		66	185	24.7	10.0
Itana 6 x K-17,Sel.1-26-1	13692	18	20	2.7	13.5
Wasatch x Kharkof-17 Sel. 18-5	13691	31	85	11.3	12.2

Table XXXIX. Agronomic data from dryland off-station winter wheat nursery grown in Mineral County on the Charles Frey farm, Superior, Montana in 1962-1963. Single row plots, four replications.

Date Planted: 9/18/62 Date Harvested: 8/5/63 Size of Plot: 16 square feet

Variety or Cross	C.I.No.	Height in Inches	% Stand	Plot yields in Grams I	II	III	IV	Total Grams	Yield Bushel per/A	Bushel Weight in Lbs.
Westmont	12930	32	76	300	379	295	457	1431	35.8	60.3
Wasatch x Kharkof-17, Sel.18-5	13691	35	93	250	335	305	400	1290	32.3	61.4
Tendroy	13426	36	96	255	211	245	474	1185	29.6	61.0
(14 x 50-3) x Burt, Sel. 101	13438	22	68	235	330	180	421	1166	29.2	62.0
Triplet	5408	32	70	190	271	320	377	1158	29.0	60.6
Wasatch	11925	34	73	240	280	280	291	1091	27.3	61.0
Itana	13933	29	83	215	115	340	377	1047	26.2*	60.0
Yogo/Wasatch-3 x Cheyenne 56-6-5		35	90	170	305	350	240	1065	26.6*	61.2
Omar	13072	26	51	229	234	215	297	975	24.4*	58.5
Gaines	13448	23	78	140	303	257	251	951	23.8*	61.2
Delmar	13442	32	81	196	325	196	228	945	23.6*	59.5
Burt	12696	26	66	185	175	304	280	944	23.6*	59.5
Cheyenne	8885	36	86	185	235	191	297	908	22.7*	60.6
Itana 6 x K-17, Sel. 1-26-1	13692	33	85	126	192	166	297	763	19.1*	--

NOTE: Westmont is used as a check in this nursery.
* Varieties yielding significantly less than the check (.05)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	36983.7376	10.28**
Varieties	13	7400.31584	2.06*
Error	39	3599.24453	
Total	55		

$\bar{x}$.....	26.6
S.E.$\bar{x}$.....	2.9969
L.S.D.(.05).....	8.6
C.V.%.....	11.26

Table XL. Selections made from breeding nurseries from 1963-1964. Planting at Creston, Montana in 1963.

Cross	Heading Date	Lodging	Stripe Rust 0-4	Stripe Rust %	Creston Number	1963 R No.
F-4 Bulk Selections						
Burt x 178383	6- 6	85	i	0	C-62- 4	
" x "	6- 8	0	i	0	C-62- 7	
" x "	6- 7	95	i	0	C-62- 8	
" x "	6-12	10	i	0	C-62-31	
" x "	6-13	0	i	0	C-62-44	
" x "	6-12	0	i	0	C-62-58	
" x "	6-13	0	i	0	C-62-68	
Im 462-N#10 x Itana 684^{16}) P.I. 178383#5 OAV 25)	6-14	0	2	10	C-62-69	
Plant Selections F-3						
Im 462-N#10 x Itana 684^{15}) P.I. 178383#9 x OAV 25)					C-63- 1	89
Im 462-N#10 x Itana 684^{15}) P.I. 178383#9 x OAV 25)					C-63- 2	90
Im 462-N#10 x Itana 684 ^{16}) P.I. 178383#5 x OAV 25)					C-63- 3	107
Im 462-N#10 x Itana 684 ^{17}) P.I. 178383#9 x OAV 25)					C-63- 4	128
" "					C-63- 5	129
" "					C-63- 6	130
" "					C-63- 7	132
" "					C-63- 8	133
" "					C-63- 9	134
" "					C-63-10	136
" "					C-63-11	137
" "					C-63-12	140
" "					C-63-13	142
" "					C-63-14	143
Im 462-N#10 x P.I. 178383 ^{31}) unknown)					C-63-15	151
" "					C-63-16	153
(4) 563 BC_4 x 5789) (15) 5510 BC_4 x 5772)					C-63-17	273
Pope's Material						
					Moscow No.	
Burt Selection 2					62M36009 C-63-18	*P 9
" " 3					62M36010 C-63-19	P10
" " 1					62M36011 C-63-20	P11
F_3 Burt x Cheyenne Sel. 3					62M36040 C-63-21	P21

