NINETEENTH ANNUAL REPORT

1967

Northwestern Montana Branch
of the
Montana Agricultural Experiment Station

Route 4
Kalispell, Montana

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AUTHOR: Vern R. Stewart and E. R. Hehn, Plant Disease Reporter. 1967 51: 702-705

EXPERIMENT STATION BULLETINS:

TITLE: Red Clover Hay Production in Montana, Bulletin 615
AUTHOR: C. S. Cooper, C. W. Roath and R. F. Eslick

TITLE: Yield and Quality of Sainfoin Seed as Related to Stage of Maturity Bulletin 614
AUTHOR: A. E. Carleton, L. E. Wiesner, A. L. Dubbs and C. W. Roath

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AUTHOR: Vern R. Stewart - Montana Farmer-Stockman

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TITLE: Western Montana Agricultural Research NW and W Cir. #102
AUTHOR: C. W. Roath, Vern R. Stewart, Don R. Merkley and Don Graham

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TITLE: Altasweed Red Clover
AUTHOR: A. F. Shaw and C. W. Roath; Management Guides Cooperative Extension Service, MSU MG 030.2

ACTIVITIES

Efficiency on a Branch Station is synonymous with percentage of total time and resource spent on meaningful research. Never-the-less the opportunity to do research might disappear if we do not participate in certain activities.

DATE	ACTIVITY	STAFF	LOCATION
Jan. 10	Agricultural Council	Roath	Kalispell
17	Sugar Beet Meeting	Stewart	Billings
18	Huntley Br. Sta. Adv. Comm. Meeting	Stewart	Huntley
23	Beef Futures School	Stewart	Kalispell
Feb. 13	Forage School	Roath	Kalispell
14	Forage School	Roath	Ronan
15	Forage School	Roath	Stevensville
16	Forage School	Roath	Deer Lodge
17	Forage School	Roath	Dillon
14-16	Weed Society of American Meetings	Stewart	Washington D.C.
18	Tour Amchem Facilities	Stewart	Philadelphia, Pa.
22	Advisory Committee	Roath Stewart	Polson
28-	Planning Conference	Roath Stewart	Bozeman
March 3			
7	Conservation Day	Roath	Polson
14	KGVO-TV	Roath	Missoula
14	Agricultural Council	Roath Stewart	Kalispell
17	County Agents Up-Dating School	Roath Stewart	Missoula
21	Pesticide School	Stewart	Missoula
28	KGVO-TV	Stewart	Missoula
Apr. 11	Agricultural Council	Stewart	Kalispell
May 12	High School Biology Class Tour	Stewart	Station
19	FFA Boys Tour	Roath Stewart	Station
June 1	Computer Seminar	Stewart	Missoula
July 14	Dr. Thomas's(Stanford U.)Botany Class Tour	Roath Stewart	Station
July 19	Field Day - Staff Conference	Roath Stewart	Corvallis
21	Montana Plant-Food Assoc. Tour	Roath Stewart	Station
25	4-H Group Tour	Roath	Station
31	Tour of Flathead Co. with Dr. Thomas	Stewart	Flathead County
Aug. 10	Lake County Jr. Fair - Judging	Roath	Ronan
23	Missoula County Fair - Judging	Roath	Missoula
Sept. 2	Sanders County Fair - Judging	Roath	Plains
Oct. 16-20	Annual Conference	Roath Stewart	Bozeman
27	Technical Action Panel	Roath Stewart	Kalispell
Nov. 8	Potato Seminar (Banquet Speaker)	Roath	Deer Lodge
16	TAP Planning Meeting	Stewart	Kalispell
Dec. 5	TAP Meeting	Stewart	Kalispell

VISITORS

The following individuals visited the station in 1967:

DATE	NAME	REPRESENTING	ADDRESS
Feb. 10	Carl Clogston	Pacific Power & Light Co.	Kalispell
	Everett Burns	" " " " "	"
Mar. 27	Miss Janet Abel	Columbia Falls High School	Columbia Falls
	Miss Celeste Hoener	" " " "	" "
29	George Hubbard	Farmer	Rt. 4, Kalispell
Apr. 3	Merle Lyda	County Extension Agent	Kalispell
	Darrell Peterson	" " "	"
5	Lewis Fuller	SCS	"
	Lloyd Wiedenman	SCS	"
8	John Shaw	Glacier Ins. Co.	"
11	James Crane	Missoulian	Missoula
14-15	Joe Asleson	Montana State University	Bozeman
19	Dean Finnerty	DuPont	Minneaspolis, Minn.
May 4	Tom Neidlinger	Diamond Alkali Co.	Cleveland, Ohio
15	Roger Scott	Geigy Chemical Co.	Missoula
11	John Thomas	Stanford University	Palo Alto, Calif.
12	Leo Evans	O'Neil Printers	Kalispell
July 13	J. A. Hoffmann	ARS, Washington State U.	Pullman, Washington
13	Lewis Fuller	SCS	Kalispell
	Henry Robinson	Vo-Ag. High School	"
	Luther Lalum	" " " "	"
	Merle Lyda	County Extension Agent	"
18	Bill O'Malley	Comico American	Spokane, Wn.
Aug. 3	Homer Metcalf	Montana State University	Bozeman
15	Dean Finnerty	DuPont	Minneapolis, Minn.
	Don Smith	"	North Dakota
24-25	Ken Dunster	Amchem Products	Loveland, Colo.
29	C. L. Prochnow	Stauffer Chemical Co.	Portland, Ore.
Sept. 2	Mr. Schmitz	Farmer	Ronan
5	Ray Volin	Montana State University	Bozeman
6	Arthur Mangles	Farmer	Polson
8	Don Merkley	Western Mont. Br. Sta.	Corvallis
	Diana Popham	" " " "	"
	E. R. Hehn	Montana State University	Bozeman
	Jim DeBree	" " "	"
	Bill Larus	" " "	"
15	Carl Stimson	Farmer	Belgrade
28	Roy Deming	Conrad National Bank	Kalispell
	Harry Farrington	" " "	"
	Everett Smyth	Chipman Chemical Co.	College Place, Wn.
Oct. 3	Roger Scott	Geigy Chemical Co.	Missoula
4	Marvin Jones	FHA	Kalispell
	Bob Johnson	"	"
	Mr. Hern	"	Polson
	Charles Green	"	"

Station visitors continued.

DATE	NAME	REPRESENTING	ADDRESS
Oct. 5	Art Jacobs	Montana State University	Bozeman
16	Wes Ledford	Chipman Chemical Co.	Spokane, Wn.
Nov. 9	Henry Ficken Jr.	Farmer	Kalispell
	Henry Ficken Sr.	Farmer	Kalispell
	J. A. Hoffmann	ARS Washington State U.	Pullman, Wn.
17	Ray Zimmerman	Farmer	Rt. 4, Kalispell
29	Leland Kade	Montana Farmer Stockman	Spokane, Wn.
	Willis Carr	Pacific Power & Light Co.	Kalispell
	Chet Mahugh	Mutual of Omaha	Kalispell
30	Martin Burris	Agricultural Experiment Sta.	Bozeman
	Don Graham	Western Montana Branch Sta.	Corvallis
Dec. 6	Merle Lyda	County Extension Agent	Kalispell
	John Mitchem	Daily Inter-Lake	Kalispell
8	Bill Ward	Pacific Power & Light Co.	Bigfork

GENERAL ADMINISTRATION

750

Included in the administrative budget for Northwestern Montana Branch Station is one month of salary for the Superintendent, the station travel allowance, office supplies and repair and maintenance of office equipment.

Clerical time has been increased to provide for having office help from 9 A.M. to 3:30 P.M. each week day. Phones have been placed in each office for added convenience. These steps serve to provide better service to those who call.

A new Gestetner mimeograph is a welcome addition to office equipment.

At their meeting in the spring of 1967 the Advisory Committee indicated interest in making the Robert's lease a permanent part of the Northwestern Branch Station and thus insure continuity in the dryland research. Should this body be successful in attempts to purchase at this time, even at what might seem to be a pretty steep price, they will doubtless provide a necessary facility at much less price than at a future time. Possibly one that otherwise might not be available later at any price.

The administrative budget for 1967-68 is $4524.00.

PHYSICAL PLANT

751

The physical plant budget includes one month of the Superintendent's salary, labor for maintenance of buildings and roads, materials and supplies, fuel, light, power, and the lease fee for the Robert's lease.

No major building or improvement projects were attempted during the year. Until the matter of purchase of the Robert's lease is settled none is planned.

Budget for 1967-68 is $3000.00.

GENERAL FARM

752

One month of the Superintendent's salary, the major part of the farm foreman's salary, labor, the cost of leasing and purchasing machines, plus gas, oil and supplies, make up the General Farm budget.

Incidental revenue from farming and livestock amounts to some $5500.00, which is appropriated to the station for operations. This revenue is as was stated, incidental, and the reason for farming is to provide as well as can be for the research of the station.

The new truck scales provide additional farm production information and facilitate sale of feeds, seeds and produce.

A budget of $13,343.00 was provided for General Farm operations in 1967-68.

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CLIMATOLOGY

The crop year of 1966-67 will go down on record as one of the drier years since records have been kept at the Northwestern Montana Branch Station, however it is not the driest year. The driest year was recorded in 1954-55 when the annual precipitation was 12.75. In 1952-53 precipitation was 14.72 and the third driest year was 1956-57 when the precipitation was 13.89. The precipitation for 1966-67 was 15.38 inches. This is a variation from the normal of 3.63 inches of precipitation. The average over the 18 year period is 19.10 inches of precipitation.

The mean temperature for the crop year was 45.1° F., and the average for over the 18 years is 43.5° F. Summer temperatures were somewhat higher than the long term period, but higher maximums and higher averages have been recorded in the past 18 years. The highest temperature for 1967 was 95° F. The mimimum was 2° above zero.

The 1967 growing season of 120 days was one of the longer frost free periods, being exceeded in length by the year 1966 when the growing season was 135 days. The 32° recorde on the 23rd of September, 1967, caused little or no damage to garden vegetables. A killing frost occurred the 15th of October which terminated all annual plant growth. Table 1

Table 1. Summary of climatic data by months for the 1966-67 crop year (September to August) and averages for the period 1949-67 at the Northwestern Montana Branch Station, Route 4, Kalispell.

Weather Variable	Month and Year												Total or Ave. Growing Season
	Sept. 1966	Oct. 1966	Nov. 1966	Dec. 1966	Jan. 1967	Feb. 1967	Mar. 1967	Apr. 1967	May 1967	June 1967	July 1967	Aug. 1967	
Precipitation (inches)													
Current Year	.79	1.34	3.33	1.68	1.50	.62	1.27	.99	1.30	2.53	.02	.01	15.38
Ave. 1949 to 1966-67	1.38	1.46	1.61	1.63	1.60	1.14	1.03	1.30	2.01	2.94	1.30	1.61	19.01
Mean Temperature (°F)													
Current Year	59.3	43.4	25.6	30.4	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	45.1
Ave. 1949 to 1966-67	53.9	44.2	32.6	26.9	22.5	27.9	32.1	43.1	51.9	58.4	64.4	64.5	43.5

Last killing frost in spring*
1967. . . . . May 26 (28°)
Ave. 1949-67. . . . . May 28

First killing frost in fall*
1967. . . . . Sept. 23 (32°)
Ave. 1949-67. . . . . Sept. 14

Frost-free period
1967. . . . . 120 days
Ave. 1949-67. . . . . 108 days

Maximum summer temperature. . . . . 95° Aug. 19, 1967

Minimum winter temperature. . . . . 2° Jan. 24, 1967

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

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Table 2. Comparison of monthly averages for 1966-67 and 1950-67 for Northwestern Montana Branch Station, Route 4, Kalispell, Mont. (Creston)

	Air Temperature (Fahrenheit)									Precipitation		
	Average 1966			Average 1967			Average 1950-67					Average
Month	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	1966	1967	1950-67
January	26.3	31.8	20.8	31.0	36.1	25.3	22.5	29.6	15.3	1.42	1.50	1.60
February	27.7	35.3	27.7	33.2	40.9	25.5	27.9	36.2	19.5	.67	.62	1.14
March	34.5	45.4	23.6	32.9	41.3	24.5	32.1	41.9	22.2	.53	1.27	1.03
April	42.9	54.8	30.9	40.6	52.6	28.6	43.1	55.0	29.6	.76	.99	1.30
May	54.3	69.8	38.7	52.2	66.0	38.4	51.9	65.6	38.1	1.18	1.30	2.01
June	56.0	69.1	42.8	59.4	73.3	45.4	58.4	72.2	44.6	6.57	2.53	2.94
July	64.5	81.2	47.7	66.1	84.8	47.4	64.4	81.4	47.4	2.49	.02	1.30
August	61.7	78.4	45.0	67.2	87.2	47.2	64.5	79.3	46.3	1.64	.01	1.61
September	59.3	74.9	43.6	61.0	78.9	43.1	54.3	69.4	39.1	.79	1.37	1.40
October	43.4	55.1	31.7	45.9	55.8	35.9	44.4	56.2	33.1	1.34	1.88	1.51
November	33.4	41.1	25.6	33.8	41.3	26.3	32.3	39.9	25.1	3.33	.62	1.55
December	30.4	36.1	24.6	25.1	30.8	19.4	26.9	33.0	20.7	1.68	1.16	1.65
Total	534.4	673.0	402.7	548.4	689.0	407.0	522.7	659.7	381.0	22.40	13.27	19.04
Average	44.5	56.1	33.6	45.7	57.4	33.9	43.6	55.0	31.8			

FROST FREE PERIOD

	1966	1967	1950-67
Last freeze date:	May 18	May 26	May 28
First freeze date:	Sept. 30	Sept. 23	Sept. 14
Frost free season:	135 days	120 days	108 days

PART I

1967

Annual Research Report

Northwestern Montana Branch

of the

Montana Agricultural Experiment Station

Kalispell, Montana

by

C. W. Roath

Superintendent

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1967 ANNUAL DATA FOR DATE OF LAST CUTTING ALFALFAS

INTRODUCTION:

A study of fall harvest dates with two species, five replications and a schedule of five harvest dates was designed by Eslick and planted in Creston, Bozeman and other irrigated locations in 1963. Harvest was in two cuttings with dates of the second varied in 1964 and 1965. In 1966 and 1967 two standard date harvests were made and the third cutting dates varied. Tabulated data for 1967 is included in this report.

RESULTS AND DISCUSSION:

Annual data tabulation shows a yield difference of .74 tons for Vernal and 1.17 for Flandria in the first two standard date cuttings because of previous dates of fall cutting. In seasons yield this difference becomes 1.13 tons per acre for Vernal and 1.86 tons per acre for Flandria. Statistical analysis of data shows the yield difference to be significant at the 1% level for Vernal and for Flandria, with the later harvest dates exceeding the earliest.

SUMMARY AND CONCLUSIONS:

Tabulation of four year data is less impressive than the 1967 annual data since yield was lost during the early years of two cutting harvest by waiting until freeze-down to harvest an over mature cutting. This would have been prevented by a three cutting harvest. It is however very gratifying to see how well the less winter hardy variety Flandria has maintained production when the last cutting is delayed until too late for regrowth to rob the root system. And how nearly Vernal yields the fourth harvest year duplicate first harvest year yields under this system.

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Table 1. Seasons yield in tons per acre in 1967, by cutting and date of fall harvest.

Variety	Date	Cutting	Replications 1	2	3	4	5	Total	Average
Vernal	6/15	1	.44	1.18	1.78	.57	.75		
	7/21	2	.91	.83	.91	.67	.86		
	8/21	3	.17	.22	.32	.17	.24		
		Season	1.52	2.23	3.01	1.41	1.85	10.02	2.00
Flandria	6/15	1	.66	1.10	1.80	.68	1.07		
	7/21	2	.85	.92	1.18	.87	1.29		
	8/21	3	.21	.25	.37	.32	.49		
		Season	1.72	2.27	3.35	1.87	2.85	12.06	2.41
Vernal	6/15	1	.84	1.09	.96	.83	.90		
	7/26	2	.86	1.03	.78	.87	.82		
	8/28	3	.40	.31	.34	.45	.30		
		Season	2.10	2.43	2.08	2.15	2.02	10.78	2.16
Flandria	6/15	1	.87	.91	.83	.94	.90		
	7/26	2	.78	1.20	1.06	1.10	.89		
	8/28	3	.34	.56	.56	.60	.44		
		Season	1.99	2.67	2.45	2.64	2.23	11.98	2.40
Vernal	6/15	1	.95	1.23	1.47	1.00	.68		
	7/26	2	.92	1.08	1.28	1.18	.97		
	9/ 5	3	.39	.43	.66	.79	.55		
		Season	2.26	2.74	3.41	2.97	2.20	13.58	2.72
Flandria	6/15	1	.69	1.33	2.15	.82	.79		
	7/26	2	1.07	1.25	1.22	1.20	.88		
	9/ 5	3	.57	.77	1.05	.72	.69		
		Season	2.33	3.35	4.42	2.74	2.36	15.20	3.04
Vernal	6/15	1	.90	1.40	1.11	1.07	.63		
	7/26	2	1.02	1.26	1.13	.91	1.12		
	9/11	3	.40	.67	.65	.51	.63		
		Season	2.32	3.33	2.89	2.49	2.38	13.41	2.68**
Flandria	6/15	1	1.29	1.65	1.21	1.20	.84		
	7/26	2	1.51	1.61	1.34	1.56	1.56		
	9/11	3	.69	.92	.87	.95	.84		
		Season	3.49	4.18	3.42	3.71	3.24	18.04	3.61**

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Table 1. (con't)

Variety	Date	Cutting	Replications 1	2	3	4	5	Total	Average
Vernal	6/15	1	1.33	1.77	1.53	.91	.90		
	7/26	2	1.36	1.39	1.27	1.12	1.02		
	9/28	3	.57	.69	.73	.57	.47		
		Season	3.26	3.85	3.53	2.60	2.39	15.63	3.13**
Flandria	6/15	1	1.64	1.70	1.65	1.70	1.21		
	7/26	2	1.98	1.84	1.44	1.50	1.59		
	9/28	3	1.21	.98	.85	1.17	.90		
		Season	4.83	4.52	3.94	4.37	3.70	21.36	4.27**

Summary by variety - Last cutting date
Five plot average by dates - Seasons yield

Variety	Last Cutting Date 8/21	8/28	9/ 5	9/11	9/28	Total	Average
Vernal	2.00	2.16	2.72	2.68	3.13	12.69	2.54
Flandria	2.41	2.40	3.04	3.61	4.27	15.73	3.15
2 Variety average	2.20	2.28	2.88	3.15	3.70		

VERNAL

$\bar{x}$..... 2.5368
S.E.$\bar{x}$..... .16271
L.S.D.(.05).. .49
L.S.D.(.01).. .67
C.V. %..... 6.41

FLANDRIA

$\bar{x}$..... 3.1456
S.E.$\bar{x}$..... .24562
L.S.D.(.05).. .74
L.S.D.(.01).. 1.01
C.V. %..... 7.81

Analysis of Variance

Source	D. F.	Mean Square	F.
Replications	4	.73125	5.52
Varieties	4	1.03654	7.83*
Error	16	.13239	
Total	24		

Source	D.F.	Mean Square	F.
Replications	4	.44172	1.47
Varieties	4	3.24051	10.74**
Error	16	.30166	
Total	24		

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Table 2. Four year average yield by varieties and fall dates.

Variety	Fall Date	Years 1 (1964)	2 (1965)	3 (1966)	4 (1967)	Total	Average
Vernal	1	4.58	4.78	3.80	2.00	15.16	3.03
Flandria	1	5.28	5.81	4.82	2.41	18.32	3.66
Vernal	2	5.04	4.64	4.27	2.16	16.11	3.22
Flandria	2	5.34	5.38	4.58	2.40	17.70	3.54
Vernal	3	4.07	4.70	~~4.44~~ 4.47	2.72	15.93	3.19
Flandria	3	4.61	5.52	5.34	3.04	18.51	3.70
Vernal	4	4.42	4.57	4.71*	2.68*	16.38	3.28
Flandria	4	5.62	5.68	5.95*	3.61*	20.86	4.17
Vernal	5	3.66	4.66	4.97*	3.13*	16.42	3.28
Flandria	5	4.66	5.84	5.94*	4.27*	20.71	4.14

yields of August 30 are the check yields

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1967 SAINFOIN EVALUATION AND SEED PRODUCTION

INTRODUCTION:

Two intrastate nurseries have been harvested, clones transplanted from foundation Eski fields in 1960 have been observed, comparative response of sainfoin and other species in other studies has been recorded, and seed produced in 1967. Results of these several phases of sainfoin work are tabulated and evaluated in this report.

RESULTS AND DISCUSSION:

A. Annual data in 1967 from an irrigated nursery on the Northwestern Montana Branch Station comparing Eski and Hall Sainfoin with Cicer Milkvetch and Ladak alfalfa shows the sainfoins and the milkvetch to be essentially equal, all significantly below Ladak alfalfa in yield. This nursery is located where a high water table limits early growth and where milkvetch might have been expected to be superior to other species. In three year yields alfalfa leads, followed by Eski, Hall and lastly by Cicer.

B. A comparison of sainfoin varieties seeded in 1966 has produced a surprise situation with the inclusion of an imported strain that in the seeding year (1966) and again this year exceeded Eski in yield. Most other varieties are below Eski in yield at the 5% level of significance when harvested in three cuttings and grown under irrigation. Yields of Eski and the strong growing introduction were 5.3 and 6.4 tons per acre.

C. Certain selected plants of Eski sainfoin transplanted in 1966 from foundation fields to an isolated dryland location lived and produced seed in 1967. Of these the earlier blooming ones were clipped and those blooming later than average allowed to produce seed. Of the later ones some ripened uniformly, while others did not, some produced smooth seed and some rough.

D. Seed of Eski sainfoin was produced on an original dryland field of three acres seeded with Bozeman seed in 1961. Approximately 700 pounds per acre in dirt was obtained. Also 1 3/4 acres drilled with seed from foundation fields was harvested which produced 800 pounds of seed per acre. Both fields were swathed and the swaths thrashed thru a combine in a pickup operation after a few days of drying. By applying the lessons learned in 1966 and reported in Bulletin #614, seed of good yield, good weight and good maturity was obtained.

E. Sainfoin was used as one species in the Species-Care-Harvest Nurseries, (Report #3). Fertilizer response was studied in comparison to alfalfa in Report #5. An intrastate standard pasture study with sainfoin as a major species was seeded for evaluation in 1968 and subsequent years.

Sainfoin Evaluation and Seed Production (con't)

SUMMARY AND CONCLUSIONS:

A. Eski sainfoin has lived and maintained production above three tons per acre for three harvest years in a soil in which a high water table fluctuates from near surface in early spring to perhaps seven feet below surface by fall. In this situation Cicer Milkvetch and Hall Sainfoin have produced somewhat less and Ladak Alfalfa 4/10 ton more per acre.

B. A stronger growing sainfoin variety or strain is producing more than Eski the first year following seeding.

C. Smooth seed has been secured from uniformly ripening late blooming Eski transplants.

D. Eski Sainfoin failed to make alfalfa-like response to fertilizers in a study at Northwestern Montana Branch Station.

E. Seven hundred to eight hundred pounds of Eski Sainfoin seed per acre of good weight and maturity was obtained by applying lessons reported in Bulletin #614.

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Table 3. Irrigated Sainfoin -Alfalfa,-Vetch Nursery grown in 1967. Seasons yield in tons per acre. Dry Lbs from 60 sq. ft. x .40656.

First Cutting: June 15, 1967 Second Cutting: August 9, 1967

Variety	Cutting	Replications 1	2	3	4	Total	Average
Eski Sainfoin	1	2.06	2.03	1.93	1.63	7.65	1.91
	2	1.26	1.10	1.01	1.02	4.39	1.10
	Season	3.32	3.13	2.94	2.65	12.04	3.01
Hall Sainfoin	1	1.85	2.03	2.16	1.52	7.56	1.89
	2	.96	.97	.97	.79	3.69	.92
	Season	2.81	3.00	3.13	2.31	11.25	2.81
Cicer Milkvetch	1	1.70	1.45	2.31	1.68	7.14	1.79
	2	.98	1.56	1.24	1.05	4.83	1.21
	Season	2.68	3.01	3.55	2.73	11.97	2.99
Ladak Alfalfa	1	1.65	1.75	1.79	1.76	6.95	1.74
	2	1.34	2.18	2.39	1.80	7.71	1.93
	Season	2.99	3.93	4.18	3.56	14.66	3.67

NOTE: Ladak used as a check in this nursery.

$\bar{x}$..... 3.12
S.E.$\bar{x}$..... .15783
L.S.D.(.05).. .50
C.V. %..... 5.06

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.33881	3.40
Varieties	3	.55991	5.62*
Error	9	.09964	
Total	15		

Table 4. Three year yield summary.