*P: Pope

Table XLI. Field notes taken on material obtained from W. K. Pope, University of Idaho, Moscow, Idaho in 1963. Field No. F-3.

Discription	1963 Row Number	Moscow Number	Heading Date	Stripe Rust Type 0-4	Stripe Rust %	Stripe Rust Coefficient	Lodging in %
Itana-W Sel. 1	1	62M 2504	6-11	2	5	2.0	0
Itana-W Sel. 2	2	62M 2503	6-13	i	0	0	100
Turkey Sel. 1	3	62M36001	6-14	i	0	0	100
Turkey Sel. 2	4	62M36002	6-10	i	0	0	100
Turkey Sel. 3	5	62M36003	6-11	i	0	0	100
Turkey Sel. 4	6	62M36004	6-11	i	0	0	100
Turkey Sel. 5	7	62M36005	6-12	0	5	.5	0
Burt Sel. 1	8	62M36008	6-11	2	20	8.0	0
Burt Sel. 2	9	62M36009	6- 9	1	20	4.0	0
Burt Sel. 3	10	62M36010	6-10	1	20	4.0	0
Burt Sel. 4	11	62M36011	6-10	0	10	1.0	0
Burt Sel. 5	12	62M36012	6-10	0	30	3.0	0
F_3 Burt x Chey Sel. 1	19	62M36033	6- 9	i	0	0	65
F_3 Burt x Chey Sel. 2	20	62M36034	6-11	i	0	0	65
F_3 Burt x Chey Sel. 3	21	62M36040	6-13	i	0	0	65
F_6 Ridit x Trip[2]	22	62M 861	6-13	4	80	80.0	100
Omar Rogue	23	62M 801	6-13	3	100	80.0	65

Table XLII. Yield data from a fungicide study using Dithane S-31, for the control of stripe rust in winter. Conducted on the Archie Brevik farm in Lower Valley, Kalispell, Montana in 1963. (Aerial applications)

Date Harvested:	Westmont, 8/7/63		Gaines, 8/14/63	
Treatment	Rate pounds per Acre	Date	Yield Bushel per Acre	Bushel Weight in Pounds
		WESTMONT		
1 application	3 lbs.	6- 1	33.7	58.0
-	Check	---	29.3	---
2 application	6 lbs.[1]	6- 1 6-18	28.9	58.0
		GAINES		
1 application	3 lbs.	6- 1	60.2	63.0
-	Check	---	55.7	---
2 application	6 lbs.[1]	6- 1 6-18	60.1	---

[1] - 3 lbs. per acre per application.

Table XLIII. Agronomic and yield data from fungicide study conducted on the Leonard Marshell farm, Kalispell, Montana in 1963. Plot 10'x60'. Harvested four random samples from each treatment.

Date Applied: 1st - 5/29/63 Date Harvested: 8/12/63
2nd - 6/12/63 Plot Size for yield: 13.3 square ft.

Treatment	Smaple NO in Grams 1	2	3	4	Total Grams	Yield Bu/A	Bu. Wt. in Lbs.	Protein in %
Dithane S-31 1 application	380	356	326	402	1464	44.1	57.9	12.6
Check	340	230	355	355	1280	38.5	56.6	12.6
Dithane S-31 2 applications	404	315	420	453	1592	47.9	59.5	12.6
Check	410	210	537	336	1493	44.9	55.5	12.6
Dithane S-31 2 applications	460	285	390	410	1545	46.5	58.5	12.8

Dithane S-31 applied at 3 pounds per acre.