Variety	Tons per Acre per Year 1	2	3	Total	Average
Eski Sainfoin	3.43	3.61	3.01	10.05	3.35
Hall Sainfoin	2.43	3.34	2.81	8.58	2.86
Cicer Milkvetch	.46	3.02	2.99	6.47	2.16
Ladak Alfalfa	3.46	4.08	3.67	11.21	3.74

Table 5. Intrastate Sainfoin Varieties grown in 1967. Yields in tons per acre at 12% moisture.

First cutting: June 19, 1967
Second cutting: July 31, 1967
Third cutting: September 12, 1967

Variety	Cutting	Replications 1	2	3	4	Total	Average
Hall	1	3.14	2.53	2.63	2.94	11.24	
	2	.83	.86	.87	.72	3.28	
	3	.52	.61	.52	.52	2.17	
	Season	4.49	4.00	4.02	4.18	16.69	4.17
Eski	1	3.27	3.15	3.24	3.39	13.05	
	2	1.48	1.22	1.41	1.42	5.53	
	3	.81	.66	.52	.69	2.68	
	Season	5.56	5.03	5.17	5.50	21.26	5.31
N. K. Czeck.	1	3.32	2.30	2.68	3.15	11.45	
	2	2.12	2.06	2.03	2.17	8.38	
	3	1.35	1.40	1.52	1.43	5.70	
	Season	6.79	5.76	6.23	6.75	25.53	6.38*
Lethbridge	1	3.28	2.78	3.02	2.53	11.61	
	2	.91	1.15	1.26	1.41	4.73	
	3	.59	.59	.75	.88	2.81	
	Season	4.78	4.52	5.03	4.82	19.15	4.79
N. K. Poland	1	2.41	2.01	2.85	3.21	10.48	
	2	.89	1.12	1.01	.81	3.83	
	3	.47	.31	.40	.43	1.61	
	Season	3.77	3.44	4.26	4.45	15.92	3.98
Onar	1	2.40	2.12	1.41	2.72	8.65	
	2	.84	1.00	1.02	1.14	4.00	
	3	.41	.67	.54	.82	2.44	
	Season	3.65	3.79	2.97	4.68	15.09	3.77

NOTE: Eski used as check in this nursery.
* Variety yielding significantly more than the check (.05)

$\bar{x}$..... 4.735
S.E.$\bar{x}$..... .17872
L.S.D.(.05) .54
C.V.%..... 3.77

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.46153	3.61*
Varieties	5	3.8930	30.47**
Error	15	.12776	
Total	23		

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RESPONSE OF SAINFOIN AND ALFALFA TO FERTILIZER TREATMENTS

INTRODUCTION:

A paired plot study of the response of two legumes to fertilizer treatment with four replications was initiated in 1965 with Donald R. Graham and C. W. Roath co-operating. It has been interesting to note the difference in response pattern which is even more pronounced this second year of harvest than it was the first.

RESULTS AND DISCUSSION:

Analysis of the data from each species as a separate study shows no significance in the sainfoin data while that for alfalfa is highly significant. This is to say, that none of the treatments have made any real difference in yield of sainfoin. On the other hand all treatments used made real difference in the yield of alfalfa, using potash, sulfur and phosphorus at all rates. The greatest yield is from the highest rate of phosphorus. One wonders what yields might have been obtained from use of combinations of potash, sulfar and high phosphorus. An interesting sidelight is that moisture was thought to be limiting since no irrigation water was applied. Regrowth was such that alfalfa was harvested three times, sainfoin only twice.

SUMMARY AND CONCLUSIONS:

Yields of alfalfa was increased significantly by all treatments while yields of sainfoin was not affected by any treatment. This would seem to say that a lower level of fertility was adequate for sainfoin than for alfalfa.

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Table 6. Fertilizers on Sainfoin in 1967.
Seasons yield in tons per acre in two cuttings, non-irrigated.
First Cutting: June 19, 1967 Second Cutting: August 2, 1967

Fertilizer	Cutting	Replications 1	2	3	4	Total	Average
Potash	1	3.06	2.84	2.84	3.10		
	2	.94	.81	.77	.85		
	Season	4.00	3.65	3.61	3.95	15.21	3.80
Sulfur	1	2.55	2.20	2.37	1.56		
	2	.84	.89	1.02	.78		
	Season	3.39	3.09	3.39	2.34	12.21	3.05
Check	1	3.66	2.53	1.79	3.43		
	2	.86	1.00	.76	1.22		
	Season	4.52	3.53	2.55	4.65	15.25	3.81
25 P annual	1	2.85	2.93	2.85	2.39		
	2	.79	.99	.96	1.04		
	Season	3.64	3.92	3.81	3.43	14.80	3.70
50 P	1	2.02	2.79	2.47	2.51		
	2	.76	1.04	.97	.74		
	Season	2.78	3.83	3.44	3.25	13.30	3.33
100 P	1	3.20	2.58	2.34	4.23		
	2	.78	1.02	.75	1.12		
	Season	3.98	3.60	3.09	5.35	16.02	4.01
150 P	1	2.58	2.65	2.11	2.61		
	2	.84	.94	.89	.94		
	Season	3.42	3.59	3.00	3.55	13.56	3.39

$\bar{x}$..... 3.58392
S.E.$\bar{x}$..... .29877
L.S.D.(.05) N.S.
C.V.%..... 8.34

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.34804	
Fertilizer	6	.45190	1.27
Error	18	.35705	
Total	27		

Table 7. Fertilizer on Alfalfa in 1967.
Seasons yields in tons per acre in three cuttings, non-irrigated.

First Cutting: June 19, 1967
Second Cutting: August 2, 1967
Third Cutting: September 12, 1967

Fertilizer	Cutting	Replications 1	2	3	4	Total	Average
Potash	1	2.69	2.42	2.76	2.46		
	2	2.06	2.12	2.06	1.97		
	3	1.07	1.07	1.17	.84		
	Season	5.82	5.61	5.99	5.27	22.69	5.67
Sulfur	1	2.31	2.24	2.39	1.89		
	2	2.45	2.10	2.35	1.90		
	3	1.02	.96	1.11	.80		
	Season	5.78	5.30	5.85	4.59	21.52	5.38
Check	1	2.57	1.68	2.08	1.59		
	2	1.54	1.69	1.78	1.55		
	3	.39	.49	.69	.36		
	Season	4.50	3.86	4.55	3.50	16.41	4.10
25 P annual	1	2.85	2.93	2.85	2.39		
	2	1.36	2.45	1.96	1.80		
	3	.46	1.04	.82	.72		
	Season	4.67	6.42	5.63	4.91	21.63	5.41
50 P	1	2.84	3.22	2.97	2.39		
	2	1.89	1.96	2.14	2.01		
	3	.61	.54	1.00	1.11		
	Season	5.34	5.72	6.11	5.51	22.68	5.67
100 P	1	2.37	2.70	2.35	2.26		
	2	1.61	2.30	2.20	2.21		
	3	.78	1.26	.98	1.09		
	Season	4.76	6.26	5.53	5.56	22.11	5.53
150 P	1	3.26	3.22	2.68	2.92		
	2	2.06	2.31	2.04	2.04		
	3	1.03	1.10	1.07	1.13		
	Season	6.35	6.63	5.79	6.09	24.86	6.22

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	.59777	2.69
Fertilizers	6	1.67148	7.53*
Error	18	.22203	
Total	27		

$\bar{x}$..... 5.425
S.E.$\bar{x}$..... .2356
L.S.D.(.05).. .70
C.V.%..... 4.34

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RESPONSE OF IRRIGATED PASTURES TO FERTILIZER TREATMENTS

INTRODUCTION:

Three pasture mixtures treated with nine annual fertilizer treatments and seeded in 1960 in plots with four replications have been harvested in 1967. Small random plot samples are taken prior to each grazing with sheep for yield. Sheep numbers sufficient to utilize the grass in all plots in three or four days are used and plots given as many growing days as practical. Usually stems and weeds of little value remain and are mowed following grazing.

RESULTS AND DISCUSSION:

By comparing pasture mixtures we see that mean yields for all treatments are very similar, both for 1967 and for the six years of uniform treatment. Orchard-Trefoil has the highest yield for untreated checks, and Orchard-Alfalfa holds a very slight lead in total yield for the greatest amount of fertilizer. All mixtures respond similarly to treatment with 100-80-0 leading, followed by 100-40-0 second and 50-80-0 third. In two mixtures 50-40-0 is fourth and fifth in one. In two of the three cases 0-80-0 is above 100-0-0.

All treatments yield significantly above untreated checks in 1967 in Orchard-Ladino plots. All except for 50-0-0 in Orchard-Alfalfa plots and all except 50-0-0, 0-40-0 and 0-80-0 produced significantly above checks in Orchard-Trefoil plots.

For 1967, 100-80-0 produced an average of 2.33 tons per acre on a 12% moisture basis than did untreated checks for three pasture mixtures. Four times this amount of lush green forage before drying would have provided 80 pounds a day for a cow for 233 days of grazing.

SUMMARY AND CONCLUSION:

Combinations of nitrogen and phosphorus in annual applications produce much more grazing than either alone,when applied to three pasture mixtures that over a six year period have responded similarly. The additional grass produced in 1967 by the use of 100-80-0 would provide 80 pounds a day for cows for 233 days.

Table 8. Fertilizer for irrigated pasture, orchard - trefoil, in 1967. Seasons yields in tons per acre at 12% moisture.

First Cutting: May 25, 1967
Second Cutting: July 5, 1967
Third Cutting: August 18, 1967

Treatment N	Treatment P	Cutting	Replications 1	2	3	4	Total	Average
50	40	1	.42	1.52	.76	.76		
		2	1.03	1.20	1.39	1.18		
		3	.12	.37	.38	.32		
		Total	1.57	3.09	2.53	2.26	9.45	2.36*
100	40	1	.76	1.61	1.14	1.02		
		2	1.26	1.79	1.98	1.21		
		3	.26	1.01	.59	.37		
		Total	2.28	4.41	3.71	2.60	13.00	3.25*
0	40	1	.51	.59	.76	.08		
		2	.81	1.02	1.03	.99		
		3	.27	.75	.43	.21		
		Total	1.59	2.36	2.22	1.28	7.45	1.86
100	0	1	.85	1.36	.47	.25		
		2	1.34	1.43	.85	1.02		
		3	.54	.52	.35	.31		
		Total	2.73	3.31	1.67	1.58	9.29	2.32*
0	80	1	.59	.08	.25	.17		
		2	1.11	1.15	.99	.78		
		3	.62	.25	.33	.27		
		Total	2.32	1.48	1.57	1.22	6.59	1.65
100	80	1	1.36	1.36	1.19	1.02		
		2	1.56	1.98	1.64	1.19		
		3	.59	.21	.45	.38		
		Total	3.51	3.55	3.28	2.59	12.93	3.23*
50	80	1	1.06	1.02	.76	.85		
		2	1.56	1.55	1.04	1.44		
		3	.50	.26	.19	.33		
		Total	3.12	2.83	1.99	2.62	10.56	2.64*
50	0	1	.42	.34	1.27	.25		
		2	.96	.99	1.20	1.13		
		3	.18	.14	.50	.24		
		Total	1.56	1.47	2.97	1.62	7.62	1.91
0	0	1	.08	.34	.59	.17		
		2	.45	.93	.78	.70		
		3	.09	.28	.52	.19		
		Total	.62	1.55	1.89	1.06	5.12	1.28

Table 8. Fertilizer for irrigated pasture (con't)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.08445	3.18
N	2	4.18362	12.29*
P	2	1.76072	5.17*
NxP	4	.72915	2.14
Error	24	.34059	
Total	35		

$\bar{x}$..... 2.27805
S.E.$\bar{x}$..... .2918
L.S.D.(.05) .85
C.V.%..... 12.81

Table 9. Fertilizer for irrigated pasture, orchard - ladino, in 1967. Seasons yields in tons per acre at 12% moisture.

First Cutting: May 25, 1967
Second Cutting: July 7, 1967
Third Cutting: August 18, 1967

Treatment N	Treatment P	Cutting	Replications 1	2	3	4	Total	Average
50	40	1	.93	1.02	1.02	1.02		
		2	1.08	1.36	1.58	1.33		
		3	.72	.63	.58	.51		
		Total	2.73	3.01	3.18	2.86	11.78	2.95
100	40	1	1.36	1.02	1.02	1.02		
		2	1.23	1.83	1.61	1.50		
		3	.80	.84	.72	.65		
		Total	3.39	3.69	3.35	3.17	13.60	3.40
0	40	1	.17	.68	.68	.34		
		2	1.05	1.21	.83	.89		
		3	.58	.43	.17	.24		
		Total	1.80	2.32	1.68	1.47	7.27	1.82
100	0	1	.68	1.10	1.19	.34		
		2	.97	1.41	1.74	.65		
		3	.61	.83	.71	.22		
		Total	2.26	3.34	3.64	1.21	10.45	2.61
0	80	1	.17	.59	.80	.76		
		2	1.14	1.12	1.20	1.30		
		3	.48	.54	.42	.44		
		Total	1.79	2.25	2.42	2.50	8.96	2.24

Table 9. Fertilizer for irrigated pasture (con't).

Treatment N	Treatment P	Cutting	Replications 1	2	3	4	Total	Average
100	80	1	1.02	1.36	1.19	1.02		
		2	1.45	1.60	1.50	1.64		
		3	1.00	1.08	.75	.36		
		Total	3.47	4.04	3.44	3.02	13.97	3.49
50	80	1	.93	1.36	1.27	.85		
		2	1.52	1.62	1.62	1.36		
		3	.86	1.14	.56	.45		
		Total	3.31	4.12	3.45	2.66	13.54	3.39
50	0	1	.17	.97	.51	.08		
		2	.73	1.64	1.12	.51		
		3	.33	1.21	.20	.06		
		Total	1.23	3.82	1.83	.65	7.53	1.88
0	0	1	.08	.25	.21	.08		
		2	.54	.62	.48	.53		
		3	.18	.47	.06	.06		
		Total	.80	1.34	.75	.67	3.56	.89

$\bar{x}$..... 2.51833
S.E.$\bar{x}$..... .25815
L.S.D.(.05).. .75
C.V.%..... 10.25

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.93615	7.26
N	2	7.35591	27.60*
P	2	5.01291	18.81*
NxP	4	.10834	
Error	24	.26656	
Total	35		

Table 10. Fertilizer for irrigated pasture, orchard - alfalfa, in 1967. Seasons yield in tons per acre at 12% moisture.

First Cutting: May 25, 1967
Second Cutting: July 7, 1967
Third Cutting: August 18, 1967

Treatment N	Treatment P	Cutting	Replications 1	2	3	4	Total	Average
50	40	1	.85	.89	.85	.59		
		2	1.56	1.14	1.51	1.00		
		3	.70	.33	.52	.54		
		Total	3.11	2.36	2.88	2.13	10.48	2.62
100	40	1	.85	.85	.72	.72		
		2	1.72	1.20	1.84	1.34		
		3	1.00	.42	.37	.38		
		Total	3.57	2.47	2.93	2.44	11.41	2.85
0	40	1	.55	.42	.30	.42		
		2	1.13	1.20	.68	1.07		
		3	.98	.92	.46	.60		
		Total	2.66	2.54	1.44	2.09	8.73	2.18
100	0	1	.85	.51	.76	.08		
		2	1.18	1.26	1.21	.41		
		3	.70	.30	.30	.18		
		Total	2.73	2.07	2.27	.67	7.74	1.94
0	80	1	.30	.72	.25	.68		
		2	1.09	1.51	1.01	.89		
		3	.36	.52	.27	.40		
		Total	1.75	2.75	1.53	1.97	8.00	2.00
100	80	1	1.06	1.02	.85	1.02		
		2	1.84	1.45	2.16	1.67		
		3	.83	.46	.39	.90		
		Total	3.73	2.93	3.40	3.59	13.65	3.41
50	80	1	.76	1.10	.80	.76		
		2	1.52	1.55	1.26	1.29		
		3	.28	.89	.22	.51		
		Total	2.56	3.54	2.28	2.56	10.94	2.74

Table 10. Fertilizer for irrigated pasture (con't).

Treatment N	Treatment P	Cutting	Replications 1	2	3	4	Total	Average
50	0	1	.25	.76	.51	.08		
		2	1.08	1.36	.96	.47		
		3	.24	.71	.29	.10		
		Total	1.57	2.83	1.76	.65	6.81	1.70
0	0	1	.25	.34	.08	.08		
		2	.81	1.00	.38	.46		
		3	.27	.29	.28	.09		
		Total	1.33	1.63	.74	.63	4.33	1.08

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1.07364	3.83
N	2	2.91835	10.42*
P	2	4.57879	16.35*
NxP	4	.15881	
Error	24	.28006	
Total	35		

$\bar{x}$..... 2.28027
S.E.$\bar{x}$..... .26460
L.S.D.(.05) .77
C.V.%..... 11.60

Table 11. Six year average yield summary by mixture and treatment in tons per acre at 12% moisture.

Treatment N	Treatment P	Orchard-Trefoil	Orchard-Ladino	Orchard-Alfalfa	3 Mixture Average	Rank
50	40	3.20	3.35	3.58	3.38	4
100	40	3.47	3.85	3.73	3.68	2
0	40	2.68	2.60	2.82	2.70	7
100	0	3.33	2.93	2.79	3.02	5
0	80	2.66	2.94	3.06	2.89	6
100	80	3.57	3.68	4.03	3.76	1
50	80	3.36	3.71	3.66	3.58	3
50	0	2.86	2.26	2.74	2.62	8
0	0	2.15	1.58	2.02	1.92	9
Mean		3.03	3.01	3.16	3.07	

SPECIES-CARE-HARVEST NURSERIES

INTRODUCTION:

Giving recognition to the importance of; 1. Species and varieties; 2. Fertility levels; 3. Harvest schedules, in the production of nutrients in forage has led to incorporation of these factors or influences into a single study. It is hoped that their influence can be seen and measured, singly and as exhibited, either addatively or multiplied.

RESULTS AND DISCUSSION:

Irrigated nurseries seeded in 1966 were harvested in three locations. Locations are treated as replications in this study. Six species each receive three fertilizer treatments and are harvested in early, medium and late harvest schedules. Annual data is presented by harvest schedule for each location; from Kalispell in Table 1, from Ronan in Table 2, from Missoula in Table 3. Table 4 presents a summary of all data to which statistical analysis is attached. Chemical analysis of late harvested samples is shown in Table 5.

Statistical analysis shows varieties, harvest schedules and fertilizer treatments all to be significant with real differences also in locations and with interactions between factors also significant. When varieties are compared at all locations Ladak alfalfa is seen to be high in yield with Altaswede second and Eski third. The legumes are followed by Pennlate, Oahe and Alkar in that order. Some variation occurs by location, most notably at Ronan, where Altaswede is high and Eski low.

By harvest schedules the medium harvest is best for yield on the average, but not for all species at all locations. At Kalispell early harvest provided time for three cuttings of alfalfa and the greatest yield. More total yield from some species grown at Kalispell was secured by the late harvest schedule. At Ronan inadequate irrigation for late growth favored medium harvest for nearly all species. Yields of most species were also best for medium harvest schedules at Missoula.

Phosphorous plentifully supplied to all species was generally beneficial to grasses and legumes at Kalispell. At Missoula an irrigation ditch along the ends of the unfertilized plots may have been of equal benefit with phosphorous and results were erratic. At Ronan the plots were apparently so short of nitrogen that use of phosphorous without nitrogen resulted in depressed yields.

Nitrogen in addition to phosphorous on the grasses on the grasses was highly beneficial in nearly all cases at Kalispell. At Ronan nitrogen was obviously badly needed. At Missoula even though instances of terrific response can be cited the NP plots suffered from being furthest from the ditch.

Some surprises came from chemical analysis of late harvested first cutting samples when it was presumed that early maturing species would be greatly below later maturing species in protein. While it is true that orchardgrass protein

Results and Discussion con't.:

content was low at this date it is also true that later grasses were not greatly better on the samples taken. Alfalfa was still high in protein among the species at the late July dates.

SUMMARY AND CONCLUSIONS:

The study indicates tremendous potential forage production from the species and varieties used if treated properly. Note, seven ton yields of Ladak alfalfa at two locations, six ton yields of altaswede clover at Ronan, and of Eski at Missoula. Yields of grasses in about seven tons also appear possible if nitrogen is supplied in addition to phosphorous.

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Table 1. Seasons yield in tons per acre at 12% moisture from Northwestern Montana Branch Station, Kalispell, Montana in 1967, by cutting schedule.

Species	Cutting	Check	P	NP	Average
	Early Harvest: Cuttings - 6/12, 7/31 & Ladak 9/12				
Pennlate	1st	1.38	1.50	2.98	
	2nd	.88	1.09	1.07	
	Total	2.26	2.59	4.05	2.96
Eski	1st	1.34	1.93	1.83	
	2nd	1.28	1.50	1.88	
	Total	2.62	3.43	3.71	3.25
Oahe	1st	2.24	2.87	4.01	
	2nd	.59	.99	.84	
	Total	2.83	3.86	4.85	3.85
Ladak	1st	1.65	2.12	2.26	
	2nd	2.58	3.43	3.19	
	3rd	1.40	1.97	1.92	
	Total	5.63	7.52	7.37	6.87
Alkar	1st	1.78	2.00	2.43	
	2nd	.90	1.40	1.47	
	Total	2.68	3.40	3.90	3.33
Altaswede	1st	2.35	3.03	2.56	
	2nd	1.89	2.28	2.48	
	Total	4.24	5.31	5.04	4.87
	Medium Harvest: Cuttings - 6/27 & 8/21				
Pennlate	1st	3.62	3.79	5.36	
	2nd	.95	.93	1.94	
	Total	4.57	4.72	7.30	5.46
Eski	1st	4.25	3.78	4.04	
	2nd	1.02	1.25	1.48	
	Total	5.27	5.03	5.52	5.27
Oahe	1st	2.98	4.10	4.67	
	2nd	.59	.56	.85	
	Total	3.57	4.66	5.52	4.58

Table 1 . (con't) Medium Harvest

Species	Cutting	Check	P	NP	Average
Ladak	1st	1.98	2.46	3.59	
	2nd	2.02	3.05	3.20	
	Total	4.00	5.51	6.79	5.45
Alkar	1st	2.16	2.63	4.09	
	2nd	.23	.28	.34	
	Total	2.39	2.91	4.43	3.24
Altaswede	1st	4.35	4.14	4.45	
	2nd	1.23	1.06	1.32	
	Total	5.58	5.20	5.77	5.85
	Late Harvest: Cuttings - 7/10 & 9/12				
Pennlate	1st	5.06	5.53	5.58	
	2nd	1.59	1.75	3.46	
	Total	6.65	7.28	9.04	7.66
Eski	1st	3.78	3.99	3.79	
	2nd	1.65	1.44	1.21	
	Total	5.43	5.43	5.00	5.28
Oahe	1st	6.00	6.61	5.97	
	2nd	.79	.89	.91	
	Total	6.79	7.50	6.88	7.05
Ladak	1st	2.39	2.39	3.03	
	2nd	2.33	3.73	3.16	
	Total	4.72	6.12	6.19	5.67
Alkar	1st	3.43	4.02	4.84	
	2nd	.62	.57	.98	
	Total	4.05	4.59	5.82	4.82
Altaswede	1st	4.36	4.84	4.95	
	2nd	1.44	1.52	1.41	
	Total	5.80	6.36	6.36	6.18

Table 2. Seasons yield in tons per acre at 12% moisture from the Gene Allard farm at Ronan, Montana in 1967 by cutting schedule.

Species	Cutting	Check	P	NP	Average
		Early Harvest: Cuttings - 6/13 & 8/7			
Pennlate	1st	1.24	.79	2.30	
	2nd	.54	.55	1.05	
	Total	1.78	1.34	3.35	2.15
Eski	1st	1.09	1.15	1.27	
	2nd	.57	.73	.85	
	Total	1.66	1.88	2.12	1.89
Oahe	1st	1.67	1.02	2.75	
	2nd	.43	.44	.56	
	Total	2.10	1.46	3.30	2.29
Ladak	1st	1.53	1.62	1.63	
	2nd	.64	1.15	.92	
	Total	2.17	2.77	2.55	2.49
Alkar	1st	1.43	.88	2.07	
	2nd	.68	.63	.59	
	Total	2.11	1.51	2.66	2.09
Altaswede	1st	2.90	3.54	3.68	
	2nd	.55	.95	.87	
	Total	3.45	4.49	4.55	4.16
		Medium Harvest: Cuttings - 6/28 & 8/30			
Pennlate	1st	2.11	1.26	3.39	
	2nd	1.42	1.31	1.33	
	Total	3.53	2.57	4.72	3.60
Eski	1st	1.56	1.73	1.58	
	2nd	1.08	1.45	1.65	
	Total	2.64	3.18	3.23	3.01
Oahe	1st	2.17	1.91	3.87	
	2nd	.83	.85	.62	
	Total	3.00	2.76	4.49	3.42

Table 2 . (con't) Medium Harvest

Species	Cutting	Check	N	NP	Average
Ladak	1st	2.08	3.24	2.68	
	2nd	2.07	2.84	2.06	
	Total	4.15	6.08	4.74	4.99
Alkar	1st	2.06	1.97	3.03	
	2nd	1.15	1.24	.94	
	Total	3.21	3.21	3.97	3.46
Altaswede	1st	3.29	4.28	3.35	
	2nd	1.35	2.01	1.95	
	Total	4.64	6.29	5.30	5.41
	Late Harvest: Cutting - 7/21 - then too dry for regrowth				
Pennlate	1st				
	Total	2.05	1.41	3.25	2.26
Eski	1st				
	Total	1.74	1.99	2.33	2.02
Oahe	1st				
	Total	3.49	3.71	4.30	3.83
Ladak	1st				
	Total	2.48	2.39	2.15	2.34
Alkar	1st				
	Total	2.05	2.15	3.84	2.68
Altaswede	1st				
	Total	2.31	2.98	2.66	2.65

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Table 3. Seasons yield in tons per acre at 12% moisture from the A. D. Neilson farm, Missoula, Montana in 1967 by cutting schedule.