$\bar{x}$..... 44.4
S.E.$\bar{x}$..... 3.60684
L.S.D..... NS
C.V.%..... 8.12

Table XLIV. Agronomic data from data of seeding study on the Lance Claridge farm, Route 3, Kalispell, Montana in 1963. Four dates. Four replications. Four row plots.

Date Harvested: 8/9/63 Size of Plot: 32 square feet.

Variety	Seeding Date	Plot yields in Grams I	II	III	IV	Total Grams		Yield Bushel per Acre	Bushel Wt. in Pounds	Protein in per cent	Heading Date
Westmont	Aug. 15	484	355	399	595	1833		22.9	60.1	11.4	6- 9
	Aug. 31	535	444	501	410	1890		23.6	60.2	10.1	6- 7
	Sept. 13	611	427	585	530	2153		26.9	60.5	10.8	6- 7
	Sept. 28	330	280	330	302	1242		15.5	60.5	12.4	6-10
							$\bar{x}$	22.2	60.3	11.2	6- 8
Gaines	Aug. 15	560	659	350	482	2051		25.6	59.1	—	6- 9
	Aug. 31	505	581	365	142	1593		19.9	60.0	—	6-11
	Sept. 13	630	576	695	266	2167		27.1	60.1	—	6-12
	Sept. 28	280	215	215	385	1095		13.7	57.5	—	6-18
							$\bar{x}$	21.6	59.2	—	6-12
Delmar	Aug. 15	385	329	285	450	1449		18.1	60.0	12.1	6- 9
	Aug. 31	446	382	355	160	1343		16.8	59.8	11.8	6- 9
	Sept. 13	496	485	620	450	2051		25.6	59.5	12.8	6-10
	Sept. 28	190	190	405	290	1075		13.4	56.5	12.6	6-15
							$\bar{x}$	18.5	59.0	12.3	6-11
Cheyenne	Aug. 15	515	451	360	605	1931		24.1	60.7	10.8	6- 8
	Aug. 31	545	450	575	274	1844		23.1	60.5	10.9	6- 9
	Sept. 13	581	490	545	495	2111		26.4	60.5	10.2	6-10
	Sept. 28	444	245	500	395	1584		19.8	59.0	14.1	6-15
							$\bar{x}$	23.4	60.2	11.5	6-11

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	20729.16666	1.76
Dates	3	131343.75	11.14**
Varieties	3	27665.58333	2.35
Dates & Varieties	9	6593.19444	
Error	45	11786.65555	
Total	64		

The effect of seeding date on yield, bu.wt. protein & heading Date

Aug. 15	22.7	60.0	11.4	6- 9
Aug. 31	20.9	60.1	10.9	6- 9
Sept. 13	26.6	60.2	11.3	6-10
Sept. 28	15.6	58.4	13.0	6-15
$\bar{x}$	21.4	59.6	11.7	6-11

Table XLV. Summary of selected winter wheat data from varieties grown at the Northwestern Montana Branch Station during the years 1955 - 1963.