Species	Cutting	Check	N	NP	Average
		Early Harvest: Cuttings - 6/15 & 8/8			
Pennlate	1st	1.40	1.50	3.27	
	2nd	1.67	1.94	3.00	
	Total	3.07	3.44	6.27	4.26
Eski	1st	2.68	3.04	2.33	
	2nd	2.21	1.91	2.04	
	Total	4.89	4.95	4.37	4.74
Oahe	1st	1.24	1.52	2.90	
	2nd	1.00	1.38	1.48	
	Total	2.24	2.90	4.38	3.17
Ladak	1st	2.78	3.08	2.30	
	2nd	3.66	4.26	3.24	
	Total	6.44	7.34	5.54	6.44
Alkar	1st	1.10	1.35	2.10	
	2nd	1.10	1.44	.80	
	Total	2.20	2.79	2.90	2.63
Altaswede	1st	2.21	3.09	1.57	
	2nd	.78	1.85	1.38	
	Total	2.99	4.94	2.95	3.63
		Medium Harvest: Cuttings - 6/28 & 8/25			
Pennlate	1st	2.35	2.10	4.03	
	2nd	1.50	1.91	1.68	
	Total	3.85	4.01	5.71	4.52
Eski	1st	4.60	4.71	2.85	
	2nd	2.61	2.43	1.80	
	Total	7.21	7.14	4.65	6.33
Oahe	1st	3.09	2.90	2.77	
	2nd	.86	.85	.99	
	Total	3.95	3.75	3.76	3.82

Table 3 . (con't) Medium Harvest

Species	Cutting	Check	P	NP	Average
Ladak	1st	5.05	4.11	2.84	
	2nd	3.24	3.74	3.46	
	Total	8.29	7.85	6.30	7.48
Alkar	1st				
	Total	2.11	1.74	2.55	2.13
Altaswede	1st	5.44	3.83	4.17	
	2nd	1.57	2.79	1.75	
	Total	7.01	6.62	5.92	6.52
	Late Harvest: Cuttings - 7/14 & 8/31				
Pennlate	1st	1.21	1.67	3.52	
	2nd	.32	.70	.36	
	Total	1.53	2.37	3.88	2.59
Eski	1st	4.29	3.60	1.68	
	2nd	2.80	2.47	.45	
	Total	7.09	6.07	2.13	5.10
Oahe	1st				
	Total	1.68	2.67	3.12	2.49
Ladak	1st	3.97	4.78	4.17	
	2nd	3.26	4.63	2.93	
	Total	7.23	9.41	7.10	7.91
Alkar	1st				
	Total	1.93	3.15	2.36	2.46
Altaswede	1st	4.79	3.92	3.28	
	2nd	2.60	2.20	1.17	
	Total	7.39	6.12	4.45	5.99

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Table 4. Summary of 1967 Species-Care-Harvest Data.

Variety	FERTILIZER LEVELS Check	P	N+P	$\bar{x}$ Varieties
Pennlate	3.25	3.30	5.29	3.95
Eski	4.28	4.34	3.67	4.10
Oahe	3.29	3.70	4.40	3.80
Ladak	5.01	6.11	5.41	5.51
Alkar	2.53	2.83	3.60	2.99
Altaswede	4.82	5.37	4.78	4.99
$\bar{x}$ Fertilizer levels	3.87	4.28	4.53	/$\bar{x}$-4.22

Variety	HARVEST TIME Early 6/15 & 8/8	Mid-Season 6/28 & 8/25	Late 7/14 & 8/31	$\bar{x}$
Pennlate	3.12	4.55	4.16	3.95
Eski	3.29	4.87	4.13	4.10
Oahe	2.99	3.94	4.46	3.80
Ladak	5.26	5.97	5.31	5.51
Alkar	2.68	2.95	3.33	2.99
Altaswede	4.22	5.81	4.94	4.99
$\bar{x}$ Harvest time	3.60	4.68	4.38	/$\bar{x}$-4.22

Table 4 . (con't)

Variety	LOCATIONS Kalispell	Ronan	Missoula	$\bar{x}$
Pennlate	5.38	2.67	3.79	3.95
Eski	4.60	2.31	5.39	4.10
Oahe	5.16	3.07	3.16	3.80
Ladak	5.98	3.28	7.28	5.51
Alkar	3.80	2.75	2.41	2.99
Altaswede	5.52	4.07	5.38	4.99
$\bar{x}$ Location	5.07	3.03	4.57	/$\bar{x}$-4.22

$\bar{x}$..... 4.2221
S.E.$\bar{x}$..... .34291
C.V.%..... 8.12

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Square	F.
V Variety (6)	5	109.43933	21.88787	62.05*
HT Harvest timing(3)	2	34.17550	17.08775	48.44*
FL Fertility level(3)	2	11.99448	5.99724	17.00*
Location (3)	2	123.39313	61.69656	174.89*
V x HT	10	13.06283	1.30628	3.70*
V x FL	10	33.34652	3.33465	9.45*
HT x FL	4	2.29758	.57440	1.62NS
V x HT x FL	20	178.50965	8.92548	25.30*
Error	107	37.74667	.35277	
Total (162)	161	543.96569		

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Table 5. Chemical analysis of late cutting forages, late first cutting hay at three locations, based on three samples per location.

Variety	Kalispell 7/10	Ronan 7/21	Missoula 7/14	Average
		PROTEIN		
Pennlate	6.3	6.4	5.2	6.0
Eski	9.6	7.1	8.7	8.5
Oahe	8.2	5.3	5.5	6.3
Ladak	13.8	8.7	14.7	12.4
Alkar	7.8	5.9	5.8	6.5
Altaswede	11.7	8.6	10.8	10.4
		PHOSPHOROUS		
Pennlate	.14	.26	.21	.20
Eski	.22	.20	.23	.22
Oahe	.14	.15	.17	.15
Ladak	.18	.19	.19	.19
Alkar	.14	.20	.17	.17
Altaswede	.21	.21	.17	.20

EVALUATION OF POTATO VARIETIES, SELECTIONS AND BREEDING MATERIAL IN 1967

INTRODUCTION:

Research with potatoes at Northwestern Montana Branch Station in 1967 consisted of single plot or single row evaluation of Montana selections and named varieties and of Hoyman seedlings and selections. Those in which there is a sufficient interest and for which adequate seed is available will be evaluated in replicated yield studies at a later date.

RESULTS AND DISCUSSION:

1. Montana Selections

Seed of 33 Montana seedlings and named varieties was supplied by the Plant and Soils Science Department in sufficient quanity to make single or duplicate row evaluation of characteristics at this location. Hills were spaced two feet apart and the plots irrigated. All entries were subjected to rogueing as required. Notes were taken on occasion. The advice of Orville McCarver, Extension Horticulture Specialist was followed with respect to rogueing necessity. Both Mr. McCarver and Prof. Homer Metcalf were present at digging time and assisted with evaluation and selection of material to keep for further study. Five Montana selections, one North Dakota selection and one named variety were retained.

2. Hoyman Seedlings

Nineteen-hundred tubers from ten families were received from Dr. Wm. G. Hoyman of Prosser, Washington, USDA, A.R.S., for growth, observation and for selection of exceptional hills. These were seeded in hills two feet apart in 40 inch rows in an irrigated field isolated from other potatoes. A description furnished by Dr. Hoyman provides information about these tubers, and can be found in Table 2.

During the growing season the planting was cultivated, irrigated and weeded as a commercial planting. Rather severe rogueing was accomplished on the theory that plants with unthrifty and undesirable vine types would prove unpopular even if tuber production would recommend the hill for further study.

Vines were beat before harvest to prevent regrowth following showers and to encourage ripening. Hand digging to permit individual hill evaluation was done September 25 and 26, with Prof. Homer Metcalf and Extension Horticulturist Orville McCarver both present to assist with hill selection. A generous number, possibly as many as 70 hills were saved for closer observation for scab incidence or other defects. Hills surviving this close scrutiny will be grown out in 1968. Six nice mature well shaped tubers were considered a minimum number for hill selection.

A. Hills selected in 1966 from Hoyman seedlings

Twenty hills selected from some 4000 hills planted with tubers received in 1966 from Dr. Hoyman, A.R.S., were planted two feet apart in single rows, the length depending on the number of seed pieces secured from the selected hills, this number varying from 18 to 37.

Potato Evaluation (con't)

From description received from Dr. Hoyman, the parentage and expected response is found in Table 3.

When dug September 26, and carefully evaluated by Prof. Metcalf, Extension Specialist, Orville McCarver and Northwestern Branch Station Superintendent, C. W. Roath, eight were saved for further increase and evaluation pending the results of gravity determination and scab readings. These are indicated by an asterisk in Table 3.

On August 3, 1967, Prof. Metcalf inspected the Hoyman selections and at that time described those picked later for additional study as follows:

242 - 2	Triumph type tuber on large vine.
261	Round russet, heavy set, skin already quite firm. Very long stolons and rugose foliage.
262	Round russet, heavy set, skin fairly well set. Shorter stolons. Medium rugose foliage.
265	Round smooth, very heavy set, skin slips readily, vigorous vines of good habit, rugose foliage.
267 - 1	Round smooth, very heavy set, skin slips readily, very long stolons, rather upright plant, rugose.
273 - 2	Round russet, good size, low set, early extra big vines.
281 - 2	Oblong, smooth, white on big vines with lilac flowers. Light set.
282	Smooth round, medium set, on upright vine.

Annual data for those kept for further study is shown in Table 3. If after washing the scab incidence should be high or if by lab determination, specific gravity should be low, one or more of these eight selections maybe discarded without additional study. Twenty-five pound samples of all except 261 were sent to the Plant and Soil Science Department for laboratory determination of specific gravity and scab incidence. Fifty pounds was reserved at Northwestern Branch Statin for possible use in 1968.

SUMMARY & CONCLUSION:

Tubers from a few dozen hills selected from the 1900 hills planted with Hoyman seedling tubers in 1967 were kept for growing in hill rows in 1968. Seed from eight hill rows grown in 1967 was saved for additional evaluation. Also a few selections from Montana seedlings were kept for further evaluation. Freedom from disease in the vines plus freedom from scab and other tuber diseases, plus desirable type yield size and maturity of tubers per hill are determining factors for seedling hill selection.

Table 1. Annual data on Montana seedlings grown at Northwestern Montana Branch Station in 1967.

Number	Hills	Lbs/ Hill	% Cull	Vines	Tubers
M55907-2	17	3	55	Small-top rosetting	Long,rough,white
P.R.168-3	29	2¼	39	Med-healthy	Long,flat,cracks
M56024	6	2		Med-blight	Thick,oval,white
M55967-3	13	4	39	Med-blight	Rough,cracks
M55963	8	3	4	Small-late	Red,mature,deep end
Bounty	23	5	8	Med-blight	V lg,red,cracks & scab
M45938-5	31	4	40	Small-blight	Rough,cream color
M55967-1	19	4½	62	Large-gem like	V lg,rough,white (end
M55951	6	3		Med-blight	Pink blush,round,deep seed-
M55965	12	2¼	22	Small-late	Rough,cracks & hollow
M55966-1	8	2		Small-curled leaf	Rough,scab,green end
M45938-16	25	2	14	Small-blight	V lg,late
M55970	22	6	49	Large-healthy	V lg,long,rough,white
M45933	30	2½	66	V lg-healthy	Late,large,rough
M55968	4	5½		Med	Variable
M55963-4	12	4¼		Med-blight	Cracks & scab
M55974	7	6		Large-green	Late,rough,scab
Monona	32	5	15	Large-vigorous	Rough,cracks,scab
A589-65	22	1¼	24	Large-green	Small,cracks
Wyred (1)	16	7½	53	(1) healthy	Cracks
				V lg-remaining plants	Large,rough,variable size
M55968-3	5	2		Small-blight	Oblong,red
M55967	12	2½	16	V lg-healthy	Med size,scab
M55966	11	3 3/4	40	Med-blight	Rough
M55968-5	6	3	7	Med	Brown with pink eyes
M45906-A-41	15	3½	23	Large-green	Red,long flat,scab
M25908-1 (1)	40	3/4		Med size	Small,gator hide
M36075-10 (2)	26	4½	4	Large-early	Red,eyes shallow, med size
M6102-8 (1)	29	4½	1		Mature,smooth
(2)				Med-gem like	Plump,oblong,with light net
ND4524-4R (2)	26	4	1	Med-healthy	Red,round,flat,smooth,med
M5908-1 (1)(2)	32	5	5	Med-usefull	Smooth,mature
M55967-2 (2)	17	5½	12	Med-usefull	Thick,round,white
Blanca (2)	31	4	2	Med-virorous	Small,smooth,rf,sl net
M35939-7 (2)	33	5	1	Large-some blight	Large,mature,red net

NOTE: Closer spacing might have made some of the large rough entries look much better.

(1) Included in 1967 Granny Goose Trials.
(2) Saved for further study if lab report is favorable.

Table 2. Seedling potato tubers from Dr. Hoyman in 1967.
Planting date: May 17, 1967

Family Number	Pedigree[1]	Number Tubers	Should segregate for resistance to[2]:
283	7-2 x 12-3	100	Sc, Vw, Lb,
284	7-2 x F107-30	200	Sc, Vw, Lb,
285	12-3 x 168-3	400	Sc, Vw, Lb, High Sp. Gr.
286	22-10 x 12-3	200	Sc, Vw, Lb,
287	39-1 x 12-3	100	Sc, Vw, Lb,
288	48-1 x 12-3	100	Sc, Vw, Lb, Lr,
289	168-3 x 12-3	400	Sc, Vw, Lb, High Sp. Gr.
290	168-3 x 39-1	200	Sc, Vw, Lb, High Sp. Gr.
292	F107-30 x 12-3	100	Sc, Vw, Lb,
293	Kennebec x 12-3	100	Sc, Vw, Lb,
		1900	

[1] Female occurs first
[2] Sc - Common scab, Vw - Verticillium wilt, Lb - Late blight, X - Virus X - immunity, Lr - Leafroll

Most all of the 1900 tubers have russet skin

Table 3. Description of Hoyman families from which 1966 selections were made.

Family Number	Parentage Female and Male	Progeny Segregating for Resistance To: (1)
242*	B5063-3 x 12-3	Vw, Sc, Lb,
249	F 158-4 x F52-4	Vw, Sc, Lb, X
257	7-2 x 12-6	Vw, Sc, Lb, X
261*	15-13 x 12-3	Vw, Sc, Lb, X
262*	22-10 x 12-3	Vw, Sc, Lb,
265*	39- 1 x 12-6	Vw, Sc, Lb, X
267*	A 596-1 x 12-3	Vw, Sc, Lb,
268	A 596-1 x 12-6	Vw, Sc, Lb, X
273*	B4848-1 x 12-3	Vw, Sc, Lb, Lr,
276	F 52-4 x 39-1	Vw, Sc, Lb, X
277	F 107-30 x 12-3	Vw, Sc, Lb,
280	F 158-4 x 12-3	Vw, Sc, Lb,
281*	F 158-4 x 12-6	Vw, Sc, Lb, X
282*	F 158-4 x 39-1	Vw, Sc, Lb,

1/ Vw - Verticillium wilt, Sc - Scab, Lb - Late blight, X - virus x, Lr - Leafroll

* Indicates families from which selections were made for further study in 1967 (See Table 4)

Table 4. 1966 Hoyman potato hills grown in 1967 and selected for further study.

Number	Hills	Lbs/Hill	Vines (8-30-67)	Tubers
242-2	37	2½	Large, green, healthy	Blocky, mature, red, crisp & tasty
261	20	2 3/4	Med. size, useful with tr blight	Smooth, oval with heavy net
262	36	5	Large, healthy, showing maturity	Smooth, oblong, mature, uniform, with dense net
265	36	4¼	Large (gem-like) vines with tr blight	Flat, oval, white with firm skin. Gravity?
267-1	22	4½	Med. size, useful	Smooth, oval with light net shallow eyes. Scab?
273-2	31	3	Large, useful vines with some leaf curl	Oblong, smooth, mature, heavy net & high apparent gravity, some aligator
281-2	29	4	Med. size, usefull	Smooth, oblong, mature
282	30	3½	Large, green & healthy	Smooth, round oblong with apparent high gravity

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HIGH MOISTURE BARLEY FOR LAMBS

On September 8, 1967, thirteen lambs weighting 902 pounds after a four percent pencil shrink or an average of 69.4 pounds were continued on self-fed high moisture barley after an eighteen day post weaning period, and were fed high moisture barley and limited alfalfa hay for thirty-three days until sold October 12, 1967.

The weather was unusually warm for September with maximums in the seventy's and eighty's for all but three days during the month and fly strike was a serious problem; reducing gains of lambs requiring treatment. (1)

During the thirty-three day period 1255 pounds of high moisture (27.0%) barley was consumed along with 280 pounds of alfalfa hay. Weighed,less four percent pencil shrink, October 12, the total weight of the thirteen lambs was 1081 pounds or an average of 83.2. This weight indicated a gain of 13.8 per head or an average daily gain of .418.

This rate of gain was accomplished by consuming 2.925 pounds of the high moisture barley and .65 pounds of alfalfa per head per day. At the moisture content fed 8.6 pounds of grain was required per pound of gain, however if the grain is reduced to a 12% (2) moisture basis the feed requirement was 7.5 pounds per pound of gain.

Cost wise if alfalfa is valued at $20.00 per ton and the barley at 1.615 cwt (1.90 @ 12% moisture) each pound of gain would cost 12.89 cents. This seems quite reasonable when compared to lamb values in the market.

Compared to 1966 results when lambs were also self-fed high moisture barley the 1967 gains were 2/10 pounds better per day on the average and cheaper by 3.5 cents per pound. There was no loss in 1966 and no particular difficulty, however mold in the barley became progressively heavier after the plastic silos containing some 1500 pounds of barley were opened, and this was thought to reduce consumption and gain. The grain was stored in plastic bags in 1967, each containing about 65 pounds, and the grain was free of mold unless the bags were accidently punctured. In 1966 a check lot of lambs self-fed equal parts of whole oats, whole barley and dry beet pulp gained an average of .478 pounds per head per day, slightly more than the .418 gain of the high moisture barley lambs in 1967. The cost due to the price of dry beet pulp was higher for the mixture, 14.9 cents per pound of gain.

Tabulation of essential facts will be found in the table on the next page.

SUMMARY:

This seems to indicate that high moisture barley is safe for self-feeding lambs, quite capable of producing good gains if the barley is of good quality, and perhaps less expensive than other feed possibilities.

(1) The lamb most seriously affected gained 5.8 pounds during the feeding period.
(2) The weight of barley reduced by 15 percent.

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FARM FLOCK IMPROVEMENT BY BREEDING AND SELECTION

Registered Columbia rams have been used exclusively in the improvement program at Northwestern Branch Station recently and attention centered on a registered flock with high performance records. As rapidly as seems expedient all non-registered and cross bred females and those registered ones, that fail to produce satisfactorily are being sold. Sale of the more desirable foundation animals will be held to a minimum during the up grading process.

As of January 1, 1968, the flock will consist of fifty females. Forty-two of these are registered or have two registered parents and have not been inspected. The average three previous generation, three year wool equivalent index for the forty-two is 30.7 based on the assumption (not always valid) that one pound of wool is worth four pounds of lamb. Only eleven have established their own three year index and the average of these is 29.4.

A brief statistical summary of 1967 flock activity follows:

Females over 1 year in the spring of 1967:	35
Ewe lambs kept for replacements:	11
Total females:	46
Males on hand:	5
Total animals:	51
Fleeces shorn:	51
Pounds grease wool:	510
Lambs born:	64
Lambs weaned:	51
Receipts from wool (inc. incentive):	$ 323.11
Receipts from lambs:	416.64
Receipts from sale of breeding stock & cull ewes:	288.80
Total receipts:	$1028.55
Receipts per female over one year:	$ 29.39

On hand January 1, 1968 will be fifty-one females and four males, unless losses are sustained or rams are sold. Twenty-three of these are ewe lamb replacements, eleven are yearlings, and only seventeen are mature ewes.

Table 1, lists second, third and fourth year weaned lamb records of all Columbia ewes kept for this period and bred to Columbia rams for at least two of the three years, beginning with the keeping of complete production records. Greater variation is expected in lamb production than in growth of wool among ewes of similar breeding.

As may be seen by the statistical analysis of the data that real differences in lamb production exhist, that chief among the characteristics of those high in production are the ability to wean lambs every year and not single lambs but twins most of the time. Characterizing the low group is the opposite, ie erratic lambing and very few twins.

Table 1. Self-feeding high moisture barley to lambs.

	1	2	3
Feeding Period	1966	1966	1967
Rations	Dry pulp mix	High moisture barley	High moisture barley
Lambs on feed	12	12	13
Days on feed	43	43	33
Weight In	779.1	796.9	902
Weight Out	1025.7	934.5	1081
Daily gain per head	.478	.267	.418
Feed Consumed			
Hay	129	196	280
Grain	1415	1423	1255
Feed per lb. gain	6.28	11.8	8.6
Feed per lb. gain @ 12%M	6.28	8.8	7.5
Cost per lb. of gain			
Hay @ $20.00 T	1.29	1.96	2.80
Grain @ 2½¢	35.38		
Grain $1.90 @ 12%		@$1.35 19.21	@$1.615 20.27
Feed Cost	$36.67	$21.17	$23.07
Cost per lb. of gain	.1487	.1539	.1289

PART II

1967

Annual Research Report

Northwestern Montana Branch

of the

Montana Agricultural Experiment Station

Kalispell, Montana

by

Vern R. Stewart

Associate Agronomist

YEAR: 1967

TITLE: Herbicides for Weed Control in New Seeding of Legumes

PROJECT: Weed Investigations MS 754

PERSONNEL: Leader: Vern R. Stewart
Cooperator: Chemical Company Research and Development Representative

LOCATION: Northwestern Montana Branch Station Field X-3

DURATION: Five years

OBJECTIVES:

1. To measure the effectiveness of certain herbicides in the control of annual weeds in sainfoin.

2. To determine the effect of herbicides used on the sainfoin plant.

PROCEDURES:

Ten herbicides were used in this study. A list is attached. Plots were 10' x 20' or 200 square feet. Three replications were used in the study.

Herbicides were applied with a tractor mounted sprayer using 44.5 gallons of water per acre. Those applied pre-plant and incorporated were incorporated with an eight foot tandem disk, traveling four miles per hour. Depth of incorporation was 1½ to 2 inches. Post-emergence applications were made June 29, when the sainfoin was in the three to five leaf stage.

Sainfoin plant and weed counts were made in an area 3" x 48", using a quadrant. Eight counts were made in each plot or a total of 24 for each treatment in the study.

The analysis of variance procedure was used to measure differences in herbicide treatments.

SIGNIFICANT FINDINGS:

1. ACP 66-130 was the most effective herbicide for weed control, but rates above four ounces were quite injurious to the sainfoin plants. The four ounces reduced plant populations and reduced plant vigor.

Significant findings (con't)

2. Bromoxynil and ACP 66-71B gave similar weed control and effect on sainfoin. As herbicide rates were increased sainfoin population decreased, also increased effect on plant vigor.

3. The herbicides applied pre-plant and pre-emergence did not give effective weed control. No significant damage was noted on the sainfoin plant.

FUTURE PLANS:

Consideration is being given to expanding this program to cover several legumes in the study. Those being considered are sainfoin, alfalfa, red clover. Specific varieties of each species may also be included.

HERBICIDES FOR WEED CONTROL IN NEW SEEDING OF LEGUMES

INTRODUCTION:

Controlling weeds in new seedings of sainfoin is in its third year. This years study consisted of nine herbicides, some have been used in previous years, others are new this season.

Plots are 10' x 20', replicated three times. Herbicides were applied with a research sprayer. Post-emergence applications were made when the sainfoin was in the five leaf stage.

RESULTS AND DISCUSSION:

The stand of sainfoin was less than desirable. The check plot was only 4.5 plants in the area counted (3" x 48"). In previous years stands have been between eight and nine plants for the same area. The weed population was somewhat less than found in previous years. The predominate weed species were: sheperds purse, (Capsella bursa-pastoris L. medic); fan weed (Thaspi arvense L.); lambs quarter (Chenopodium album L.); and red root pigweed (Amaranthus retoflexus L.). Some grass weeds were noted: quack grass (Agropyron ripens L.) and foxtail (Setaria lutescens (Weigel)Hubb).