Variety or Cross	C.I. No.	YEAR									$\bar{x}$ and Year No.	Long Term % of Westmont	Average for 2 years	Average for 9 years
		1955	1956	1957	1958	1959	1960	1961	1962	1963				
Cheyenne	8885	59.8	71.0	59.3	49.0	51.8	41.4	49.5	55.5	61.9	55.5 (9)	100 (9)	58.7	55.5
Columbia	12928	59.9	65.1	51.1	56.0	49.4	33.8	48.4	--	--	52.0 (7)	92 (7)	--	--
Itana	12933	55.6	73.0	58.1	55.6	50.5	32.6	48.0	50.3	54.5	53.1 (9)	96 (9)	52.4	53.1
Karmont	6700	50.3	58.3	46.2	45.5	45.4	37.5	44.4	50.4	--	47.3 (8)	83 (8)	--	--
Newturk	6935	46.6	54.6	58.9	43.8	49.4	47.0	31.6	50.3	47.4	47.7 (9)	86 (9)	48.9	47.7
Omar	13072	--	--	55.5	61.0	55.5	29.1	52.2	--	--	50.6 (5)	96 (5)	--	--
Tendoy	13426	--	--	--	54.0	52.4	38.6	47.8	54.2	62.2	51.5 (6)	99 (6)	58.2	--
Wasatch	11925	57.4	65.1	42.8	49.3	44.8	30.3	43.5	50.6	--	48.0 (8)	85 (8)	--	--
Westmont	12930	62.7	68.6	60.7	64.9	53.3	34.3	51.1	57.2	45.6	55.4 (9)	100 (9)	51.4	55.4
Yogo	8033	54.1	60.1	45.1	49.4	45.6	35.0	37.9	--	--	46.7 (7)	83 (7)	--	--
Rego	13181	--	66.7	50.0	59.8	55.6	35.5	46.7	60.6	60.2	54.3 (8)	100 (8)	60.4	--
YTO-117	13542	--	--	--	--	46.8	33.4	48.5	48.7	--	44.4 (4)	91 (4)	--	--
Delmar	13442	--	--	--	--	--	--	--	55.3	71.8	63.6 (2)	124 (2)	63.6	--

TITLE: Preliminary Investigations, 1963

PROJECT NUMBER: 5028 (Oil Seed Crops)

PERSONNEL: Leader - Vern R. Stewart
Cooperators - R. F. Eslick, Dan Niffenegger, D. R. Merkley

FUNDS: State - $784.00

LOCATION: Northwestern Montana Branch Station, Field No. E-1
Western Montana Branch Station, Corvallis, Montana

DURATION: Indefinite

OBJECTIVES:

1. To determine the agronomic adaptability and oil potential of several plant species.
2. To determine the canary grass variety best adapted for Western Montana conditions.
3. By natural selection find a strain of safflower that will mature and produce seed in Western Montana.

EXPERIMENTAL DATA:

INTRODUCTION

The search for crops to replace diverted small grain crops continues. Work by the Northwestern Montana Branch Station in 1963 consisted of three new crops nurseries, two safflower breeding blocks, the regional safflower nursery and a canary seed nursery.

MATERIALS AND METHODS

Research plots were grown in four row plots, replicated four times. Eight feet of the two center rows were harvested for yield. Plots were harvested with a jeri-mower and threshed with a vogel thresher. However, early maturing lines or species were harvested by hand.

Three new crops nurseries were grown in 1963. Two were grown under irrigation and one under non-irrigated conditions. One of the irrigated nurseries was grown on the Western Montana Branch Station at Corvallis. This nursery contained eleven entries which included; wheat, oats and barley.

The regional safflower nursery was grown on the Western Montana Branch Station under irrigated conditions. This nursery contained ten entries and was replicated four times.

Two breeding blocks of bulk safflower lines were grown. One at the Northwestern Montana Branch and one at the Western Montana Branch Station. The seed blocks were harvested in bulk and will be reseeded another year.

The canary grass nursery for bird seed contained ten entries and was grown in four replications under dryland conditinns.

RESULTS AND DISCUSSION

New Crops Nursery

The two new-crops nurseries grown at the station were partially destroyed by hail on August 24th. Because of the hail only the spring wheat, flax, safflower and crambe were harvested. The long growing season accounts in part for the rather high safflower yields in these studies. Table XLVI and XLVII, contain information from all entries as it pertains to flowering or heading date for the dry and irrigated studies, also included will be data for those lines which were harvested for yield.

Yields in the new crops nursery at Corvallis were very good, with one exception, that being safflower. The mean for the nursery was 2973 pounds per acre. Oats (Park) was the highest yielding species in the nursery, but not significantly higher than barley (Unitan). The low safflower yields are the result of a severe root rot disease in this entry. This was caused, no doubt, from over irrigation of this nursery. Flax did not ripen evenly in this study and there were still some green bowls when harvested on October 23rd. See Table XLVIII for details of this study.