For purpose of analysis, all weeds were totaled. However, a break down is given for grassy weeds and broad leaf weeds in Table 1.

The pre-plant and pre-emergence applied herbicides gave little weed control. EPTC at 32 ounces gave only 22%, which is not a very acceptable value. In general, this group caused little or no damage to sainfoin population or plant vigor.

Bromoxynil and ACP 66-71B were quite similar in the effect on weeds and sainfoin. As the rates increased for both herbicides, sainfoin population was reduced as was the plant vigor. Weed control was about the same for all rates except the 12 ounce rate of ACP 66-71B, where 82.5% control was obtained.

ACP 66-130 gave excellent weed control but was quite detrimental to the sainfoin. Stands were significantly reduced and plant vigor reduction was severe.

Bromoxynil and Dalapon gave good weed control with just a slight stand reduction in sainfoin at the 4 + 32 ounce rate, however at the higher rate stand reduction was greater. Plant vigor was severely affected by both the 4 + 32 ounce rate and 6 + 32 ounce rate.

Eight ounces of 2,4-DB gave no weed control,at 12 ounces per acre, 60% control was obtained. Stands were reduced some and reduction in plant vigor.

Results and Discussion (con't)

The 16 ounce rate of ACP 63-57 gave 72.5% weed control with a reduction of stand of sainfoin and vigor of plant.

Combinations of ACP 63-57 and Bromoxynil resulted in almost total loss of stand of sainfoin and complete control of all weeds.

Table 2, gives a summary of the data.

SUMMARY AND CONCLUSION:

1. ACP 66-130 was the most effective herbicide for weed control, but rates above 4 ounces were quite injurious to sainfoin plants. The 4 ounce rate reduced plant populations and plant vigor.

2. Bromoxynil and ACP 66-71B gave similar weed control and effect on sainfoin. As herbicide rates were increased, sainfoin population decreased, also increased effect on plant vigor.

3. The herbicides applied pre-plant and pre-emergence did not give effective weed control. No significant damage was noted on the sainfoin plant.

HERBICIDES USED

Common Name	Trade Name or Other	Chemical Name	Company
2,4-DB	Butyrack	4(2,4-dichlorophenoxy)butyric acid	Amchem
ACP 63-57		N-(3,4-dichlorophenyl)-2,2-dimethyl valerimide	Amchem
Benefin	Balon	N-butyl-N-ethyl, alpha,alpha,alpha-Trifluro-2,6-dinitro-p-toluidine	Elanco
Bromoxynil	Brominil	3,5-dibromo-4-hydroxybenzonitrile	Amchem
Dacthal		dimethyl ester of tetrachloroteraphthalic acid	Diamond
EPTC	Eptam	ethyl N,N,-dipropylthiolcarbamate	Stauffer
Dalapon	Dowpon	2,2-dichloropropionic acid	Dow
ACP 66-130		Bromoxynil formulation as octanoic acid ester	Amchem
ACP 66-71B	Chloroxynil	3,5-dichloro-4-hydroxy benzonitrile	Amchem
Sindone B		(1)-dimethyl-4,6-diisopropyl-5-indanyl ethyl Ketane	Amchem

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VRS
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Table 1. Data from herbicide study on sainfoin. Location field # X-3, Northwestern Montana Branch Station. Size of plot: 200 square feet. Plant counts from 8 qudrants per 3" x 48".

Treatment	Rate/A in oz.	Plot No.	Plant Populations: Sainfoin	Broadleaf	Grasses	Other	Total Weed $\bar{x}$	% Weed Control	Plant Vigor 0-10
Eptam	16	101	24	16	2	0			9
Pre-plant		215	16	23	2	0			9
Incorporate		321	24	4	0	0			10
	Total		64	43	4	0			28
	$\bar{x}$		2.6	1.8	.17	0	1.96	0	9
Eptam	32	102	34	15	0	0			10
Pre-plant		211	25	12	0	0			9
Incorporate		302	41	3	0	0			10
	Total		100	30	0	0			29
	$\bar{x}$		4.2	1.3	0	0	1.25	25.0	10
Balan	12	103	22	25	2	2			10
Pre-plant		216	25	16	0	0			10
Incorporate		308	41	8	1	0			10
	Total		88	49	3	2			30
	$\bar{x}$		3.7	2.0	.13	.08	2.25	0	10
Balan	16	104	27	16	1	0			9
Pre-plant		219	26	7	0	0			8
Incorporate		307	51	12	0	1			10
	Total		104	35	1	1			27
	$\bar{x}$		4.3	1.5	.04	.04	1.54	7.5	9
Balan	24	105	29	14	0	0			9
Pre-plant		212	30	13	0	1			10
Incorporate		320	39	17	0	0			10
	Total		98	44	0	1			29
	$\bar{x}$		4.1	1.8	0	.04	1.88	0	10
Dacthal	128	106	35	5	1	0			10
Pre-emergence		226	30	16	0	0			9
		315	24	8	1	0			9
	Total		89	29	2	0			28
	$\bar{x}$		3.7	1.2	.08	0	1.29	22.5	9
Dacthal	192	107	42	14	0	0			9
Pre-emergence		227	26	17	0	0			8
		303	40	3	0	0			9
	Total		108	34	0	0			26
	$\bar{x}$		4.5	1.4	0	0	1.42	15.0	9

Table 1 (con't)

Treatment	Rate/A in oz.	Plot No.	Plant Populations: Sain-foin	Broad-leaf	Grasses	Other	Total Weed $\bar{x}$	% Weed Control	Plant Vigor 0-10
Sindone-B	24	108	24	24	2	0			9
Pre-plant		228	30	24	1	1			9
Incorporate		301	44	7	0	0			10
	Total		98	55	3	1			28
	$\bar{x}$		4.1	2.3	.13	.04	2.46	0	9
Sindone-B	48	109	35	20	3	0			8
Pre-plant		208	25	13	0	0			7
Incorporate		329	41	8	0	0			9
	Total		101	41	3	0			24
	$\bar{x}$		4.2	1.7	.13	0	1.83	0	8
Bromoxynil	4	110	24	4	1	0			6
Post-emergence		222	37	1	0	0			7
		312	31	2	6	0			7
	Total		92	7	7	0			20
	$\bar{x}$		3.8	.29	.29	0	.58	65.0	7
Bromoxynil	6	111	3	1	6	1			5
Post-emergence		224	12	2	0	0			8
		305	20	1	2	0			6
	Total		35	4	8	1			19
	$\bar{x}$		1.5	.17	.33	.04	.54	67.5	6
Bromoxynil	12	112	3	2	6	0			4
Post-emergence		214	1	0	0	0			0
		310	4	2	3	0			3
	Total		8	4	9	0			7
	$\bar{x}$		.33	.17	.38	0	.54	67.5	2
ACP 66-71-B	4	113	24	2	2	0			10
Post-emergence		205	32	5	0	0			9
		306	35	2	2	0			8
	Total		91	9	4	0			27
	$\bar{x}$		3.8	.38	.17	0	.54	67.5	9
ACP 66-71-B	6	114	28	1	6	0			8
Post-emergence		217	27	2	1	0			5
		314	32	1	2	0			8
	Total		87	4	9	0			21
	$\bar{x}$		3.6	.17	.38	0	.54	67.5	7

Table 1 . (con't)

Treatment	Rate/A in oz.	Plot No.	Plant Populations: Sain-foin	Broad-leaf	Grasses	Other	Total Weed x̄	% Weed Control	Plant Vigor 0-10
ACP 66-71-B	12	115	10	1	0	0			4
Post-emergence		225	23	2	0	1			6
		316	25	2	1	0			5
	Total		58	5	1	1			15
	x̄		2.4	.20	.04	.04	.29	82.5	5
ACP 66-130	4	116	16	0	1	0			3
Post emergence		221	25	0	0	0			2
		313	25	0	2	0			4
	Total		66	0	3	0			9
	x̄		2.8	0	.13	0	.13	92.5	3
ACP 66-130	6	117	7	0	0	0			1
Post-emergence		220	12	0	0	0			2
		322	14	0	0	0			2
	Total		33	0	0	0			5
	x̄		1.4	0	0	0	.00	100.0	2
ACP 66-130	12	118	2	0	0	0			0
Post-emergence		223	10	0	1	0			2
		304	1	0	0	0			1
	Total		13	0	1	0			3
	x̄		.54	0	.04	0	.04	97.5	1
Bromoxynil +	4 + 4	119	8	3	0	0			3
2,4-DB ester		213	9	2	0	1			4
Post-emergence		327	23	0	2	0			6
	Total		40	5	2	1			13
	x̄		1.7	.21	.08	.04	.33	80.0	4
Bromoxynil +	4 + 8	120	12	2	0	0			5
2,4-DB ester		207	19	4	3	0			5
Post-emergence		311	21	1	3	0			5
	Total		52	7	6	0			15
	x̄		2.2	.29	.25	0	.54	67.5	5
Bromoxynil +	4 + 32	121	14	0	0	0			4
Dalapon		206	22	4	1	0			6
Post-emergence		318	26	1	0	1			3
	Total		62	5	1	1			13
	x̄		2.6	.21	.04	.04	.29	82.5	4

Table 1 . (con't)

Treatment	Rate/A in Oz.	Plot No.	Plant Populations: Sain-foin	Broad-leaf	Grasses	Other	Total Weed $\bar{x}$	% Weed Control	Plant[1] Vigor 0-10
Bromoxynil +	6 + 32	122	7	1	0	0			2
Dalapon		202	11	1	0	0			2
Post-emergence		323	16	0	2	0			3
	Total		34	2	2	0			7
	$\bar{x}$		1.4	.08	.08	0	.17	90.0	2
2,4-DB ester	8	123	28	16	0	0			7
Post-emergence		229	38	9	2	0			8
		328	43	22	0	0			9
	Total		109	47	2	0			24
	$\bar{x}$		4.5	2.0	.08	0	2.04	0	8
2,4-DB ester	12	124	20	11	2	0			6
Post-emergence		204	19	9	0	0			6
		324	31	13	3	0			7
	Total		70	33	5	0			19
	$\bar{x}$		2.9	1.4	.21	0	1.58	60.0	6
ACP 63-57	16	125	15	4	0	0			9
Post-emergence		218	16	3	0	0			4
		326	27	3	1	0			6
	Total		58	10	1	0			19
	$\bar{x}$		2.4	.92	.04	0	.46	72.5	6
ACP 63-57 +	8 + 4	127	12	0	0	0			4
Bromoxynil		209	5	0	0	0			1
Post-emergence		309	14	0	0	0			2
	Total		31	0	0	0			7
	$\bar{x}$		1.3	0	0	0	0	100.0	2
ACP 63-57 +	8 + 6	128	1	0	0	0			0
Bromoxynil		203	6	0	0	0			0
Post-emergence		319	11	0	1	0			2
	Total		18	0	1	0			2
	$\bar{x}$		.75	0	.04	0	.04	97.5	1
Check		129	28	12	0	0			10
		201	36	6	1	0			9
		325	36	17	4	0			10
	Total		100	35	5	0			29
	$\bar{x}$		4.2	1.5	.20	0	1.67	0	10

[1] Plant vigor = 0 - all plants dead 10- normal plant.

Table 1. (con't)

APPLICATION DATE

Pre-plant incorporated - 5/29/67
Pre-emergence - 6/12/67
Post-emergence -6/29/67

Analysis of Variance (Sainfoin population)

Source	D.F.	Mean Square	F.
Replications	2	73.68542	13.92
Treatments	27	41.79734	7.90
Trt. x Rep.	54	3.52584	
Error	588	5.29443	
Total	671		

Analysis of Variance (Weed population)

Source	D.F.	Mean Square	F.
Replications	2	5.85953	4.19*
Treatments	28	14.84173	10.61*
Trt. x Rep.	54	3.01970	2.16*
Error	588	1.39944	
Total	671		

Table 2. Data from herbicide study on a new seeding of sainfoin at Northwestern Montana Branch Station in 1967, Kalispell, Montana.

Treatment	Application Time	Rate/A ounces	Plant Counts[1] Sainfoin	Plant Counts[1] Weeds	Plant Vigor[2] 0-10	% Weed Control
EPTC	Pre-plant[3]	16	2.6	1.96ab[4]	9	0.0
EPTC	" "	32	4.2	1.25ab	10	25.0
Benifin	" "	12	3.7	2.25ab	10	0.0
Benifin	" "	16	4.3	1.54ab	9	7.5
Benifin	" "	24	4.1	1.88ab	10	0.0
Dacthal	Pre-emergence	128	3.7	1.29ab	9	22.5
Dacthal	" "	192	4.5	1.42ab	9	15.0
Sindone-B	Pre-plant[3]	24	4.1	2.46a	9	0.0
Sindone-B	" "	48	4.2	1.83ab	8	0.0
Bromoxynil	Post-emergence	4	3.8	.58ab	7	65.0
Bromoxynil	" "	6	1.5	.54ab	6	67.5
Bromoxynil	" "	12	.33	.54ab	2	67.5
ACP 66-71-B[a]	" "	4	3.8	.54ab	9	67.5
ACP 66-71-B	" "	6	3.6	.54ab	7	67.5
ACP 66-71-B	" "	12	2.4	.29ab	5	82.5
ACP 66-130 [b]	" "	4	2.8	.13ab	3	92.5
ACP 66-130	" "	6	1.4	.00	2	100.0
ACP 66-130	" "	12	.54	.04ab	1	97.5
Bromoxynil + 2,4-DB ester	" "	4 + 4	1.7	.33ab	4	80.0
Bromoxynil + 2,4-DB ester	" "	4 + 8	2.2	.54ab	5	67.5
Bromoxynil + Dalapon	" "	4 + 32	2.6	.29ab	4	82.5
Bromoxynil + Dalapon	" "	6 + 32	1.4	.17ab	2	90.0
2,4-DB ester	" "	8	4.5	2.04ab	8	0.0
2,4-DB ester	" "	12	2.9	1.58ab	6	60.0
ACP 63-57	" "	16	2.4	.46ab	6	72.5
ACP 63-57 + Bromoxynil	" "	8 + 4	1.3	.00	2	100.0
ACP 63-57 + Bromoxynil	" "	8 + 6	.75	.04ab	1	97.5
Check			4.2	1.67ab	10	0.0

1/ Plant counts based on 8 counts in a 3" x 48" quadrant, 3 replications
2/ 0 = Plants dead, 10= vigorous normal plants
3/ Pre-plant incorporated with double disk
4/ Multiple range test.(items having common letter, not significant one from another)
a/ ACP 66-71-B (Bromoxynil formulation)
b/ ACP 66-130 (Oil soluble amine of ioxynil)

Application Dates:
Pre-plant incorporate - May 29, 1967
Pre-emergence - June 12, 1967
Post-emergence - June 29, 1967

TITLE: Chemical Control of Weeds in Sugar Beets

PROJECT: Weed Investigations MS 754

YEAR: 1967

PERSONNEL: Leader - Vern R. Stewart
Cooperators - Don Baldridge, Glen Hartman, Chemical company, Research & Development Represenatives, Great Western & Holly Sugar Companies

LOCATION: Homer Bailey Farm, Corvallis, Montana

DURATION: Indefinite

OBJECTIVES:

To determine what herbicides will effectively control weeds in sugar beets and further measure the effects of these herbicides on sugar beets.

PROCEDURES:

Ten herbicides alone and in combination were used in this study. (Table 1) Plots were 10 x 60 feet (600 sq. ft.), replicated three times. Herbicides were applied pre plant and incorporated with a tandem disk. The plot was harrowed to make a seed bed for the sugar beets. Herbicides were applied with a research type sprayer, using 44.5 gallons of water per acre.

Plant counts of weeds and sugar beets were made when the beets were in the four to six leaf stage. Eight counts were made in each plot using a quadrant 3" x 48", placed over the beet row.

The data was analyzed using each count as a sub sample in each plot.

The predominate weed species found naturally in this study were; pig weed (Amaranthus retoflexus L.), lambs quarter (Chenopodium album L.), and black nightshade (Solanum nigrum L.).

SIGNIFICANT FINDINGS:

TD 283 alone and in combination gave the most effective weed control of all species. Above two pounds, some injury to beets occurred, however as the season progressed the affected plants seemed to recover. Ro-neet at 3 #/a and TD 283 at 2 #/a gave excellent weed control and caused very slight injury to the sugar beet plant. Ramrod was least effective on black nightshade of any of the products used.

FUTURE PLANS:

At this wriing future plans are somewhat indefinite. No doubt work on sugar beet weed control will continue at about the same level.

Chemical Control of Weeds in Sugar Beets

INTRODUCTION:

Research on chemical weed control is in its fourth year in Western Montana. This years study contained 25 treatments. Nine herbicides were used alone or in combination. Herbicides used are listed below. Plots were 10' x 60' or 600 square feet. Data is recorded in tabular form later in this report.

RESULTS AND DISCUSSION:

Immediately following incorporation of these herbicides in this study, a heavy shower of rain fell. Temperatures were near or above normal, which allowed for good germination of weeds and sugar beets.

Some differences were found in beet stands because of herbicides, however these were not found to be highly significant. The lowest stands of beets were noted in the treatment of pyrazon at 3 #/a and ramrod at 3 #/a. The greatest injury to beets was observed using pyrazon at 4 #/a plus TCA at 5 #/a, with the same injury factor noted using TD 283 at 3 #/a. The use of TD 283 alone and in combination resulted in higher injury factors than other compounds used, with one exception, that was when Ro-neet and TD 283 were used in combination.

The combination of Ro-neet at 3 #/a plus TD 283 at 2 #/a was most effective in control of pigweed and nightshade. Lambsquarter was most effectively controlled using a combination of pyrazon and TD 283. Ramrod was the least effective on nightshade of all the herbicides used. Table 1 gives complete tabulation of data. In Table 2 a summary of data is provided.

SUMMARY AND CONCLUSION:

TD 283 alone and in combination gave the most effective weed control of all species. Above two pounds, some injury to beets occurred, however as the season progressed the affected plants seemed to recover. Ro-neet at 3 #/a and TD 283 at 2 #/a gave excellent weed control and caused very slight injury to the sugar beet plant. Ramrod was least effective on black nightshade of any of the products used.

Herbicides used in Sugar Beet Study

Common Name	Trade Name or other	Chemical Name	Company
Pyrazon	Pyramin	5-amino-4-chloro-2 phenyl-3(2H)-pyridazinone	Amchem
T.C.A.	T.C.A.	trichloroacetic acid	Dow
	Amchem66-28	Pyrazon analog	Amchem
Na-endothall		7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid	Pennsalt
TD 283		mono(dimethyltridecyl)amine salt of endothall	Pennsalt
CP 31393	Ramrod	N isopropyl-2-chloroacetanilide	Monsanto
R 2063	Ro-neet	ethyl, N-cyclohexyltheocarbamate	Stauffer
Pebulate	Tilliam	S-propyl butylethylthiolcarbamate	Stauffer
Diallate	Avadex	S-2,3-dichloroallyl N,N-diisopropylthiolcarbamate	Monsanto
Sindone		(1-1-dimethyl-4,6-diisopropyl-5-indanyl ethyl ketone	Amchem

Table 1. Sugar beet weed control data from Ravalli County, grown on the Homer Bailey Farm, Corvallis, Montana in 1967.

Treatment	Rate/a in #'s	Plot #	Beets[1]	Pigweed[1]	Lambsquarter[1]	Nightshade[1]	Other[1]	Total Weeds		% Weed Control	Plant Vigor 0-10[2]
Pyrazon	4	101	73	13	2	10	-	25			2
		215	77	3	-	14	-	17			0
		321	64	16	3	50	-	69			1
		Total	214	32	5	74	-	111		80.5	
		$\bar{x}$	8.9	1.3	.20	3.1	-	4.62	cd[3]		1.00
Pyrazon + TCA	3.75 + 1.25	102	77	12	1	13	-	26			2
		211	63	11	-	19	-	30			0
		302	65	1	1	5	-	7			4
		Total	205	24	2	37	-	63		88.9	
		$\bar{x}$	8.5	1.0	.08	1.3	-	2.63	cd		2.00
Pyrazon + TCA	4 + 5	103	61	6	1	10	-	17			4
		216	76	9	1	16	-	26			4
		308	75	26	1	49	-	76			4
		Total	212	41	3	75	-	119		79.1	
		$\bar{x}$	8.8	1.7	.13	3.1	-	4.96	cd		4.00
Amchem 66-28	5	104	73	13	3	39	-	55			0
		219	77	10	3	32	-	45			0
		307	80	23	2	55	-	80			0
		Total	230	46	8	126	-	180		68.4	
		$\bar{x}$	9.6	1.9	.33	5.3	-	7.50	bcd		0.00
Pyrazon + Na-endathall	3 + 2	105	65	5	2	3	1	11			3
		212	67	10	1	1	-	12			1
		320	67	7	1	4	-	12			2
		Total	199	22	4	8	1	35		93.9	
		$\bar{x}$	8.1	.92	.17	.33	.04	1.46	cd		2.00
Pyrazon + TD 283	3 + 2	106	59	2	-	7	-	9			4
		208	71	2	-	5	-	7			3
		315	82	3	-	-	-	3			4
		Total	212	7	-	12	-	19		96.7	
		$\bar{x}$	8.8	.29	-	.50	-	.79	cd		3.67
Pyrazon + TD 283	4 + 3	107	71	3	-	2	-	5			4
		222	63	8	4	4	-	16			3
		303	75	4	3	4	-	11			3
		Total	209	15	7	10		32		94.4	
		$\bar{x}$	8.7	.63	.29	.42	-	1.33	cd		3.33

Table 1.(con't)

Treatment	Rate/a in #'s	Plot #	Beets[1]	Pigweed[1]	Lambsquarter[1]	Nightshade[1]	Other[1]	Total Weeds		% Weed Control	Plant Vigor 0-10[2]
Pyrazon + Ramrod	3 + 2	108	77	11	1	24	-	36			3
		224	84	20	1	49	1	71			0
		301	75	7	-	19	-	26			0
		Total	236	38	2	92	1	133		76.7	
		$\bar{x}$	9.8	1.6	.08	3.8	.04	5.54	cd		1.00
Pyrazon + Ramrod	3 + 3	109	63	4	-	6	-	10			5
		214	60	4	-	19	-	23			1
		312	65	1	1	20	-	22			1
		Total	188	9	1	45		55		90.5	
		$\bar{x}$	7.8	.38	.04	1.9		2.29	cd		2.33
Ramrod	3	110	66	17	-	68	-	85			4
		205	79	12	1	97	3	113			0
		305	82	13	-	101	1	115			0
		Total	227	42	1	266	4	313		45.1	
		$\bar{x}$	9.5	1.8	.04	11.1	.17	13.04	b		1.33
TD 283	2	111	74	5	-	7	-	12			4
		217	76	3	1	9	-	13			3
		310	79	5	-	-	-	5			4
		Total	229	13	1	16	-	30		94.7	
		$\bar{x}$	9.5	.54	.04	.67	-	1.25	cd		3.67
TD 283	3	112	66	2	1	-	-	3			4
		225	78	4	2	-	-	6			3
		306	74	3	2	-	-	5			5
		Total	218	9	5	-	-	14		97.5	
		$\bar{x}$	9.1	.38	.20	-	-	.58	d		4.00
Pyrazon + Ro-neet	3 + 2	113	63	11	1	13	-	25			3
		221	77	11	-	16	-	27			0
		314	82	3	3	20	-	26			0
		Total	222	25	4	49	-	78		86.3	
		$\bar{x}$	9.3	1.0	.17	2.0	-	3.25	cd		1.00
Pyrazon + Sindone	4 + 1.5	114	75	12	-	21	1	34			2
		220	67	4	-	38	-	42			2
		316	66	3	1	19	-	23			2
		Total	208	19	1	78	1	99		82.6	
		$\bar{x}$	8.7	.79	.04	3.3	.04	4.12	cd		2.00

Table 1. (con't)

Treatment	Rate/a in #'s	Plot #	Beets[1]	Pig-weed[1]	Lambs-quarter[1]	Night-shade[1]	Other[1]	Total Weeds		% Weed Control	Plant Vigor 0-10[2]
Ro-neet	3	115	80	13	1	22	1	37			0
		223	68	17	4	26	1	48			0
		313	90	4	1	17	2	24			1
		Total	238	34	6	65	4	109		80.9	
		$\bar{x}$	9.9	1.4	.25	2.7	.17	4.54	cd		.33
Ro-neet	4	116	68	6	2	5	-	13			3
		213	81	6	2	12	1	21			2
		322	89	3	2	18	1	24			0
		Total	238	15	6	35	2	58		89.8	
		$\bar{x}$	9.9	.63	.29	1.5	.08	2.42	cd		1.67
Pebulate	3	117	74	8	6	23	2	39			1
		207	81	16	4	36	1	57			0
		304	89	19	-	31	1	51			1
		Total	244	43	10	90	4	147		74.2	
		$\bar{x}$	10.2	1.8	.42	3.8	.17	6.12	bcd		.67
Pebulate	4	118	75	7	1	29	1	38			3
		206	77	8	2	32	1	43			0
		311	86	16	-	60	-	76			0
		Total	238	31	3	121	2	157		72.5	
		$\bar{x}$	9.9	1.3	.13	5.0	.08	6.54	bcd		1.00
Ro-neet + Diallate	2.5 + .75	119	72	5	2	21	1	29			0
		202	80	4	1	9	1	15			5
		318	89	3	1	22	2	28			2
		Total	241	12	4	52	4	72		87.4	
		$\bar{x}$	10.0	.50	.17	2.3	.17	3.00	cd		2.33
Ro-neet + Diallate	3.25 + 1.75	120	73	8	1	4	-	13			3
		204	71	4	-	14	2	20			1
		323	76	2	-	8	1	11			2
		Total	220	14	1	26	3	44		92.3	
		$\bar{x}$	9.2	.58	.04	1.1	.13	1.83	cd		2.00
Pebulate + Diallate	2.5 + .75	121	63	16	4	34	3	57			1
		218	74	27	-	16	2	45			4
		324	77	1	1	91	3	96			1
		Total	214	44	5	141	8	198		65.3	
		$\bar{x}$	8.9	1.8	.20	5.9	.33	8.25	bc		2.00

Table 1. (con't)

Treatment	Rate/a in #'s	Plot #	Beets[1]	Pigweed[1]	Lambsquarter[1]	Nightshade[1]	Other[1]	Total Weeds		% Weed Control	Plant Vigor 0-10[2]
Pebulate + Diallate	3.25 + 1.75	122	76	8	4	38	4	54			2
		210	68	14	1	19	23	57			1
		317	88	2	-	27	-	29			2
		Total	232	24	5	84	27	140		75.4	
		$\bar{x}$	9.7	1.0	.20	3.5	1.1	5.83	cd		1.67
Ro-neet + Ramrod	3 + 3	123	65	4	-	37	-	41			3
		209	71	5	-	-	2	7			2
		309	73	1	-	9	-	10			3
		Total	209	10	-	46	2	58		89.8	
		$\bar{x}$	8.7	.42	-	2.3	.08	2.42	cd		2.67
Ro-neet + TD 283	3 + 2	124	75	3	4	5	-	12			1
		203	70	3	1	-	-	4			3
		319	79	1	1	-	-	2			1
		Total	224	7	6	5	-	18		96.8	
		$\bar{x}$	9.3	.29	.25	.21	-	.75	cd		1.67
Check		125	62	41	18	82	4	145			0
		201	62	23	10	51	7	91			0
		325	80	34	5	285	10	334			0
		Total	204	98	33	418	21	570		0	
		$\bar{x}$	8.5	4.1	1.4	17.4	.88	23.75a			0.00

1/ Figure based on 24 counts in 3 replications in a quadrant 3" x 48".
2/ 0-10 = 0 - no injury 10 - plants dead
3/ Multiple range test

Analysis of Variance

Sugar Beet Population

Source	D.F.	Mean Square	F.
Replication	2	51.855	12.47*
Treatment	24	8.97597	2.16*
Trt x Rep	48	4.74388	1.14
Error	525	4.15928	
Total	599		

Analysis of Variance

Weed Population

Source	D.F.	Mean Square	F.
Replication	2	173.05667	11.80*
Treatment	24	576.01361	39.27*
Trt x Rep	48	105.79299	7.20*
Error	525	14.66857	
Total	599		

Application Date: April 25, 1967
Temperature: 45°
Humidity: 100%
Wind: calm to 10 miles per hour
Cloud cover: cloudy to rain

Table 2. Summary of weed control data from sugar beet study conducted on the Homer Bailey farm, Corvallis, Montana in 1967.

Treatment	Rate/a in pounds	Plant Counts					% Weed Control	Beet Injury 0-10[1]
		Sugar Beets	Pig-weed	Lambs-quarter	Night-shade	Other		
Check	0	8.5	4.1	1.4	17.4	.88	0	0
Ramrod	3	9.5	1.8	.04	11.1	.17	45.1	1.33
Pebulate+Diallate	2.5 + .75	8.9	1.8	.20	5.9	.33	65.3	2.00
Amchem 66-28	5	9.6	1.9	.33	5.3	0	68.4	0
Pebulate	4	9.9	1.3	.13	5.0	.08	72.5	1.00
Pebulate	3	10.2	1.8	.42	3.8	.17	74.2	.67
Pebulate+Diallate	3.25+1.75	9.7	1.0	.20	3.5	1.1	75.4	1.67
Pyrazon+Ramrod	3 +2	9.8	1.6	.08	3.8	.04	76.7	1.00
Pyrazon+TCA	4 +5	8.8	1.7	.13	3.1	0	79.1	4.00
Pyrazon	4	8.9	1.3	.20	3.1	0	80.5	1.00
Ro-neet	3	9.9	1.4	.25	2.7	.17	80.9	.33
Pyrazon+Sindone	4 +1.5	8.7	.79	.04	3.3	.04	82.6	2.00
Pyrazon+Ro-neet	3 +2	9.3	1.0	.17	2.0	0	86.3	1.00
Ro-neet+Diallate	2.5 + .75	10.0	.50	.17	2.3	.17	87.4	2.33
Pyrazon+TCA	3.75+1.25	8.5	1.0	.08	1.3	0	88.9	2.00
Ro-neet+Ramrod	3 +3	8.7	.42	0	2.3	.08	89.8	2.67
Ro-neet	4	9.9	.63	.29	1.5	.08	89.8	1.67
Pyrazon+Ramrod	3 +3	7.8	.38	.04	1.9	0	90.5	2.33
Ro-neet+Diallate	3.25+1.75	9.2	.58	.04	1.1	.13	92.3	2.00
Pyrazon+Na-endothall	3 +2	8.1	.92	.17	.33	.04	93.9	2.00
Pyrazon+TD 283	4 +3	8.7	.63	.29	.42	0	94.4	3.33
TD 283	2	9.5	.54	.04	.67	0	94.7	3.67
Pyrazon+TD 283	3 +2	8.8	.29	0	.50	0	96.7	3.67
Ro-neet+Td 283	3 +2	9.3	.29	.25	.21	0	96.8	1.67
TD 283	3	9.1	.38	.20	0	0	97.5	3.67

1/ 0-10 = 0 - no injury 10 - plants dead

TITLE: Weed Control in Mint Using Certain Herbicides

PROJECT: Weed Investigations MS 754

YEAR: 1967

PERSONNEL: Leader - Vern R. Stewart
Cooperators - DuPont Chemical Company

LOCATION: Sanders County, on the Robert Stonebrook farm, Plains, Montana.

DURATION: Three to five years

OBJECTIVES: To find an effective herbicide for control of weeds in established stands of peppermint (Mentha piperita).

PROCEDURES:

Three herbicides were used in the research program. They were: diuron [3-(3,4-dichorophenyl)-1,1-dimethylurea]; linuron [3-(3,4-dichlorophenyl)-1-methoxy-1-methyluria]; and terbacil (3-tert-butyl-5-chloro-6-methyluracil). The herbicides were applied in 44.5 gpa water per acre. Plots were 10' x 20' (200 sq. ft.) replicated three times. Evaluation of effectiveness was made by observation and using a score of 0-10 with 0 being no control and 10 being 100% control. Pictures were taken and are on file with the author.

The predominate weed species found in the study were: cheat grass (Bromus tectorum); shepherds purse (Caspella bursa-pastoris); canada thistle (Cirsium arvense); and dog fennel (Anthemis cotula).

SIGNIFICANT FINDINGS:

Linuron and diuron were not effective weed control agents. Terbacil at 3.2 pounds per acre ai gave 100% weed control.

FUTURE PLANS:

Studies to be continued measuring fall and spring applications. It is planned that yield data will be secured at harvest time, also oil content secured.

WEED CONTROL IN MINT USING CERTAIN HERBICIDES

INTRODUCTION:

Weed control in mint is perhaps the greatest problem a mint producer has. Therefore a herbicide study was designed to work toward effective weed control in mint.

Three compounds were used, namely - diuron, linuron and terbacil. Various rates were used of each product. Applications were made to a plot 10 x 20 feet, replicated three times.

RESULTS AND DISCUSSION:

Terbacil was a relatively effective weed control agent at all three rates. (Table 1) Linuron was not effective on cheat grass in this study, however the cheat was quite tall at the time of application. Diuron was not an effective weed control agent in this study. Terbacil at 3.2 pounds per acre ai gave 100% control of all weed species found in the study. See Table 1 for complete details.

SUMMARY AND CONCLUSION:

Linuron and diuron were not effective weed control agents. Terbacil at 3.2 pounds per acre ai gave 100% weed control.

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Table 1. Data from herbicide study on mint (Mentha piperita) conducted on the Robert Stonebrook farm, Plains, Montana in 1967.

Herbicide	Rate Pounds per Acre ai	0-10[1] Replications 1	2	3	$\bar{x}$
Terbacil	.8	9	6	8	7.7
Terbacil	1.6	9	10	9	9.3
Terbacil	3.2	10	10	10	10.0
Linuron	1.0	5	0	7	4.0
Linuron	2.0	5	7	3	5.0
Linuron	4.0	4	3	4	3.7
Diuron	2.0	3	5	2	3.3
Check	0.0	0	0	0	0.0

1/ 0-10 = 0 - no weed control 10 - complete control

Application Date: April 21, 1967
Relative Humidity: 30%
Wind Velocity: Calm
Temperature: 58°F

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TITLE: Control of Field Gromwell and Other Winter Annuals in Winter Wheat

PROJECT: Weed Investigations MS 754

YEAR: 1967

PERSONNEL: Leader - Vern R. Stewart
Cooperators - Weed Research Committee, Chemical Company Research and Development Representatives

LOCATION: Northwestern Montana Branch Station - Field R-8c
George Hubbard farm, Glen Roth farm, Route 4, Kalispell, Mont.

DURATION: Indefinite

OBJECTIVES: To find a herbicide that will effectively and economically control field gromwell in winter wheat with little or no deleterious effect on wheat yields.

PROCEDURES:

Four experiments and one field study made up the work done on field gromwell and winter annuals in 1966-67.

The research plot located on the station was 12 x 20 square feet. Delmar winter wheat was seeded in rows 20 feet long with 12 inches between rows. Herbicide application in the fall was made post emergence when the gromwell was in the 3 to 5 leaf stage. A total of 25 treatments using eight herbicides alone and in combination at various rates made up the study. Weed scores as to control were made, yield data was obtained by harvesting 3 rows, 16 feet long from each treatment. Each was handled as a seperate sample for yield determination and the calculation of the analysis of variance. Application was made November 17, 1966, with the exception of one spring treatment, applied May 4, 1967.

Three treatments in the study did not have chemicals applied. Two were hand weeded, one in the fall, one in the spring. One plot was left as the weedy check.

The studies on the Hubbard farm and the Roth farm were the same in design. Plots were 20 x 60 square feet. Bromoxynil was the only herbicide used. Four volumes of water were used in application of bromoxynil with the three rates of herbicide at each volume. Field gromwell (Lithospernum arvense) was the major weed on the Roth farm. On the Hubbard farm there were two predominate species, namely, Silene conaidea (no common name) and small-seeded false flax (Camelina microcarpa).

PROCEDURES (con't):

The field study on Hubbards contained the fore-going species. This was a volume study with field strips being one quarter acre in size. Two volumes at three rates of bromoxynil, one ioxynil, one rate of 2,4-D LV and a check were used in the study. Yields were obtained with a commercial combine.

A small study using two of the urea compounds (linuron & diuron) was established on the Glen Roth farm. A high population of field gromwell plants was in the area selected. Mr. Dean Finnerty designed and established the study with the help of the author.

SIGNIFICANT FINDINGS:

Experiment 1 - Plots hand weeded in the fall resulted in a 10.7 bushel per acre increase over plots hand weeded in the spring. The weedy check yield was 7.3 bushels per acre below the fall hand weeded check. Little difference in amount of weed control was found in the 4,6 and 8 ounce per acre rates of bromoxynil. Eight ounces per acre of ioxynil ester continues to give the best weed control and results in higher yields. In this study ioxynil at 8 ounces was equal in yield to the check hand weeded in the fall. See Table 2.

Experiment 2 - The 5.9 gpa volume was somewhat less in weed control than the 11.1, 22.1 and 44.5 gpa volumes. The 6 and 8 ounce rates of bromoxynil gave better weed control than the 4 ounce rate.

Experiment 3 - No significant difference in weed control. Yield variable because of stands.

Experiment 4 - Linuron gave effective weed control at 2 pounds ai per acre.

FUTURE PLANS:

Work on the weed species Silene conaidea will be increased. Additional work on weed competition is being studied.

CONTROL OF FIELD GROMWELL AND OTHER WINTER ANNUALS IN WINTER WHEAT

INTRODUCTION:

Five experiments were conducted in 1966-67 to control winter annual weeds in fall seeded winter wheat. Experiment 1, was conducted using plots 12 x 20 square feet. Experiments 2 and 3, were 20 x 60 square feet. The fourth experiment consisted of field plots one-fourth acre in size. The study put out by Dr. Finnerty and the author was the fifth study where plots were 15 x 20 square feet.

The experiments were made up of several herbicides used alone and in combination, and volume studies using Bromoxynil.

RESULTS & DISCUSSION:

Experiment 1 - The effect of weed population removal on yield was one of the objectives of this experiment. To determine this, plots were hand weeded in the fall and one in the spring. Both treatments were kept weed free during the growing season. The plots hand weeded in the fall had an average yield of 69.8 bushels per acre, whereas the plots hand weeded in the spring had an average yield of 58.9 bushels per acre. This was somewhat less than the weedy check with 62.5 bushels per acre.

No significant difference were found in yields between 4, 6 and 8 ounces of bromoxynil per acre. Weed control was similar for each rate also. Some false flax was left in the plots treated with ioxynil.

Ioxynil ester gave good weed control at 4, 6 and 8 ounces per acre. A yield reduction is noted at the four ounce rate, however this can be accounted for in the following manner. This plot was adjacent to an area that had been treated for bindweed control using picloram several months earlier.

OSC 21799 gave only fair weed control. At the 48 ounce rate it decreased yields. Considerable delay in maturity and the shortening of plants was also noted with this compound at both the 24 ounce and the 48 ounce rates.

Diuron controlled weeds only at the 24 ounce rate, and yield reduction is noted. Also noted was a slight delay in maturity, and false flax and mustard were not controlled in these plots.

When 2,4-D LV was applied in the fall at 4 and 8 ounces per acre it gave poor to fair weed control and severely depressed yields. Maturity was delayed, with the delay much greater at the 8 ounce rate than at the 4 ounce rate. The 8 ounce rate resulted in shorter plants.

MCP at 8 ounces did not affect yields materially, but gave limited weed control. Chlorflurazole + MCPA did not give effective weed control, however yields were maintained near the check or superior. This combination at 12 ounces of Chlorflurazole and MCPA at 8 ounces caused shortening of plants and some delay in maturity. The use of Chlorflurazole at 16 ounces caused considerable delay in maturity. The combination of picloram and MCP reduced yields and gave poor weed control. See Tables 1 and 2 for complete data.

Results and Discussions (con't):

Experiments 2 and 3 - An error in calibration resulted in no data from the volume rate study on the Hubbard farm.

Date from the study on the Roth farm is found in Tables 3 and 4. A little less weed control was noted at the 5.9 gpa rate of water when compared to 11.1, 22.1 and 44.5 gpa rates. There appeared to be no significant difference at the 11.1, 22.1 and 44.5 gpa rates. The 4 ounces rate of bromoxynil gave somewhat less weed control than either the 6 or 8 ounce rates.

Experiment 4 (field) - Yield data was obtained from the field plot study conducted on the Hubbard farm. In Table 5 are the data secured from this study. No weed scores were recorded, however at most rates we found fair to good weed control when compared with the check. The yield data would suggest no real difference in yield because of the herbicide. The differences shown are felt by the author to be do to stand.

Experiment 5 - This study was programed for yield data, however when the author arrived on the scene to harvest the plots the operator had removed the tall marking stakes and harvested the plot with his combine. Therefore, only weed score data are available.

Linuron was the most effective material for weed control when used at 2 pounds ai per acre. Diuron was somewhat less effective. See Table 6.

SUMMARY AND CONCLUSION:

Experiment 1 - Plots hand weeded in the fall resulted in a 10.7 bushel per acre increase over plots hand weeded in the spring. The weedy check yield was 7.3 bushels per care below the fall hand weeded check. Little difference in amount of weed control was found in the 4, 6 and 8 ounce per acre rates of bromoxynil. Eight ounces per acre of ioxynil ester continues to give the best weed control and results in higher yields. In this study ioxynil at 8 ounces was equal in yield to the check hand weeded in the fall.

Experiment 2 - An error in calibration resulted in no data from the volume rate study on the Hubbard far.

Experiment 3 - The 5.9 gpa volume was somewhat less in weed control than the 11.1, 22.1 and 44.5 gpa volumes. The 6 and 8 ounce rates of bromoxynil gave better weed control than the 4 ounce rates.

Experiment 4 - No significant difference in weed control. Yields variable because of stands.

Experiment 5 - Linuron gave effective weed control at 2 pounds ai per acre.

CHEMICALS USED

Common Name	Trade Name or Other	Chemical Name	Company
Bromoxynil	Buctril Brominil	3,5-dibromo-4-hydroxybenzonitrile	Chipman Amchem
Ioxynil		3,5-diiodo-4-hydroxybenzonitrile	Amchem
Picloram	Tordon	4-amino-3,5.6-trichloropecolinic acid	Dow
OSC 21799		1,-phenyl-3-methyl-5-allyl-hexahydro-1,3,5-triazinone-2	Velsicol
Diuron	Karmex	3-(3,4-dichlorophenyl)-1,1-dimethylurea	DuPont
MCPA		2-methyl-4-chlorophenoxyacetic acid	
Chlorflurazole		4,5-dichlor-2-trifluromethyl benzimidazole	Fisons
2,4-D LV		2,4-dichloro phenoxyacetic acid	
Linuron	Lorox	3-(3,4-dichlorophenyl)-methoxy-1-methylurea	DuPont

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Table 1. Yield and weed control data from herbicide study on winter wheat. Grown on the Northwestern Montana Branch Station in Field R-8a, in 1967.

Treatment	Rate/Acre in Ounces	Replications in Grams I	II	III	Total	Yield Bu/A.	Weed Score $\bar{x}$ (0-10)
Check	0	672	642	613	1927		
		613	618	689	1920		
		619	509	648	1776	62.5	0
Check(hand weeded fall)	0	690	621	697	2008		
		795	740	771	2306		
		613	669	687	1969	69.8	10
Bromoxynil ester	4	682	707	674	2063		
		460	685	687	1832		
		724	607	410	1741	62.6	9
Bromoxynil ester	6	719	645	638	2002		
		557	671	648	1876		
		627	701	691	2019	65.5	8
Bromoxynil ester	8	840	670	615	2125		
		556	723	815	2094		
		502	528	771	1801	66.9	9
Picloram	.5	645	632	632	1909		
		647	684	866	2197		
		538	619	655	1812	65.8	5
Ioxynil ester	4	638	461	220	1319		
		565	419	404	1388		
		638	339	560	1537	47.2	9
Ioxynil ester	6	733	513	653	1899		
		764	566	680	2010		
		671	473	618	1762	63.0	9
Ioxynil ester	8	716	626	670	2012		
		718	732	775	2225		
		797	624	577	1998	69.3	10
OCS 21799	16	696	782	704	2182		
		722	680	677	2079		
		532	573	564	1669	65.9	3
OCS 21799	24	683	597	687	1967		
		747	675	678	2100		
		640	588	604	1832	65.6	5
OCS 21799	48	536	541	489	1566		
		633	616	518	1767		
		429	410	384	1223	50.6	5
Diuron	12	689	604	811	2104		
		674	646	704	2024		
		413	413	490	1316	60.5	5
Diuron	24	718	470	745	1933		
		646	518	717	1881		
		555	450	647	1652	60.7	9

KS
VRS
4

Table 1 . (con't)

Treatment	Rate/Acre in Ounces	I	II	III	Total	Yield Bu/A.	Weed Score $\bar{x}$ (0-10[1])
2,4-D LV	4	614	612	538	1764		
		644	514	675	1833		
		446	597	525	1568	57.4	4
2,4-D LV	8	521	566	484	1571		
		609	561	579	1749		
		468	577	410	1455	53.1	8
MCP	8	610	637	686	1933		
		675	677	668	2020		
		479	601	507	1587	61.6	6
Chlorflurazole + MCPA	16 + 8	659	701	637	1997		
		742	716	744	2202		
		596	754	628	1978	68.6	5
Chlorflurazole + MCPA	12 + 8	640	676	751	2067		
		565	646	799	2010		
		456	546	676	1678	63.9	3
Chlorflurazole	16	466	624	500	1590		
		657	725	651	2033		
		361	508	536	1405	55.9	2
Picloram + MCP (M)	¼ + 4	518	683	512	1713		
		483	655	777	1915		
		349	635	562	1546	57.5	3
Picloram + MCP (M)	½ + 8	357	669	700	1726		
		408	613	650	1671		
		313	504	574	1391	53.2	7
2,4-D LV (Spr. applied)	16	506	660	678	1844		
		577	716	619	1912		
		362	553	365	1280	56.0	4
Check(Hand weeded spr.)	0	450	477	652	1579		
		457	686	758	1901		
		573	562	683	1818	58.9	10

[1] 0 = No control 10 = Complete control

$\bar{x}$..... 60.9
S.E.$\bar{x}$..... 5.1607
C.V.%..... 8.47

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	25680.15	3.21*
Treatment	23	33249.9826	4.16*
Trt x Rep	46	15224.25869	1.91*
Error	144	7989.92638	
Total	215		

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Table 2. Summary of yield from herbicide study, fall application on winter wheat at Northwestern Montana Branch Station, Kalispell, Montana, 1966-67.

Treatment	Rate in Ounces	Yield Bushel/Acre	Weed Score 0-10[1]
Check	0	62.5	0
Check (hand weeded fall)	0	69.8	10
Bromoxynil ester	4	62.6	9
Bromxoynil ester	6	65.5	8
Bromoxynil ester	8	66.9	9
Picloram	.5	65.8	5
Ioxynil ester	4	47.2	9
Ioxynil ester	6	63.0	9
Ioxynil ester	8	69.3	10
OCS 21799	16	65.9	3
OCS 21799	24	65.6	5
OCS 21799	48	50.6	5
Diuron	12	60.5	5
Diuron	24	60.7	9
2,4-D LV	4	57.4	4
2,4-D LV	8	53.1	8
MCP	8	61.6	6
Chlorflurazole + MCPA	16 + 8	68.6	5
Chlorflurazole + MCPA	12 + 8	63.9	3
Chlorflurazole	16	55.9	2
Picloram + MCP (M)	$\frac{1}{4}$ + 4	57.5	3
Picloram + MCP (M)	$\frac{1}{2}$ + 8	53.2	7
2,4-D LV (spr. applied)[2]	1	56.0	4
Check (hand weeded spr.)	0	58.9	10

Date Applied: November 17, 1966
[1] 0-10 - 0 = No control, 10 = Complete control
[2] Applied: May 4, 1967

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VRS
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Table 3. Data from herbicide study conducted on the Glen Roth farm, Route 4, Kalispell, Montana in 1967. [1]

Treatment	Rate/Acre in Ounces	Volume/Acre in Gallons	Plot Number	Reading	$\bar{x}$
Bromoxynil	4	5.9	101	5	
			302	7	6.0
Bromoxynil	6	5.9	102	8	
			308	8	8.0
Bromoxynil	8	5.9	103	9	
			307	7	8.0
Bromoxynil	4	11.1	104	9	
			303	8	8.5
Bromoxynil	6	11.1	105	8	
			301	8	8.0
Bromoxynil	8	11.1	106	9	
			312	9	9.0
Bromoxynil	4	22.1	107	9	
			305	7	8.0
Bromoxynil	6	22.1	108	9	
			310	8	8.5
Bromoxynil	8	22.1	109	9	
			306	9	9.0
Bromoxynil	4	44.5	110	9	
			304	9	9.0
Bromoxynil	6	44.5	111	9	
			311	9	9.0
Bromoxynil	8	44.5	112	9	
			309	9	9.0

[1] Crop: Wheat
Variety: Gaines
Application Date: April 13, 1967
Temperature: 42° - 44° F
Humidity: 52%
Wind: 2 - 9 mph

KS
VRS
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Table 4. Summary of herbicide data from Roth farm, Route 4, Kalispell, Montana in 1967.