Safflower

This is the first experience with safflower by the station in the Bitterroot Valley. Comparing these yields with eastern Montana yields in 1962 they were very good. The growing season was much longer than the average, being some 120 days in 1963. This may in part account for the high yields of some of the lines in this study. U-15 was the highest yielding line with 3072 pounds per acre. The mean for the study was 2302 pounds per acre. See Table XLIX.

Canary Grass

This nursery was grown under dryland conditions in 1963. Yields were comparable to yields obtained in Bozeman in 1962. Calculation and analysis of the data found in Table L were done by Mr. Dan Niffenegger.

Table XLVI. Agronomic data from irrigated new crops intrastate nursery grown at Creston, Montana in 1963. Four row plots, four replications. Field No. Y-2.

Date Planted: 5/6/63 Size of Plot: 16 square feet

Species	Variety	Flowering Date	Date Harvested	GRAMS PER PLOT I	II	III	IV	Total Grams	Yield Lbs. per Acre
Spring Wheat	Centana	7- 8	9- 4	276	325	225	192[1]	1018	1528
Flax	Redwood	7- 5	9- 4	275	265	305	240	1085	1628
Safflower	N-10	--	10-22	180	535	215	130	1060	1591
Crambe		7-13	9- 4	170	185	145	105	505	758
Barley	Unitan	6-26		DESTROYED BY HAIL					
Cow Cockle		7- 6		"	"	"			
Camelina		7- 6		"	"	"			
Mustard	Oriental Yellow(Com)	6-23		"	"	"			
Mustard	Oriental Yellow 62-1504	6-23		"	"	"			
Mustard	Oriental Yellow 62- 690	6-23		"	"	"			
Oats	Park	7- 6		"	"	"			

[1] Calculated Missing Plot

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	19261.16667	2.45
Species	3	19051.50	2.42
Error	8	7857.875	
Total	14		

$\bar{x}$..... 1376
S.E.$\bar{x}$..... 266.0217
L.S.D..... N.S.
C.V.%..... 19.33

Table XLVII. Agronomic data from dryland new crops intrastate nursery grown at Creston, Montana in 1963. Field No. A-1b. Four row plots, four replications.

Date Planted: 5/7/63 Size of Plot: 16 square feet

Species	Variety	Flowering Date	Date Harvested	I	II	III	IV	Total Grams	Yield Lbs. per Acre
Spring Wheat	Centana	7- 5	9- 4	165	360	295	360	1180	1771
Flax	Redwood	7- 6	9- 4	273	326	215	225	1039	1559
Safflower	N-10	8-17	10-22	375	403	325	465	1568	2353
Crambe		7-13	9- 4	145	240	125	40	550	825
Barley	Unitan	6-26		DESTROYED BY HAIL					
Cow Cockle		7- 6		"	"	"			
Camelina		7- 4		"	"	"			
Mustard	Oriental Yellow(Com)	6-28		"	"	"			
Mustard	Oriental Yellow 62-1504	6-29		"	"	"			
Mustard	Oriental Yellow 62- 690	6-28		"	"	"			
Oats	Park	7- 6		"	"	"			

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	7609.396	
Species	3	44221.0626	8.38**
Error	9	5277.29111	
Total	15		

$\bar{x}$..... 1627
S.E$\bar{x}$..... 218.007
L.S.D.(.05).. 697
C.V.%. 13.40

Table XLVIII. Agronomic data from new crops intrastate nursery grown at Corvallis, Montana in 1963. Four row plots, four replications.