Volume gpa	Rate of Bromoxynil-Oz. 4	6	8	$\bar{x}$ for Volume
5.9	6.0	8.0	8.0	7.3
11.1	8.5	8.0	9.0	8.5
22.1	8.0	8.5	9.0	8.5
44.5	9.0	9.0	9.0	9.0
$\bar{x}$ for rates	7.8	8.4	8.8	

Table 5. Data from herbicide study conducted on the Hubbard farm, Route 4, Kalispell, Montana in 1967.[1]

Treatment	Rate/Acre in Ounces	Volume gpa	Area Square Feet	Weight #/Plot	Yield Bushel/Acre
Bromoxynil	6	11.1	969.0	91.5	68.6
Bromoxynil	8	11.1	799.0	82.0	74.5
Bromoxynil	6	22.1	909.5	78.0	62.3
Bromoxynil	8	22.1	1011.5	95.5	68.6
Bromoxynil	4	11.1	1020.0	93.0	66.2
2,4-D LV	4	11.1	926.5	81.0	63.5
Check	0	0.0	892.5	87.5	71.2
Ioxynil	6	22.1	926.5	75.0	58.8

[1] Crop: Wheat
Variety: Gaines
Application Date: April 11, 1967
Temperature: 40°F
Humidity: 80%
Wind: 2 - 3 mph

Table 6. Data from herbicide study on the Glen Roth farm using two urea compounds, in cooperation with DuPont. Route 4, Kalispell, Montana in 1967. [1]

Treatment	Rate #/Acre	Weed Control Score 0-10[2]			
		1	2	3	$\bar{x}$
Linuron	½	7	7	2	5.3
Linuron	1	8	8	10	8.7
Linuron	2	10[3]	10[4]	10	10.0
Diuron	½	3	4	6	4.3
Diuron	1	2	5	9	5.3
Diuron	2	7	10	9	8.7
Check	0	0	0	0	0.0

1 Crop: Wheat
Variety: Gaines
Temperature: 36°F
Humidity: 75%
Wind: 9 mph
Date of Application: April 19, 1967

2 0-10: 0 = No control 10 = Complete control

3 Early in the season showed signs of injury, plants appeared to recover

4 Injury apparent date of reading, some shortening of grain

KS
VRS
5

TITLE: Control of Weeds in Silage Corn Using Herbicides.

PROJECT: Weed Investigations MS 754

YEAR: 1967

PERSONNEL: Leader - Vern R. Stewart
Cooperators- D. R. Merkley, Research & Development Chemical Company Representatives

LOCATION: Western Montana Branch Station, Corvallis, Montana

DURATION: Indefinite

OBJECTIVES: 1. To find a herbicide that will give adequate weed control, which will not affect subsequent crops such as cereals.

PROCEDURES:

The study in corn consisted of plots 10 x 20 feet, using seven herbicides alone and in combination. Herbicides were applied using 44.5 gpa volume. Three replications were used in this study.

A medium maturing variety of corn was seeded in 5 rowplots in 24 inch rows at about 35,000 plants per acre. This was seeded May 16, 1967. Herbicides were applied post plant on May 18, 1967.

Two plots were left untreated in each replication. These were used as checks. One a weedy check, the other a hand weeded check.

Population counts were made at harvest time. A weed score was recorded at the same time. Yield data is reported on a total dry matter basis for corn silage.

SIGNIFICANT FINDINGS:

Yield differences were found significant. The combination of atrazine and linuron provided excellent weed control and had no adverse effect on yield. Dicamba provided very poor weed control and resulted in a yield loss.

FUTURE PLANS: Indefinite.

KS
VRS
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CONTROL OF WEEDS IN SILAGE CORN USING HERBICIDES

INTRODUCTION:

Corn silage production has been increasing in some areas of western Montana. Weed control has been effective using Atrazine. However, this product leaves a residue and it becomes necessary to follow corn with corn in a rotation.

This study was designed to find a herbicide or combination of herbicides which will give adequate weed control and not leave a residue toxic to other crops, such as cereals and legumes.

Seven herbicides alone and in combination made up the 15 treatments including two check plots. One check plot was hand weeded, the other was a weedy check. A medium maturity hybrid corn selection was used in the study. Plots were 5 rows, space 24" by 20 ' long.

RESULTS AND DISCUSSION:

Linuron alone and in combination caused the corn plants to become a very light green when compared with the hand weeded check. This observation was made September 13, 1967, the harvest date.

No significant differences in plant population was found in this study.

Atrazine at one pound per acre plus Ramrod at two pounds per acre, gave the best control and resulted in the highest yields of dry matter. Atrazine at one pound per acre plus linuron at one pound per acre also gave equal control to the hand weeded check.

Dicamba was the least effective of all the herbicides used. There was a reduction in yield as well as very poor weed control. GS 14260 appeared to have an adverse effect on yield, but did give excellent control of the weed species present. See listing of weeds with tabular data.

Yield differences were found to be significant using the multiple range test. The atrazine at one pound per acre plus ramrod at two pounds per acre was found to be significantly higher in yield than the nine other treatments in the study. See table 3.

Residue measurements will be made during the growing season of 1968.

Weeds in Silage Corn (con't)

SUMMARY AND CONCLUSION:

Yield differences were found significant. The combination of atrazine and linuron provided excellent weed control and had no adverse effect on yield. Dicamba provided very poor weed control and resulted in a yield loss.

HERBICIDES USED

Common Name	Trade Name or Other	Chemical Name	Company
Atrazine	Atrazine	2-Chloro-4-ethylamino-6-isopropylamino-triazine	Geigy
Linuron	Lorox	3-(3,4-dichlorophenyl)-methoxy-1-methylurea	DuPont
Ramrod	CP 31393	N-isopropyl-2-Chloroacetanilide	Monsanto
CP 50144		(not available)	
EPTC	Eptam	ethyl N, N-dipropylthiolcarbamate	Stauffer
2,4-D		2,4-dichlorophenoxyacetic acid	
Dicamba	Banvel D	N-oleyl 1,3-propylene diamie salts of 2,4-D	Velsicol
GS 14260		2-tert butylamio-4 ethylamino -6-methylthio-s-triazine	Geigy

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VRS
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Table 1. Population counts and weed score from herbicide study on corn silage. Located at the Western Montana Branch Station, Corvallis, Montana in 1967.

Date Planted: May 16, 1967 Date Harvested: September 13, 1967
Date Herbicide Applied: May 18, 1967 Size of Plot: 16 sq. ft.

Treatment	Rate/Acre in pounds	Population-Plants/Plot I	II	III	Total	$\bar{x}$	Weed Score 0-10 1/
Linuron	1	47	53	50	150	50	10
Linuron + Ramrod	1 + 2	47	47	50	144	48	10
Ramrod	4	52	46	51	149	50	7
Atrazine	1	51	50	50	151	50	9
Atrazine + Linuron	1 + 1	52	51	49	152	51	10
Atrazine + Ramrod	1 + 2	52	51	54	157	52	10
50144	2	51	53	52	156	52	8
50144 + Linuron	1 + 1	49	51	46	146	49	10
Knoxweed(Eptam+2,4-D)	2 + 1	58	57	46	161	54	8
Banvel D	¼	54	47	53	154	51	3
Banvel D	½	50	48	57	155	52	5
GS 14260	2	46	48	50	144	48	9
GS 14260	4	42	49	50	141	47	10
Check	0	52	55	48	155	52	1
Check	0	50	40	49	139	46	10

1/ 0-10 - 0 = No control 10 = Complete control

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	1.4889	
Treatment	14	13.49841	1.05
Error	28	13.84603	
Total	44		

$\bar{x}$.....	49.8888
S.E.$\bar{x}$.....	2.0693
L.S.D.....	N.S.
C.V.%.....	4.15

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VRS
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Table 2. Yield data from herbicide study on corn grown on the Western Montana Branch Station, Corvallis, Montana in 1967.

Treatment	Rate/Acre in pounds	Pounds Dry Matter/Plot I	II	III	Total	% Moisture	Ton/Acre Dry Matter
Linuron	1	19.2	28.0	23.2	70.4	71.7	8.0
Linuron + Ramrod	1 + 2	22.8	25.1	25.1	73.0	71.2	8.3
Ramrod	4	27.0	24.4	23.2	74.6	74.8	8.5
Atrazine	1	26.0	21.8	22.4	70.2	74.0	8.0
Atrazine + Linuron	1 + 1	28.1	27.5	19.7	75.3	73.0	8.5
Atrazine + Ramrod	1 + 2	31.7	28.7	31.7	92.1	72.9	10.4
50144	2	32.9	28.8	24.2	85.9	70.9	9.7
50144 + Linuron	1 + 1	20.1	21.3	21.1	62.5	74.9	7.1
Knoxweed(Eptam+2,4-D)	2 + 1	25.2	23.9	22.6	71.7	74.3	8.1
Banvel D	$\frac{1}{4}$	19.4	24.9	19.7	64.0	74.8	7.3
Banvel D	$\frac{1}{2}$	16.7	26.8	23.1	66.6	73.5	7.5
GS 14260	2	26.9	21.4	21.7	70.0	75.1	7.9
GS 14260	4	17.7	18.6	19.8	56.1	76.1	6.4
Check	0	19.4	23.9	15.1	58.4	73.1	6.6
Check (cultivated)	0	26.4	20.8	22.7	69.9	73.3	7.9

$\bar{x}$..... 8.0
S.E.$\bar{x}$..... .67869
C.V.%..... 8.46

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	17.36625	1.45
Treatment	14	29.20279	2.45*
Error	28	11.93123	
Total	44		

Table 3. Summary of herbicide data from corn study grown at the Western Montana Branch Station, Corvallis, Montana in 1967.

Treatment	Rate/A in Pounds	% Moisture	Plants per Acre	Tons/A Dry Matter	Weed Score 0-10[1]	Remarks[2]
Atrazine + Ramrod	1 + 2	72.9	35,619	10.4a	10	
50144	2	70.9	35,393	9.7ab	8	Lambsquarter, pigweed
Atrazine + Linuron	1 + 1	73.0	34,485	8.5abc	10	
Ramrod	4	74.8	33,804	8.5abc	7	Purslane,pigweed,lambsquarter
Linuron + Ramrod	1 + 2	71.2	32,670	8.3abc	10	
Eptam + 2,4-D	2 + 1	74.3	36.527	8.1abc	8	Pigweed
Atrazine	1	74.0	34.258	8.0 bc	9	Pigweed, dandelion
Linuron	1	71.7	34,031	8.0 bc	10	
GS 14260	2	75.1	32,670	7.9 bc	9	Pigweed
Check (cultivated)	0	73.3	31,536	7.9 bc	10	
Dicamba	½	73.5	35,166	7.5 bc	5	Purslane,storksbill,pigweed,lambsquarter
Dicamba	¼	74.8	34,939	7.3 bc	3	Purslane,storksbill,pigweed,lambsquarter,mallow
50144 + Linuron	1 + 1	74.9	33,124	7.1 bc	10	
Check (Weedy)	0	73.1	35,166	6.6 c	0	Pigweed,purslane,storksbill,mallow
GS 14260	4	76.1	31,989	6.4 c	10	
$\bar{x}$			33,956	8.0		
S.E.$\bar{x}$			1408.417	.67869		
F .05			1.05 NS	2.45*		
C.V.%			4.15	8.46		

1/ 0-10: 0 = No control 10 = Complete control

2/ Weed species found in plots at harvest time:
Some quackgrass (Agropyron repens) found in all treatments
Purslane (Portulaca oleracea)
Pigweed (Amaranthus retroflexus)
Lambsquarter(Chenopodium album)
Dandelion (Tara/acum officinale)
Storksbill (Erodium circutarium)
Mallow (Malva neglecta)

SMALL GRAINS INVESTIGATIONS IN SPRING BARLEY

INTRODUCTION:

The research work in spring barley is designed primarly to aid the breeding program, to increase the production of barley in Western Montana.

The 1967 crop consisted of several nurseries located on station and off station. The plots were grown in four rows, randomized block design and replicated four to five times. A portion of the work was conducted under irrigation and a portion under dryland. These conditions will be discribed under Results and Discussion.

RESULTS AND DISCUSSION:

Intra-state Nursery - The intra-state station yield nurseries were grown both under dryland and irrigated conditions. The nurseries were not identical in entries in 1967. The irrigated nursery contained 25 entries and was replicated five times. Unitan was the highest yielding variety and was significantly higher than Ingrid, which was used as the check. This past season resulted in less lodging in the irrigated spring barley nurseries than in all of the years of conducting this study. This can be attributed to the low rainfall of .05 of an inch, which occurred during the months of July and August. Yields are however higher than have been recorded for some years. This is felt to be due to the lodging factor, considerable yield is lost in the harvesting of lodged grain.

Twenty-seven entries were included in the dryland intra-state nursery and were grown in four replications. Piroline, a recently released variety for Western Montana, was used as the check. None of the varieties were found to be significantly better in yield than Piroline. Only one variety, Nupana, was found to be significantly less in yield. Test weights were good to excellent in this study, having a range from forty-six pounds to fifty-six pounds per bushel. The fifty-six pounds per bushel was for the variety Nupana, which is a hulless variety. Lodging was not severe in the nursery, however some was noted in most of the entries. Table 2.

Off station Nurseries - Four off station barley nurseries were seeded in Western Montana in 1967. Two of the off station nurseries were comparisons between single row plots, replicated six times, and of four row plots, replicated four times. These were seeded in Ravalli County, located on the Western Montana Branch Station. Because of severe bird injury the comparison nurseries were not harvested. A discription of the other nurseries follows by counties.

Missoula County - This nursery was grown in four replications, contained ten entries and was grown on the A. D. Neilson farm near Frenchtown, in Missoula County. The mean for the nursery was 56.6 which is only fair for this area for barley production. The highest yielding entry in this nursery was MT 6412, with a yield of 65.7 bushels per acre. This was found to be significantly higher in yield than the variety Ingrid which is used as check. Unitan was also found to yield somewhat greater than Ingrid, but was not significantly different. Kernel size was excellent in most of the nurseries, except Ingrid, which had a low of 79% plump. Table 3.

Results and Discussion(con't)

Lake County - This nursery was grown on the James Fleming farm near Pablo in Lake County. This was designed for irrigated study but because of conditions beyond the control of the author and the grower this study was not irrigated, so the data presented here are essentially dryland data. Because of the extremely dry weather occurring during the growing season the yields from this nursery were low and the test weights are fair to poor. The kernel size was very poor with the highest plump being, Glacier x Mars with 45%. The mean yield for the nursery was 29.5 and the yields were found to be non-significant when analyzed statistically. Table 4.

In Table 5 is shown a summary of the yields from the irrigated intra-state and station yield nurseries from 1955 to 1967 at the Northwestern Montana Branch Station. With ten years in that period being included. A comparison is made with the long time check, Vantage. During a nine year period with Vantage compared to Ingrid, Ingrid is 115% of Vantage. Over the short range period Steveland for two years is 124% of Vantage, wherein the same two year period Ingrid is 113% of Vantage.

In Table 6 is the summary of the yields for the dryland intra-state and station yield nurseries for 1956 to 1967. The long time check used in this summary table is Compana. Unitan when compared with Compana is 122% of that variety for a period of ten years. Piroline compared for eight years with the variety Compana is 116%.

Two-row, Six-row Isogenic Nursery - This nursery is grown to test the yield merit of two row type barleys against a six row type. The character being tested in these studies was the lateral floret development gene. Four nurseries were grown in this isogenic study. The crosses used were Munsing x 7 Trebi, grown under both irrigated and dryland conditions and the other cross was Betzes x 7 Trail grown under dryland and irrigated conditions.

In the Munsing x 7 Trebi study grown under irrigated conditions, Trebi the parent variety, was the highest entry. The six row type appeared to be superior in yield to the two row type. There appeared to be no pattern in yield in this nursery as it pertains to the lateral floret development. The same study conducted under dryland conditions again finds Trebi the highest yielding entry in the nursery, and the six row type out yielding the two row type. There seems to be no relationship in yield to the lateral floret size gene.

In the Betzes x 7 Trail study grown under irrigation the six row type are superior to the two row types in yield. However, the data was found to be non-significant when analyzed statistically. Table 9. In the dryland study of the same cross there is about the same relationship as found in the irrigated study. Table 10.

A complete report of the isogenic study being conducted throughout the state by Dr. Gene Hockett, USDA, ARS, will be published at a later date.

Results and Discussion (con't)

Hill Study - The hill study planted by the author was harvested and the material turned over to Dr. Hockett for his analysis and these data are not available for inclusion in this report.

High-Moisture Barley - This study is state wide with Mr. J. L. Krall as coordinator. In Table 12 is a summary of the data from the harvest of high moisture barley and mature barley grown under irrigated conditions on the Northwestern Montana Branch Station. The yields are reported in pounds per acre of total dry matter per acre. Using Ingrid as the check variety, Compana and Nupana are found to be significantly less in yield at mature harvest. Hypana was added to the list as being significantly less in yield when harvested at the high moisture period. The average of the seven varieties harvested at high moisture (31%) was 189.5 pounds per acre greater in yield than the mature harvest (11%).

Table 14 gives a summary of data from harvest of high moisture and mature barley grown under dryland conditions. The first harvest was August 1, 1967 with 33.8% moisture average for the five varieties. The mature harvest had an average moisture content of 9.3%. When analyzed statistically the high moisture data was found to be significant, whereas the mature harvest yield data were found to be non-significant. The means of the two harvest dates find a slight increase in yield with the highest at the mature date of harvest.

Beardless Ingrid - In 1965 some beardless types of barley were selected from a field of Ingrid barley grown on the Vernon Johnson Farm, Northwest of Kalispell. These were selected by the author and Mr. Robert F. Eslick, Montana State University. These individual plants were increased in hills in 1966. In 1967 they were grown in individual rows, with the three plants being grown. These data are presented for the record only and are found in Table 15.

SUMMARY & CONCLUSION:

1. Unitan was significantly higher in yield than Ingrid under irrigation in 1967.

2. Piroline was found only to be significantly higher in yield than Nupana in the dryland intra-state nursery.

3. Mars x Glacier MT 6412 was highest yielding entry in the Missoula County location.

4. Over a nine year period Ingrid is 115% of Vantage under irrigation.

5. Under dryland conditions Piroline is 116% of Compana for yield over an eight year period.

6. In the isogenic studies the six row type out yielded the two row type.

Table 1. Agronomic data from irrigated intrastate barley yield nursery grown on the Northwestern Montana Branch Station in 1967. Experimental design, randomized block, five replications.

Planting Date: May 1, 1967
Harvest Date: August 21, 1967
Size of Plot: 16 square feet

Variety	Number	Yield Bu/A.	Heading Date	Ht. In.	Weight Lbs/Bu	% Plump	Lodging Prev.	Lodging Sever.
Unitan	10421	128.35*	7- 1	39	48.7	91	30	3
Zephyr	510669	120.52	7- 4	35	52.7	89	9	2
Vantage	7324	119.15	7- 1	40	50.3	91	15	3
BetxFirl III 60AB2057	12233	115.20	7- 4	40	53.8	94	28	3
Ingrid	10083	111.67	7- 7	39	51.0	87	35	5
Prior x 7Betzes Derived	6412	111.00	7- 4	39	53.8	87	48	5
BetxHII2xPir 7155-60	11868	109.97	7- 4	39	52.7	89	29	3
BetxHH2xPir 7563-60	11870	109.55	7- 3	37	52.5	87	19	3
BetxHH2xPir 7698-62	13334	109.17	7- 3	38	52.8	91	32	4
Piroline	9558	108.82	7- 3	39	53.8	93	20	4
Keystone	10877	107.97	7- 3	43	51.8	85	57	3
Grande	11758	107.55	6-28	37	48.2	97	26	3
Delta	285086	105.32	7- 3	35	53.4	92	14	3
Freja x Betzes	207196	104.77	7- 5	39	51.4	83	46	7
Betzes	6398	104.72	7- 4	40	52.7	89	54	5
Dom x Bet 211741	13337	103.65	7- 6	41	52.0	91	47	3
Steveland	13100	102.12	6-27	31	46.9	91	18	2
Conquest	11638	98.95[1]	7- 2	45	49.4	89	42	3
Hypana	11772	97.67[1]	7- 1	40	48.5	93	26	3
Betzes x Compana	207769	96.75[1]	7- 6	40	48.6	68	71	9
Prior x7Betzes early	6462	91.40[1]	6-28	34	52.9	83	80	3
Glacier x Mars 586350	13101	90.62[1]	6-28	34	45.9	91	24	3
Compana	5438	85.52[1]	7- 2	34	49.2	92	73	7
Glacier	6976	84.05[1]	6-27	33	46.1	87	32	2
Nupana Bulk	37724	69.47[1]	7- 2	34	54.0	78	76	8

NOTE: Ingrid is used as the check variety in this nursery
* Varieties yielding significantly more than the check (.05)
1 Varieties yielding significantly less than the check

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	4	86.9	1.34
Varieties	24	805.3	12.41*
Error	96	64.8	
Total	124		

$\bar{x}$.....	103.7
S.E.$\bar{x}$.....	3.6
L.S.D.(.05).	10.1
C.V.%.....	3.47

Table 2. Agronomic data from intra-state barley yield nursery grown at the Northwestern Montana Branch Station in 1967. Experimental design, random block, four replications.

Planting Date: April 28, 1967
Harvest Date: August 17, 1967
Size of Plot: 16 square feet

Variety	Number	Yield Bu/A.	Heading Date	Ht. Ins	Weight Lbs/Bu	% Plump	Lodging Prev.	Lodging Sever.
Grande	11758	68.68	6-27	25	46.8	98	70	4
Dom x Bet 211741	13337	63.25	7- 8	24	50.5	89	30	3
Priorx7Betzes Derived	6412	62.87	7- 3	25	52.3	88	40	5
Freja x Betzes	207168	61.31	7- 6	24	52.3	91	40	3
Zephyr	510669	60.90	7- 5	20	51.6	93	11	3
BetxHH 2xPir 7698-62	13334	60.84	7- 3	23	52.6	92	24	2
Bet x Mun 62AB3786	623786	60.78	7- 6	23	51.2	85	53	5
Unitan	10421	60.71	6-30	24	49.4	91	86	5
Keystone	10877	60.03	7- 3	27	49.9	89	35	4
Piroline	9558	58.31	7- 2	24	53.2	95	31	2
Compana	5438	58.15	7- 3	21	51.1	96	91	6
Freja x Betzes	207165	57.84	7- 4	25	51.3	82	53	4
Freja x Betzes	207196	57.84	7- 6	24	51.8	90	55	4
Betzes x Compana	207726	57.40	7- 7	24	50.4	78	51	6
BetxHH2xPir 7563-60	11870	56.71	7- 3	22	53.4	93	26	2
Betzes	6398	56.50	7- 4	24	51.0	81	66	4
Betzes x Compana	207769	55.43	7- 6	22	49.0	82	46	5
Hypana	11772	55.28	7- 1	24	48.4	97	45	3
Betzes x Compana	207739	54.28	7- 7	23	46.5	76	63	5
Prior x 7Betzes early	6462	53.28	6-25	23	53.0	89	55	4
Conquest	11638	52.62	7- 1	30	47.3	80	46	4
Dekap	3351	52.40	7- 2	20	52.0	88	63	5
Lico x Ogalitsu	12130	49.93	6-27	24	47.2	87	64	5
BetxHII2xPir 7155-60	11868	49.43	7- 4	22	52.5	94	30	3
Steveland	13100	49.31	6-28	20	45.5	84	45	4
Glacier x Mars MT586350	13101	47.18	6-26	26	46.6	90	61	5
Nupana Bulk	37724	41.18*	7- 4	22	56.5	71	83	7

NOTE: Piroline is used as the check variety in this nursery
* Variety yielding significantly less than the check (.05)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	1940.6	24.70
Varieties	26	133.9	1.70*
Error	78	78.4	
Total	107		

$\bar{x}$.....	56.3
S.E.x.....	4.4
L.S.D.(.05)..	12.45
C.V.%.....	7.85

KS
VRS
1

Table 3. Agronomic data from the off station barley yield nursery grown on the A. D. Neilson farm, Missoula County, Missoula, Montana in 1967. Experimental design, random block, four replications.

Planting Date: April 27, 1967
Harvest Date: August 8, 1967
Size of Plot: 16 square feet

Variety	Number	Yield Bu/A.	Ht. Ins	Weight Lbs/Bu	% Plump	Lodging Prev.	Lodging Sever.
Prior x 7 Betzes Derived	6412	65.71*	30	53.5	87	28	2
Dom x Bet 211741	13337	63.40	30	51.4	94	0	0
Betzes	6398	61.21	30	52.4	89	28	2
Unitan	10421	58.40	33	49.6	86	0	0
Bet x HII 2x Pir 7155-60	11868	57.28	28	53.4	89	0	0
Piroline	9558	56.71	31	53.2	92	0	0
Ingrid	10083	54.18	27	50.7	79	0	0
Prior x 7Betzes Early	6462	53.28	28	54.0	88	60	5
Glacier x Mars MT586350	13101	49.34	28	48.0	93	0	0
Hypana	11772	46.59[1]	32	49.6	93	40	2

NOTE: Ingrid is used as the check variety in this nursery
* Variety yielding significantly more than the check (.05)
1 Variety yielding significantly less than the check (.05)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	586.6	15.33*
Varieties	9	144.0	3.76*
Error	27	38.2	
Total	39		

$\bar{x}$.....	56.6
S.E.$\bar{x}$.....	3.0
L.S.D.(.05)..	8.97
C.V.%.....	5.46

KS
VRS
1

Table 4. Agronomic data from the off station barley yield nursery grown on the James Fleming farm in Lake County, Pablo, Montana in 1967. Experimental design, random block, four replications.