Date Planted: 5/16/63 Size of Plot: 16 square feet

Species	Date Harvested	GRAMS PER PLOT I	II	III	IV	Total Grams	Yield #/A
Oats, Park	8-21	905	1030	1094	1100	4129	6196
Barley Unitan	8-21	1035	975	940	1145	4095	6144
Spring Wheat-Centana	10-23	690	700	690	685	2765	4148
Camelina	8- 9	350	650	550	300	1850	2776
Flax, Redwood	10-23	428	418	530	442	1818	2728
Oriental Yellow Mustard 62-1504	9- 6	330	425	435	479	1669	2504
Oriental Yellow Mustard (com)	9- 6	335	425	360	365	1485	2228
Oriental Yellow Mustard 62-690	9- 6	305	380	285	400	1370	2056
Crambe	9- 6	405	225	175	289	1094	1642
Cow Cockle	8- 9	215	175	165	405	960	1440
Safflower N-10	10-23	260	92	140	65	557	836

Analysis of Variance

Source	D.F.	Mean Square	F.
Replication	3	2936.18	
Species	10	357873.823	43.80**
Error	30	8170.132	
Total	43		

$\bar{x}$.....	2973
S.E.$\bar{x}$.....	271.2558
L.S.D.(.05)..	783
L.S.D.(.01)..	1055
C.V.%.....	9.12

Table XLIX. Agronomic data from the Regional Safflower nursery grown at Corvallis, Montana in 1963. Four row plots, four replications.

Date Planted: 4/30/63 Date Harvested: 10/23/63
Size of Plot: 16 square feet

Variety or Line	Flowering Date	I	II	III	IV	Total Grams	Yield Bu. per Acre
U-15	8- 9	380	445	640	582	2047	3072
Gila	8- 9	695	410	321	434	1860	2791
N-4051	--	373	375	375	674	1797	2687
U-3	8- 9	345	315	491	490	1641	2462
A-5720-9	8- 9	360	361	400	445	1566	2350
U-5	8-12	385	325	445	360	1515	2273
A-0104	--	400	419	345	350	1514	2272
U.S. 10	8- 9	360	360	330	344	1394	2092
N-10	8- 9	310	260	348	345	1263	1895
A-4138	--	170	195	175	206	746	1119

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	9913.22667	1.29
Varieties	9	32384.2255	4.21
Error	27	7693.55814	
Total	39		

$\bar{x}$..... 2302
S.E.$\bar{x}$..... 263.225
L.S.D.(.05).. 763
L.S.D.(.01).. 1031
C.V.%..... 11.43

Table L. Data from Dryland Canary Grass Nursery grown at Creston, Montana in 1963. Field No. A-1b. Four row plots, four replications.

Date Planted: 5/7/63 Date Harvested: 8/19/63 Size of Plot: 16 square feet

Description	% Seeds with Hulls	% Seeds without Hulls	Ratio of Seeds without Hulls to Seeds with Hulls	100 Seed Weight with Hulls Grams	100 Seed Weight without Hulls Grams	Yield Pounds per Acre I	II	III	IV	Total	Average Yield
Strain 229768	93.92	1.51	.016	.727	.560	2556	2436	1560	1908	8460	2115
Strain 170622	92.35	3.03	.033	.790	.688	1992	1584	1296	1704	6576	1644
Strain 170629	90.89	2.62	.029	.755	.643	896	1704	1572	1704	5912	1478
Strain 170633	89.07	5.04	.057	.714	.646	1080	1536	1776	1512	5904	1476
Commercial from Power	93.04	2.05	.022	.859	.717	1476	1044	1524	1476	5520	1380
Strain 180863	91.38	1.99	.022	.690	.618	1020	1424	1092	1440	4976	1244
Strain 179398	89.87	2.88	.032	.755	.645	1416	1368	688	1488	4960	1240
Larcan	91.65	3.01	.033	.750	.647	1416	1260	1584	1476	5736	1434
Montana Commercial	93.48	1.42	.015	.765	.639	1536	1920	900	1356	5712	1428
Strain 189547	90.35	2.18	.024	.675	.571	1536	1236	1080	1020	4872	1218

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	117630.266	1.17
Varieties	9	277713.822	2.75*
Error	27	100958.8592	
Total	39		

$\bar{X}$..... 1466
S.E.$\bar{X}$..... 158.87012
C.V.%..... 10.84