Planting Date: April 27, 1967
Harvest Date: August 8, 1967
Size of Plot: 16 square feet

Variety	Number	Yield Bu/A.	Height Inches	Weight Lbs/Bu	% Plump
Prior x 7Betzes early	6462	37.37	27	49.5	36
Prior x 7Betzes derived	6412	33.25	28	41.4	12
Dom x Bet 211741	13337	30.71	26	44.2	39
Betzes	6398	30.09	27	45.4	11
Bet x HII 2x Pir 7155-60	11868	29.12	25	47.0	22
Unitan	10421	28.81	29	41.5	19
Glacier x Mars MT586350	13101	28.46	30	40.1	45
Piroline	9558	27.59	28	47.6	29
Hypana	11772	25.09	29	43.6	74
Ingrid	10083	24.71	25	41.8	15.

$\bar{x}$..... 29.5
S.E.$\bar{x}$..... 2.5
L.S.D.(.05).. N.S.
C.V.%..... 8.62

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	19.1	.73
Varieties	9	55.7	2.15 NS
Error	27	25.9	
Total	39		

Table 5. Summary of yields for irrigated intra-state and station yield nurseries from 1955-1967. Northwestern Montana Branch Station, Kalispell, Montana.

Variety	Number	1955	1956	1957	1958	1959	1960	1961	1965	1966	1967	Station Years	% of Vantage
Betzes	6398	62.4	67.2	62.8	71.9	93.0	65.0	66.9	88.5	67.6	104.7	10	93
Vantage	7324	74.1	74.4	70.4	81.9	90.4	55.8	71.5	101.6	67.8	119.2	10	100
Compana	5438	51.4	55.1	50.0	60.1	88.7	65.4	46.0	70.7	60.0	85.5	10	78
Piroline	9558		76.9	85.8	80.4	94.2	72.4	78.7	95.9	87.3	108.8	9	107
Unitan	10421		76.6	67.9	78.9	102.7	73.0	80.4	84.4	90.8	128.4	9	107
Ingrid	10083		98.4	94.2	94.4	101.7	68.8	90.8	92.0	88.9	111.7	9	115
Glacier	6976		76.2	82.6	53.2				95.0	85.2	84.1	6	92
Hyrana	11772								95.1	72.4	97.7	3	92
Nurana Bulk	37724								77.8	62.3	69.5	3	73
Domen x Betzes 211741	13337								89.7	77.7	103.7	3	94
Glacier x Mars MT586350	13101								111.5	88.4	90.6	3	101
Bet x HII 2xPir 7155-60	11868								84.9	68.8	110.0	3	91
Grande	11758								91.9	73.7	107.6	3	95
Keystone	10877								88.4	57.7	108.0	3	88
Conquest	11638									51.2	99.0	2	100
Steveland	13100									83.7	102.1	2	124
Bet x Firl III 60AB2057	12233										115.2	1	97
Prior x 7Betzes derived	MT6412										111.0	1	93
Bet x HH 2x Pir 7563-60	11870										109.6	1	92
Bet x HH 2x Pir 7698-62	13334										109.2	1	92
Delta	285086										105.3	1	88
Freja x Betzes	207196										104.8	1	88
Betzes x Compana	207769										96.8	1	81
Prior x 7Betzes early	MT6462										91.4	1	77

Table 11 . (con't)

Variety	High Moisture in Grams					Mature Harvest in Grams				
	Plot No.	Green Weight	% Moisture	Dry Weight	Ht. Ins.	Plot No.	Green Weight	% Moisture	Dry Weight	Ht. Ins.
Nupana	28	1028	26.6	755	31	27	453	9.7	409	31
	35	781	20.2	623	31	34	611	9.9	551	34
	74	1033	24.6	779	36	73	592	11.0	527	32
	113	692	30.4	551	35	112	536	11.6	474	37
	132	820	25.2	614	33	131	587	9.8	529	35
	Total	4354	127.0	3322	166		2779	52.0	2490	169
$\bar{x}$		871	25.4	664	33		556	10.4	498	34
Unitan	30	1328	29.5	936	40	29	1125	11.9	991	40
	48	1322	31.8	902	41	47	1006	10.8	897	39
	66	1103	24.2	836	42	65	885	10.3	794	40
	125	1511	34.2	994	43	124	1160	12.0	1021	40
	130	1111	25.1	832	40	129	958	10.3	862	39
	Total	6375	144.8	4500	206		5134	55.3	4565	198
$\bar{x}$		1275	29.0	900	41		1027	11.1	913	40

Table 12. Summary of data from harvest of high moisture and mature barley. Northwestern Montana Branch Station, Kalispell, Montana in 1967. (Irrigated)

High Moisture Harvest Date: August 10, 1967
Mature Harvest Date: August 21, 1967

	High Moisture Harvest			Mature Harvest		
Variety	Height Inches	% Moisture	Pounds/Acre Dry Matter	Height Inches	% Moisture	Pounds/Acre Dry Matter
Compana	34	29.3	3973.3*	34	10.4	3679.2*
Hypana	41	28.4	3547.2*	40	12.2	4135.4
Ingrid	40	37.2	5161.7	40	12.3	4705.6
Betzes	41	34.9	4897.6	41	10.2	4513.5
Vantage	42	34.0	4927.6	40	10.9	5095.7
Nupana	33	25.4	3985.3*	34	10.4	2989.0*
Unitan	41	29.0	5401.8	40	11.1	5479.8$\underline{1}$
$\bar{x}$	38.9	31.2	4556.5	38.4	11.1	4370.6
S.E.$\bar{x}$			265.77			207.205
L.S.D.			774.4			603.7
C.V.%			5.83			4.74

NOTE: Ingrid is used as a check in this nursery
* Varieties yielding significantly less than the check
$\underline{1}$ Variety yielding significantly more than the check

Table 13. Yield and agronomic data from barley harvest at high moisture. Northwestern Montana Branch Station, Rt. 4, Kalispell, in 1967 (Dryland)

Date Planted: April 28, 1967
Size of Plot: 16 square feet
Harvest Date: August 1, 1967 (High Moisture)
Harvest Date: August 17, 1967 (Mature)

	High Moisture (weight in grams)					Mature Harvest (weight in grams)				
Variety	Plot No.	Green Weight	% Moisture	Dry Wt.	Ht. Ins.	Plot No.	Green Weight	% Moisture	Dry Wt.	Ht. Ins.
Compana	7	766	41.0	529	26	6	474	9.7	428	22
	62	553	29.6	389	21	61	481	7.9	443	23
	69	607	39.7	366	23	68	459	9.1	417	21
	115	479	30.3	334	21	114	447	7.8	412	19
	Total	2405	140.6	1618	91		1861	34.5	1700	85
$\bar{x}$		601	35.2	405	23		465	8.6	425	21
Nupana	9	486	27.8	351	27	8	448	9.7	405	26
	50	383	25.9	284	21	49	242	9.0	220	20
	82	384	20.5	305	24	81	377	9.2	342	20
	122	332	34.3	218	21	121	251	9.7	227	20
	Total	1585	108.5	1158	93		1318	37.6	1194	86
$\bar{x}$		396	27.1	290	23		330	9.4	299	22
Betzes	14	822	35.2	533	30	13	694	10.0	625	29
	52	729	40.5	434	21	51	381	10.0	343	23
	85	536	39.3	325	26	84	343	9.8	309	24
	104	615	40.8	364	22	103	390	9.6	353	20
	Total	2702	155.8	1656	99		1808	39.4	1630	96
$\bar{x}$		676	39.0	414	25		452	9.9	408	24
Hypana	18	632	31.0	436	26	17	403	9.9	363	26
	57	645	36.9	407	28	56	545	9.3	494	25
	78	637	35.0	414	22	77	521	9.4	472	24
	111	340	32.7	229	22	110	300	8.9	273	19
	Total	2254	135.6	1486	98		1769	37.5	1602	94
$\bar{x}$		564	33.9	372	25		442	9.4	401	24
Unitan	31	550	32.2	373	28	30	644	9.4	584	23
	55	760	35.1	493	27	54	486	8.9	443	25
	67	652	33.2	436	27	66	491	9.8	443	26
	124	601	34.1	396	24	123	322	9.2	292	23
	Total	2563	134.6	1698	106		1943	37.3	1762	97
$\bar{x}$		641	33.7	425	27		486	9.3	441	24

Table 14. Summary of data from harvest of high moisture and mature barley. Northwestern Montana Branch Station, Rt. 4, Kalispell, Montana. (Dryland)

High Moisture Harvest Date: August 1, 1967
Mature Harvest Date: August 17, 1967

	High Moisture Harvest			Mature Harvest		
Variety	Height Inches	% Moisture	Pounds/Acre Dry Matter	Height Inches	% Moisture	Pounds/Acre Dry Matter
Compana	23	35.2	2430.8	21	8.6	2550.8
Nupana	23	27.1	1740.5	22	9.4	1794.6
Betzes	25	39.0	2484.8	24	9.9	2448.8
Hypana	25	33.9	2232.7	24	9.4	2406.8
Unitan	27	33.7	2550.8	24	9.3	2646.9
$\bar{x}$	24.6	33.8	2285.6	23.0	9.3	2367.2
S.E.$\bar{x}$			179.2			261.7
L.S.D.			552.5			N.S.
C.V.%			7.84			11.06

Table 15. Beardless Ingrid lines grown in 1967 at the Northwestern Montana Branch Station in Field # Y-6.

Plot Number	Yield Grams	Yield Bushel/Acre	$\bar{x}$
1	403	50.4	
1a	490	61.3	
1c	443	55.4	
1d	494	61.8	57.2
2	387	48.4	
2a	280	35.0	
2c	478	59.8	
2d	346	43.3	46.6
3	400	50.0	
3a	350	43.8	
3c	463	57.9	
3d	366	45.8	49.4

SMALL GRAINS INVESTIGATIONS IN WINTER BARLEY

INTRODUCTION:

Winter barley research is continuing with search for a variety that would be reliable under a wide range of environmental conditions.

Ten varieties were included in the 1967 nurseries. They were grown in six locations in Western Montana. Alpine and Olympia are the currently recommended varieties, however only Alpine is used as a check.

RESULTS AND DISCUSSION:

Northwestern Montana Branch Station

Significant differences were found in variety yields in this nursery. Alpine with highest yielding entry, see Table 1.

Missoula County

A mild winter in this area resulted in way above average survival of winter barley. The mean yield was 51.0 bushels per acre. No significant differences were found when analyzed statistically. Most of the entries had to be cleaned before an accurate bushel weight determination could be made. Complete data are found in Table 2.

Ravalli County

The 1967 season is the first a winter barley nursery has survived to the extent data was obtainable. Yields were low because of the low tilling numbers per plant. Stands of all varieties were above 50% with a range of 51 to 93%. Alpine had the best survival of all entries. See Table 3 for complete yield and agronomic data.

Lake County

Mild weather during the winter months in the location no doubt resulted in the rather high yields of winter barley. The mean yield was 56.8 bushels per acre. Alpine is the highest yielding entry. Test weights were fair for all entries. Differential lodging was noted in this study. See Table 4.

Sanders County

High rain fall during the early spring in the Camas Prairie area of Sanders County resulted in yields of over 80 bushels per acres. Traditionally this is a low rainfall area in Western Montana. A New York selection C.I. 11887 is the highest yielding entry. The mean yield is 70.5 bushels per acre. Stands were excellent (95-100%) in all entries in all replications. Table 5.

Winter Barley (con't)

Table 6 shows a summary of the 1967 data secured from all locations in Western Montana. Alpine ranks number one of all varieties and selections tested.

SUMMARY AND CONCLUSION:

1. Environmental conditions were mild during the 1966-67 season, thus all winter barley nurseries survived.

2. Alpine is the highest yielding variety. It is also the recommended variety for Western Montana under certain expected environmental conditions.

Table 1. Agronomic data from winter barley yield nursery grown at the Northwestern Montana Branch Station, Location 05. Randomized block design, four replications.

Seeding Date: October 10, 1966
Harvest Date: August 14, 1967
Size of Plot: 16 square feet

Variety	C.I. No.	Heading Date	Height in Ins.	Yield Bu/A	Test Wt. Lbs/Bu.
Alpine	9578	6/28	31	74.06	46.10
N. Y. 5619B-3B-1	11887	6/16	22	72.28	47.80
Mass. Sel.	11361	6/13	28	71.06	48.50
Olympia	6107	6/13	29	60.56*	48.40
Ellis	9529	6/28	26	60.25*	46.40
N. Y. 5619B-3B-1 (L)	11887	6/27	20	58.84*	48.80
OAC Strain 4 Sel. 60	51571	6/26	23	58.68*	48.70
OAC Strain 4 Sel. 60	515713	6/12	23	54.25*	47.00
OAC Strain 4 Sel. 60	515714	6/12	24	53.96*	49.60
OAC Strain 4 Sel. 60	51576	6/12	23	47.43	45.10

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

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	434.3	6.86*
Varieties	9	306.0	4.83*
Error	27	63.2	
Total	39		

$\bar{x}$.....	61.1
S.E.$\bar{x}$.....	3.9
L.S.D.(.05)	11.5
C.V.%.....	6.5

Table 2. Agronomic data from off station winter barley nursery grown in Missoula County on the Al Goodan farm, Missoula, County in 1966-67.

Date Seeded: September 28, 1966 Date Harvested: August 8, 1967 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Height in Ins.	Replications I	II	III	IV	Total Grams	Yield Bu/A.	Bushel Weight	Lodging % Prev.	Sever.
Alpine	9578	34	405	475	359	369[1]	1608	50.3	49.8	29	2
Ellis	9529	34	408	432	411	384	1635	51.1	47.7	90	5
Olympia	6107	37	467	462	432	440	1801	56.3	49.1	80	4
OAC Strain 4 Sel. 60	515713	28	332	423	394	500	1649	51.5	50.1	8	2
OAC Strain 4 Sel. 60	515714	27	424	352	365	358	1499	46.9	50.7	10	2
Mass. Sel.	11361	35	436	465	468	464	1833	57.3	47.7	27	3
N. Y. 5619B-3B-1	11887	26	478	423	431	423	1755	54.9	49.2	9	1
OAC Strain 4 Sel. 60	51571	28	401	377	401	388	1567	49.0	51.0	19	2
OAC Strain 4 Sel. 60	51576	28	341	457	396	363	1557	48.7	50.5	23	2
N. Y. 5619B-3B-1 (L)	11887	27	425	400	371	420	1616	50.5	52.0	11	1

[1] Calculate missing plot

$\bar{x}$..... 51.6
S.E.x..... 19.08
C.V.%..... 4.62

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	983.66666	
Varieties	9	3021.11111	2.07 N.S.
Error	26	1456.57692	
Total	38		

Table 3 . Agronomic data from off station winter barley yield nursery grown on the Gerald Neil farm in Ravalli County in 1966-67. Location 58 Randomized block design, four replications.

Date Seeded: September 28, 1966
Date Harvested: July 25, 1967
Size of Plot: 16 square feet

Variety	C.I. Number	Height in Ins.	Yield Bu/A	Test Wt. Lbs/Bu.	% Stand
Mass. Sel.	11361	28	37.06	49.5	92.50
N. Y. 5619B-3B-1	11887	23	34.90	48.4	78.75
Olympia	6107	28	31.78	49.6	91.25
Alpine	9578	27	28.84	40.9	93.75
Ellis	9529	27	26.18	48.3	62.50
N. Y. 5619B-3B-1 (L)	11887	21	22.87	48.1	65.00
OAC Strain 4 Sel. 60	515713	21	21.84	----	85.00
OAC Strain 4 Sel. 60	51576	21	21.78	----	83.75
OAC Strain 4 Sel. 60	515714	21	18.21	----	73.75
OAC Strain 4 Sel. 60	51571	21	14.62*	----	51.25

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

$\bar{x}$..... 25.8
S.E.$\bar{x}$..... 4.1
L.S.D.(.05).. 12.0
C.V.%..... 16.06

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	243.3	3.53*
Varieties	9	212.2	3.08*
Error	27	68.8	
Total	39		

Table 4. Agronomic data from off station winter barley yield nursery grown on the Wayland Johnson farm in 1966-67. Randomized block design, three replications.

Date Seeded: September 28, 1966
Harvest Date: July 25, 1967
Size of Plot: 16 square feet

Variety	C.I. Number	Height in Ins.	Yield Bu/A	Test Wt. Lbs/Bu.	Lodging % Prev.	Lodging Sever.
Alpine	9578	37	66.45	47.2	10	1
Olympia	6107	23	64.37	50.0	45	3
Ellis	9529	35	60.54	46.4	55	2
Mass. Sel.	11361	35	59.91	48.3	72	3
N. Y. 5619B-3B-1	11887	26	58.79	47.6	57	2
OAC Strain 4 Sel. 60	515713	25	56.45*	48.6	37	2
OAC Strain 4 Sel. 60	51576	24	55.33*	48.4	50	3
N. Y. 5619B-3B-1 (L)	11887	25	53.83*	47.1	45	2
OAC Strain 4 Sel. 60	515714	25	51.70*	49.6	38	2
OAC Strain 4 Sel. 60	51571	26	41.24*	49.3	23	4

NOTE: Alpine is used as the check in this nursery.
* Varieties yielding significantly more than the check (.05)

$\bar{x}$..... 56.8
S.E.$\bar{x}$..... 3.4
L.S.D.(.05).. 10.0
C.V.%..... 5.98

Analysis of Variance

Source	D.F.	Mean Square	F.
Replication	2	258.7	7.44*
Varieties	9	152.3	4.38*
Error	18	34.7	
Total	29		

Table 5. Agronomic data from off station winter barley yield nursery grown on the Ray Jorgenson farm in Sanders County. Randomized block design, four replications.

Date Seeded: September 29, 1966
Date Harvested: July 24, 1967
Size of Plot: 16 square feet

Variety	C.I. Number	Height in Ins.	Yield Bu/A	Test Wt. Lbs/Bu.
N. Y. 5619B-3B-1 (L)	11887	28	84.43*	48.6
N. Y. 5619B-3B-1	11887	25	77.90	50.0
Olympia	6107	35	74.87	52.2
OAC Strain 4 Sel. 60	515714	27	74.09	52.7
Ellis	9529	34	71.84	49.3
Alpine	9578	36	69.53	46.6
OAC Strain 4 Sel. 60	51571	31	68.84	51.6
OAC Strain 4 Sel. 60	51576	22	66.25	52.3
Mass. Sel.	11361	33	62.90	49.2
OAC Strain 4 Sel. 60	515713	19	54.71	50.9

NOTE: Alpine is used as a check in this nursery.
* Variety yielding significantly more than the check (.05)

$\bar{x}$..... 70.5
S.E.$\bar{x}$..... 4.9
L.S.D.(.05).. 14.4
C.V.%..... 7.03

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	683.1	6.93
Varieties	9	271.7	2.75
Error	27	98.5	
Total	39		

Table 6. Summary of winter barley data in Western Montana in 1966-67.

A. Yield bushels per acre.

Variety	C.I. Number	Location: N.W. Mt. Br. Sta.	Ravalli County	Lake County	Sanders County	Missoula County	$\bar{x}$	Rank
Alpine	9578	74.1	28.8	66.5	69.5	50.3	57.8	1
Olympia	6107	60.6*	31.8	64.4	74.9	56.3	57.6	3
Ellis	9529	60.3*	26.2	60.5	71.8	51.1	54.0	6
Mass. Sel.	11361	71.1	37.1	59.9	62.9	57.3	57.7	2
N.Y. 5619B-3B-1	11887	72.3	34.9	58.8	79.9	54.9	54.2	4
OAC Str. 4Sel. 60	515713	54.3*	21.8	56.5*	54.7	51.5	47.8	9
OAC Str. 4 Sel.60	51576	47.4*	21.8	55.3*	66.2	48.7	47.9	8
N.Y. 5619B-3B-1 (L)	11887	58.8*	22.9	53.8*	84.4	50.5	54.1	5
OAC Str. 4Sel. 60	515714	54.0*	18.2	51.7*	74.1	46.9	49.0	7
OAC Str. 4Sel. 60	51571	58.7*	14.6*	41.2*	68.8	49.0	46.5	10
$\bar{x}$		61.1	25.8	56.8	70.5	51.6		
S.E.$\bar{x}$		3.9	4.1	3.4	4.9	2.4		
L.S.D.(.05)		11.5	12.1	10.0	14.4	N.S.		
C.V.%		6.5	16.1	5.98	7.03	4.62		

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

B. Bushel weight in pounds.

Variety	C.I. Number	Location: N.W. Mt. Br. Sta.	Ravalli County	Lake County	Sanders County	Missoula County	$\bar{x}$
Alpine	9578	46.1	40.9	47.2	46.6	49.8	46.1
Olympia	6107	48.4	49.6	50.0	52.2	49.1	49.9
Ellis	9529	46.4	48.3	46.4	49.3	47.7	47.6
Mass. Sel.	11361	48.5	49.5	48.3	49.2	47.7	48.6
N.Y. 5619B-3B-1	11887	47.8	48.4	47.6	50.0	52.0	49.2
OAC Str. 4Sel. 60	515713	47.0	----	48.6	50.9	50.1	49.2
OAC Str. 4Sel. 60	51576	45.1	----	48.4	52.3	50.5	49.1
N.Y. 5619B-3B-1(L)	11887	48.8	48.1	47.1	48.6	49.2	48.4
OAC Str. 4Sel. 60	515714	49.6	----	49.6	52.7	50.7	50.7
OAC Str. 4Sel. 60	51571	48.7	----	49.3	51.6	51.0	50.2

SMALL GRAINS INVESTIGATIONS IN OATS

INTRODUCTION:

Two nurseries were grown in 1967. A uniform nursery grown throughout the Pacific Northwest consisted of 27 entries. The Montana nursery had 10 entries.

RESULTS AND DISCUSSION:

Little or no evidence of the disease Fusarium culmorum was found in this season's oat nurseries. The past four years these nurseries have been abandoned because of this disease. Yields are much higher this year when precipitation was four inches below the mean. This is in contrast to 1966 when the precipitation during the summer months alone was seven inches above the average.

In the uniform nursery, Table 1, Cayuse is the highest yielding entry, but not significantly higher than Basin which is used as the check variety. The mean was 108.3 bushels per acre.

A Minnesota entry in the Small Montana Nursery yielded 161.6 bushels per acre and was significantly higher than the variety Basin, the check. They are both mid-season varieties, heading the same date. See Table 2 for complete agronomic data.

SUMMARY:

1. The disease organism Fusarium culmorum was not in great evidence. Yields were higher than in many years, even in the reduction in total precipitation during the growing season.

2. Basin was used as a check and found to be equal or superior to all entries except Minn. II-22-220, which had a yield of 161.6 bushels per acre.

Table 1. Agronomic data from dryland uniform northwest varietal nursery. Grown on the Northwestern Montana Branch Station in 1967, Randomized block design, three replications.

Date Seeded: May 3, 1967
Date Harvested: August 17, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Heading Date	Ht. Ins.	Yield Bu/A.	Test Wt. Lbs/Bu.	% Lodging Prev.	% Lodging Sever.
Cayuse	8263	7- 9	35	142.55	39.8	22	3
Rodney	6661	7-11	45	126.22	38.8	42	3
Andrew x Mission	501218	7- 2	42	124.54	38.8	12	3
Minn. II-22-220	2874	7-11	37	122.92	36.3	42	3
Basin	5346	7-12	42	120.17	36.3	20	3
Glen	7652	7- 6	44	118.93	36.8	47	3
Stormont	8170	7- 4	39	118.68	38.8	13	3
Gopher	2027	7- 4	43	116.75	36.8	37	3
Orbit	7811	7- 7	38	116.31	37.1	18	3
Sierra	7706	7- 6	36	115.44	34.0	28	3
Gary	6662	7-10	46	112.19	38.2	33	3
O.T. 954 21-49		7-13	45	111.63	32.5	25	4
Park	6611	7-12	39	108.27	37.1	12	5
Lodi	7561	7-10	44	105.84	34.9	18	3
BxG2xC3xC4xC.I.	7815	7-10	41	105.21	38.8	17	3
G3xC2xBxC	7982	7- 9	42	104.40	38.7	40	3
Zanster	7476	7- 7	42	103.59	35.5	37	4
Clinton 59	4259	7-10	44	103.47	37.1	43	4
Sioux	8172	7- 8	41	103.34	36.2	28	3
G4xCxV3xV2xHxB	8048	7- 9	43	100.97	35.4	35	3
RxS	599613	7- 8	43	99.92	35.9	37	6
AuxAble	7670	7-10	42	98.98	38.3	23	3
Bridger	2611	7-16	51	95.74*	36.1	53	3
Ora	7976	7- 3	29	93.25*	37.2	5	2
Markton	2053	7- 9	44	89.88*	37.4	13	4
Mission	2588	7- 8	45	86.14*	36.6	20	3
Victory	1145	7-15	49	81.15*	35.0	52	6

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

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	2308.1	10.49
Varieties	26	554.8	2.52*
Error	52	220.0	
Total	80		

$\bar{x}$.....	108.3
S.E.$\bar{x}$.....	8.5
L.S.D.(.05)..	24.3
C.V.%.....	7.9

Table 2. Small oat nursery grown on the Northwestern Montana Branch Station in 1967. Randomized design, three replications.

Date Seeded: May 3, 1967
Date Harvested: August 17, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Heading Date	Ht. Ins.	Yield Bu/A.	Test Wt. Lbs/Bu.	% Lodging Prev.	% Lodging Sever.
Minn. II-22-220	2874	7-10	41	161.63[1]	36.8	3	2
Cayuse	8263	7- 8	39	156.45	38.7	2	2
Park	6611	7-11	44	141.87	38.8	1	0
Basin	5346	7-10	43	141.80	38.0	1	2
Rodney	6661	7-10	47	127.15	39.3	5	2
Gopher	2027	7- 4	44	126.59	39.7	2	0
Andrew x Mission	501218	7- 2	44	121.30*	37.4	1	0
Garry	6662	7- 9	47	116.25*	37.1	3	0
Mission	2588	7- 6	51	108.52*	37.8	3	0
Bridger	2611	7-14	53	105.34*	36.5	4	0

NOTE: Basin is used as the check in this nursery
*: Varieties yielding significantly less than the check (.05)
[1]: Variety yielding significantly more than the check (.05)

$\bar{x}$.....	130.6
S.E.$\bar{x}$.....	5.6
L.S.D.(.05)...	16.71
C.V.%.....	4.30

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	229.9	2.42
Variety	9	1109.8	11.68*
Error	18	94.9	
Total	29		

THE COMPARISON OF TRITICALE WITH WHEAT, OATS AND BARLEY AS A SPRING ANNUAL

INTRODUCTION:

Triticale, a new break through in plant breeding, was developed by Dr. Jenkins at one time stationed at the University of Manitoba at Winnepeg, Canada. Much publicity has been given to this new plant species and its productivity.

This study was designed to measure the productivity of triticale with oats, barley and wheat seeded as spring annuals. The study consisted of ten entries, one oat, one barley, two spring wheats and six lines of triticale. These were grown in six replications in plots eighteen feet long, spaced six inches with one foot between plots. Seeding rate of three hundred seeds per row was used. The two center rows were harvested for yield.

RESULTS AND DISCUSSION:

Conquest barley was the highest yielding entry in the nursery. Being significantly higher in yield than any of the lines of triticale. The total production for Conquest barley was 5684 pounds of grain per acre. The highest yielding triticale entry in the nursery was triticale 6403 with 3841 pounds per acre. This entry also had the highest protein content of any of the lines grown in 1967. The protein percentage was 18.5. This was compared to Manitou wheat with 15.3% and Pitic 62 wheat with 12.1% protein. Comparing triticale with wheat for yield, it was found that wheat varieties yielded higher. The high triticale 6403 was 3841 pounds per acre compared to Pitic 62 wheat with 5551 pounds per acre. These data do not suggest that triticale is a highly productive cereal crop for this area of Montana. Further evaluation of this species should be continued in Western Montana. The fact that it has a high protein content, appears to be disease resistant, it may find a place for use in Western Montana cereal grain production. A complete tabulation of data are found in Tables 1 and 2.

SUMMARY AND CONCLUSION:

Conquest barley was superior in yield to triticale lines by some 1843 pounds to the acre. This study should be continued to further study the merits of triticale.

Table 1. Agronomic data from triticale study grown at the Northwestern Montana Branch Station, Route 4, Kalispell, Montana in 1967. (Garden area)

Variety	Yield in Grams I	II	III	IV	V	VI	Total	Bushel Weight I	II	III	IV	V	VI	$\bar{x}$	Ht. Ins	% Ergot	Straw strength	Maturity
Triticale 6437-6	751	595[1]	485	569	623	589	3612	48.9	--	51.4	50.7	--	--	50.0	41	0	2	M
							$\bar{x}$ 602											
Manitou	807	477	684	631	698	775	4072	59.7	--	61.1	--	60.9	--	60.6	39	0	1	-
							$\bar{x}$ 679											
Triticale 6443	828	507	517	767	598	565	3782	47.2	49.9	49.8	49.9	--	--	49.2	45	0	4	M
							$\bar{x}$ 630											
Pitic 62	1112	862	932	813	938	892	5549	57.2	57.3	51.6	55.7	55.3	54.7	55.3	36	0	1	-
							$\bar{x}$ 925											
Triticale 6403	663	612	862	671	629	404	3841	--	48.9	--	49.8	49.9	--	49.5	47	0	4	M
							$\bar{x}$ 640											
Triticale 6433-6	566	620	470	540	645	464	3305	49.5	45.7	--	49.0	--	--	48.1	46	0	5	M
							$\bar{x}$ 551											
Harmon Oats	622	937	699	765	650	688	4361											
							$\bar{x}$ 727	38.1	39.5	38.8	39.2	38.0	37.8	38.6	42	0	1	-
Conquest	670	826	1332	899	868	1087	5682	--	50.4	51.2	50.8	50.8	50.7	50.8	40	0	2	-
							$\bar{x}$ 947											
Triticale 6456-3	317	648	478	460	487	487	2877	45.8	46.5	47.0	--	--	--	46.4	44	0	1	M
							$\bar{x}$ 480											
Triticale 6432-3	583	531	429	513	584	379	3019	48.0	46.9	--	49.2	--	--	48.0	42	0	3	M
							$\bar{x}$ 503											

[1] Calculated missing plot

$\bar{x}$..... 668.3g
S.E.$\bar{x}$..... 55.17714
L.S.D.(.05) 156.8
L.S.D.(.01) 209.9
C.V.%..... 8.23

Table 2. Summary of triticale data in comparison with wheat, oats and barley. Grown on the Northwestern Montana Branch Station in 1967.

Crop	Variety	Number	Ht. Ins	1-5 1/ Straw Strength	Yield Lbs/A	Bu. Wt. in Lbs.	1000 Kernel wt/mg	% Protein
Triticale		6437-6	41	2	3613*	50.0	36.8	16.4
Triticale		6443	45	4	3781*	49.2	34.2	16.2
Triticale		6403	47	4	3841*	49.5	33.6	18.5
Triticale		6433-6	46	5	3307*	48.1	36.3	18.0
Triticale		6456-3	44	1	2881*	46.4	31.1	17.3
Triticale		6432-3	42	3	3019*	48.0	37.1	17.9
Wheat	Manitou		39	1	4075*	60.6	29.7	15.3
Wheat	Pitic 62		36	1	5551	55.3	35.7	12.1
Oats	Harmon		42	1	4363*	38.6	30.6	
Barley	Conquest		40	2	5684	50.8	33.9	
	$\bar{x}$				4011			
	S.E.$\bar{x}$				331.172			
	L.S.D.(.05)				941			
	C.V.%				8.23			

* Entries yielding significantly less than Conquest Barley (.05)
1/ 1 - 5 = 1 = strong straw
5 = very weak

KS
VRS

SMALL GRAINS RESEARCH IN SPRING WHEAT

INTRODUCTION:

All nurseries were grown in four row plots, replicated four times. Yields were secured by harvesting center rows or 16 square feet. All station nurseries were grown under dryland conditions. Two off station nurseries were grown under irrigation and one was not.

RESULTS AND DISCUSSION:

Advanced Yield Nursery - Moran was the highest yielding variety in this nursery in 1967, however when analyzed statistically none of the varieties were found to be significant. The rather high C.V. can be accounted for in part, by uneven stands due to a high infestation of wireworm during the growing season. No stripe rust readings were made in 1967 in this nursery. The average yield in the nursery was 55.9 bushels per acre, which was some ten bushels less than last year. This can be accounted for by the four inches below normal rainfall during the growing season. See Table 1.

Western Regional White Wheat Nursery - Yields were found to be significant using Idaed 59 as a check. Aberdeen selection 0006 and C.I. 13981 were both significantly better in yield than the check, with 77.7 and 71.5 bushels respectively. Test weights were below average for most varieties in the nursery. It is interesting to note that the mean yield for the nursery this year and the 1966 nursery are identical. This year there was four inches less rainfall during the growing period. Perhaps this difference can be accounted for by the low incidence of stripe rust in 1966 vs 1967. See Table 2.

Smut Dwarf Yield Nursery - No significant difference was found in this yield nursery. Considerable toll of plant population was taken by wireworm infestation. The highest yielding variety in the nursery was 87.2 bushels per acre with an overall mean of 73.4 bushels per acre. This nursery was grown primarily to test several semi-dwarf varieties being developed by F. H. McNeal, spring wheat breeder, Bozeman, Montana. Table 3.

Off Station Nurseries -

Missoula County - The Missoula County nursery was grown on the A. D. Neilson farm near Frenchtown, Montana. It was grown under irrigation and excellent growing conditions prevailed for this nursery. Mean yield of the nursery is 41.4, no significant differences were found in the yield of varieties. However, Aberdeen selection, C.I. 13977 was the highest yielding entry in this nursery. See Table 4 for complete data.

Ravalli County - The nursery grown in Ravalli County was on the Western Montana Branch Station, but was not harvested because of the severe bird damage that occured during the heading and maturing portion of the season. Therefore, it was felt that the data that would be secured would be unreliable.

Spring Wheat (con't)

Lake County - This nursery grown in Lake County was on the James Fleming farm in a relatively good location, however during the growing season it was found that the nursery was located in a severe infestation of Canada thistle. They were controlled. The nursery was not irrigated as arranged, therefore the yields were very low. The highest yielding variety in the nursery is Idead 59, a soft white wheat. Stripe rust was no problem in the nursery. The mean for the nursery is 11.1. Table 5 gives complete data.

In Table 6 there is a summary of the dryland, hard red spring wheat nursery grown at the Northwestern Montana Branch Station. Making a comparison, 250-17 x TLT_2 x B52-91 MT 6610 is 123% of Sheridan, 106% of Thatcher, 104% of Centana, so it does have a potential in this area. However, this is only two years data. Before making a decision additional data should be obtained.

Table 7 is a ten year summary of the western regional white spring wheat nurseries. Based on the percentage of Idaed 59, Aberdeen selection 0006 seems to show the most promise in the nursery this year.

SUMMARY AND CONCLUSION:

Fortuna, yield wise, seems to show promise as a yielding variety in Western Montana. After four years study, however it is severe on lodging, but not anymore severe than Sheridan. MT 6610, shows considerable promise as good stripe rust resistance and fairly good straw and maybe a potential for agronomic characteristics here in Western Montana.

C.I. 13979 yields 119% of Idaed 59 and also C.I. 13979 has good stripe rust resistance and is relatively early. It is only a day later in heading than Idaed 59. This should make it acceptable in Western Montana.

Table 1. Agronomic data from the spring wheat advanced yield nursery grown at the Northwestern Montana Branch Station in 1967. Experimental design - RB, four replications. Field No. Y6

Date Seeded: May 3, 1967 Harvest Date: September 5, 1967 Size of Plot: 16 sq. ft.

Variety	C. I. Number	Yield Bu/A.	Weight Lbs/Bu	Height Inches	Heading Date	Lodging	
						Prev.	Sever.
Moran	13743	67.57	59.6	41	7/11	34	4
B52-91 x K338-Lee	6623	65.80	59.5	40	7/ 3	16	3
B52-91 x B60-40	6661	65.32	59.8	40	7/ 3	25	3
Wells	13333	62.82	63.0	40	7/ 8	50	4
B52-91 x KF-Cnt	6617	62.25	58.6	39	7/ 4	11	3
Thatcher	10003	60.62	60.4	40	7/ 5	35	4
3718-6-8 x B52-91	6646	59.02	59.8	43	7/ 7	9	2
3718-6-8 x B52-91	6647	58.05	62.0	41	7/ 4	19	3
Leeds	13768	58.05	62.0	41	7/ 5	13	3
B52-91 x K338-Lee	6621	57.87	60.0	41	7/ 5	5	2
II-50-17 x Plt 2x B52-91	6610	57.77	57.8	40	7/ 5	21	3
Manitou, R. L. 4159	13775	57.47	58.8	40	7/ 6	46	3
B52-91 x K338-Lee	6620	56.77	58.5	42	7/ 3	20	3
B52-91 x KF-Cnt	6619	56.52	59.5	41	7/ 9	19	3
B52-91 x KF-Cnt	6618	56.37	60.0	40	7/ 5	9	3
Fortuna	13596	56.37	61.2	38	7/ 5	65	3
Sheridan	13586	54.50	59.5	42	7/ 8	23	3
Centana	12974	54.45	59.8	43	7/ 9	26	4
K338 x Conley	661	54.40	61.0	40	7/ 7	25	2
KF-Cnt x B52-91	6634	54.07	56.4	39	7/ 4	5	2
(NRN10-BVR14 x TC1x 498	647	52.70	57.6	38	7/ 3	5	3
II-50-72 x2 M2824	13773	52.27	61.2	41	7/ 9	20	2
Lakota	13335	52.10	59.9	40	7/ 8	46	4
Ceres	6900	51.07	61.2	44	7/ 8	36	3
B50-18 x RSC 2x B52-91	6678	50.87	61.6	40	7/ 5	13	3
Chris, 525-1	13751	50.62	59.8	41	7/ 7	33	3
Rescue	12435	49.67	57.5	43	7/ 9	56	5
5244 x B59-3	6640	48.77	61.3	42	7/ 8	21	3
Crim	13465	47.90	59.7	41	7/ 5	13	3
Sawtana	13304	46.62	59.0	44	7/10	40	4

NOTE: Centana used as a check in this nursery

Table 1. (con't)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	5522.8	63.21
Varieties	29	114.1	N.S.
Error	87	87.3	
Total	119		

$\bar{x}$.....	55.9
S.E.$\bar{x}$.....	4.6
L.S.D.(.05)..	N.S.
C.V.%.....	8.35

Table 2. Agronomic data from the western regional white wheat nursery grown at the Northwestern Montana Branch Station in 1967. Experimental design - RB, four replications, Field No. Y6.

Date Seeded: May 3, 1967 Harvest Date: September 5, 1967 Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Weight Lbs/Bu	Height Inches	Heading Date	Lodging Prev.	Lodging Sever.
Aberdeen Selection	0006	77.72*	58.5	34	7/10	26	3
Lemhi 62 x CI 13636	13981	71.47*	57.4	38	7/ 9	19	3
Lee x NO 58-TC A6119S-46	13979	67.40	59.4	36	7/ 6	31	3
Idaed x Burt, 30-2	13742	66.90	60.3	34	7/ 6	11	2
Lemhi 62 x2 Idaed	13982	66.42	58.9	40	7/ 5	20	3
Moran	13743	65.37	59.2	37	7/10	58	3
Premier x2 FR 2x5 Idaed	13984	64.32	60.6	37	7/ 5	20	3
Sv x Lee 2x N10-B 3x Ut	256002	63.30	55.6	30	7/14	10	3
Premier x2 Fr 2x5 Idaed	13983	60.97	58.9	36	7/ 4	19	3
Baart	1697	60.85	59.7	43	7/10	83	5
Ramona 50	5009	60.27	56.8	40	7/ 4	14	3
Sv x Lee 2x N10-B 3x Ut	256001	59.90	57.8	32	7/11	10	2
Idaed 59	13631	59.57	60.5	35	7/ 5	19	3
Thatcher	10003	57.35	58.0	39	7/ 7	18	3
Lemhi 66	13969	57.22	56.7	41	7/13	11	2
Eureka-Lemhi x3 Idaed	13980	56.62	56.7	41	7/ 5	13	3
Idaed x Burt, Sel. 111-1	671	55.62	59.3	33	7/10	13	3

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Table 2 . (con't)

Variety	C.I. Number	Yield Bu/A.	Weight Lbs/Bu	Height Inches	Heading Date	Lodging Prev.	Lodging Sever.
Burt x Onas 52, Lind 466	4468	55.37	55.7	37	7/12	11	2
Burt x Onas 52, Lind 168	4740	54.50	53.9	36	7/16	15	3
Federation 67	13732	54.22	58.0	39	7/ 8	14	2
N10-B 2x2 12228 3x L53	13977	52.57	54.7	29	7/12	15	2
Federation	4734	43.70	52.9	38	7/13	11	3
Lemhi	11415	37.15	55.3	38	7/10	19	3

NOTE: Idaed 59 is used as a check in this nursery
*: Varieties yielding significantly more than the check (.05)

$\bar{x}$.....	59.5
S.E.$\bar{x}$.....	4.0
L.S.D.(.05)..	11.36
C.V.%.....	6.77

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	4547.2	69.94
Varieties	22	294.1	4.52*
Error	66	65.0	
Total	91		

Table 3. Agronomic data from semidwarf yield nursery grown at the Northwestern Montana Branch Station in 1967. Experimental design - RB, four replications, field No. Y6.

Date Seeded: May 3, 1967 Harvest Date: September 5, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Weight Pounds Bushel	Ht. Ins.	Heading Date	Bundle Weight Grams	Grain-Straw Ratio
Nrnl0 x3Bvrl4 2	6715	87.23	59.7	35	7/ 9	1973.33	1.26
Nrnl0 x3Bvrl4 2	6712	82.29	59.4	34	7/ 9	1801.00	1.20
Nrnl0 x3Bvrl4 2	678	81.13	60.5	46	7/ 9	2057.33	1.54
Nrnl0 x3Bvrl4 2	6722	79.69	57.8	32	7/ 8	1692.00	1.12
Nrnl0 x3Bvrl4 2	6710	79.49	59.3	35	7/ 9	1943.67	1.49
Nrnl0 x3Bvrl4 2	6723	79.49	58.4	33	7/10	1826.33	1.29
Nrnl0 x3Bvrl4 2	677	78.46	58.4	34	7/ 9	1822.33	1.32
Nrnl0 x3Bvrl4 2	6719	77.59	59.8	36	7/ 9	1913.33	1.46
Nrnl0 x3Bvrl4 2	6714	77.49	60.4	36	7/ 9	1786.00	1.31
Nrnl0 x3Bvrl4 2	6716	77.43	58.8	33	7/10	1697.67	1.19
Nrnl0 x3Bvrl4 2	675	76.53	59.5	33	7/ 9	1773.00	1.32
Nrnl0 x3Bvrl4 2	674	75.23	58.2	37	7/ 9	1800.67	1.40
Nrnl0 x3Bvrl4 2	6720	72.00	59.3	34	7/ 9	1575.67	1.19
Centana 3	12974	69.56	61.5	43	7/ 9	1812.67	1.61
Nrnl0 x3Bvrl4 2	676	69.03	57.7	32	7. 9	1581.00	1.29
Nrnl0 x3Bvrl4 2	6718	68.89	59.9	45	7/ 9	1739.33	1.52
Nrnl0 x3Bvrl4 2	679	68.56	60.5	46	7/ 9	1846.00	1.69
Nrnl0 x3Bvrl4 2	6711	68.39	60.8	46	7/ 9	1758.67	1.57
Nrnl0 x3Bvrl4 2	6724	68.13	60.4	45	7/ 8	1771.00	1.60
Nrnl0 x3Bvrl4 2	6717	67.83	60.0	45	7/ 9	1832.00	1.69
Nrnl0 x3Bvrl4 2	671	67.73	60.9	41	7/ 8	1558.67	1.31
Nrnl0 x3Bvrl4 2	673	66.59	60.2	43	7/ 9	1684.00	1.53
Nrnl0 x3Bvrl4 2	672	66.23	59.9	45	7/ 9	1630.00	1.47
Nrnl0 x3Bvrl4 2	6721	66.06	60.7	45	7/ 9	1714.33	1.60
Nrnl0 x3Bvrl4 2	6713	64.66	57.3	33	7/10	1527.00	1.36

$\bar{x}$..... 73.4
S.E.$\bar{x}$..... 5.6
L.S.D.(.05).. N.S.
C.V.%..... 7.68

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	114.9	1.20
Varieties	24	119.6	N.S.
Error	48	95.4	
Total	74		

Table 4. Agronomic data from off station irrigated spring wheat nursery grown in Missoula County on the A. D. Neilson farm, Frenchtown, Montana in 1967.

Date Seeded: April 27, 1967
Date Harvested: August 22, 1967
Size of Plot: 16 sq. ft.

Variety	C. I. No.	Replications I	II	III	IV	Total	Yield Bu/A.	Bu. Wt. in Lbs.
Sheridan	13586	338	490	352	452	1632	40.8	59.8
Aberdeen 64A69405	13977	444	552	368	506	1870	46.8	57.9
Chris	13751	386	390	380	505	1661	41.5	62.3
Thatcher	10003	447	449	397	380	1673	41.8	60.5
Centana	12974	364	335	381	439	1519	38.0	61.3
Lemhi 66	13969	347	490	469	294	1600	40.0	56.1
Manitou	13775	413	407	376	384	1580	39.5	60.9
Fortuna	13596	425	520	466	427	1838	46.0	59.0
Idaed 59	13631	449	378	305	283	1415	35.4	59.2
Crim	13465	426	540	414	413	1793	44.8	58.4

$\bar{x}$..... 41.4
S.E.$\bar{x}$..... 2.95928
L.S.D..... N.S.
C.V.%..... 7.13

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	7869.49333	2.25
Varieties	9	5119.35888	1.46
Error	27	3502.93593	
Total	39		

Table 5. Agronomic data from dryland off station spring wheat nursery grown in Lake County on the James Fleming farm, Pablo, Montana in 1967.

Date Seeded: April 27, 1967
Date Harvested: August 8, 1967
Size of Plot: 16 sq. ft.

Variety	C. I. No.	Height in Ins.	Replications I	II	III	IV	Total	Yield Bu/A.
Sheridan	13586	34	114	119	140	104	477	11.9
Aberdeen 64-A69405	13977	21	91	69	96	131	387	9.7
Chris	13751	27	95	134	73	76	378	9.5
Thatcher	10003	28	96	124	95	156	471	11.8
Centana	12974	27	81	138	81	96	396	9.9
Lemhi	13969	24	95	70	80	72	317	7.9
Manitou	13775	30	101	106	79	114	400	10.0
Fortuna	13596	29	145	101	136	113	495	12.4
Idaed 59	13631	29	173	139	211	178	701	17.5*
Crim	13465	30	140	92	101	122	455	11.4

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

$\bar{x}$.....	11.1
S.E.$\bar{x}$.....	1.2276
L.S.D.(.05)	3.6
C.V.%.....	11.04

Analysis of Variance

Source	D.F.	Mean Square	F.
Replication	3	115.025	
Varieties	9	2664.58333	4.42*
Error	27	602.83143	
Total	39		

Table 6. Summary of dryland hard red spring wheat yields from the advanced yield nursery, Northwestern Montana Branch Station, Route 4, Kalispell, Montana. 1957-1967

Variety	C. I. No.	1957	1959	1960	1961	1962	1963	1964	1965	1966	1967	Number Sta. Years	Total	% of Centana	% of Thatcher	% of Sheridan
Centana	12974	12.8	45.4	33.5	28.3	59.1	34.3	47.8	61.1	50.4	54.5	10	427.2	100	99	92
Ceres	6900	11.6	40.0	21.1	26.0	43.2	28.1	56.6	55.0	53.6	51.1	10	386.3	90	90	86
Rescue	12435	8.3	42.0	31.8	23.6	41.1	56.2	42.2	63.5	39.4	49.7	10	397.8	93	93	87
Sawtana	13304	10.5	42.3	34.8	26.4	45.1	48.1	51.0	58.2	53.7	46.6	10	416.7	98	97	91
Thatcher	10003	12.2	42.0	29.0	27.4	49.7	34.7	46.7	65.4	62.2	60.6	10	429.9	101	100	95
Crim	13465			28.8	22.8	48.8	27.5	43.0	71.8	58.7	47.9	8	349.3	95	93	88
Sheridan	13586				38.5	59.4	36.9	50.6	72.8	50.9	54.5	7	363.6	108	105	100
Wells	13333					52.6	33.7	57.0	58.4	67.9	62.8	6	332.4	108	104	102
Lakota	13335					64.9	37.3	59.1	67.1	75.3	52.1	6	355.8	116	111	109
Fortuna	13596							62.9	76.8	66.2	56.4	4	262.3	123	112	115
Manitou R.L. 4159	13775							50.8	62.2	67.5	57.5	4	238.0	113	101	104
Chris, 525-1	13751							41.8	59.3	51.3	50.6	4	203.0	95	86	89
(NRN10-BVR14xTC)x498	647								63.0	50.6	52.7	3	166.3	100	88	93
II-50-17xPlt^{2}xB52-91	6610									72.0	57.8	2	129.8	124	106	123
B52-91 x B60-40	6661									71.5	65.3	2	136.8	130	111	130
K 338 x Conley	661									69.9	54.4	2	124.3	118	101	117
Moran	13743									62.3	67.6	2	129.9	124	106	123
B52-91 x KF-CNT	6619									58.1	56.5	2	114.6	109	93	109
II-50-72 x 2M2854	13773									51.4	52.3	2	103.7	99	84	98
B 52-91 x K338-Lee	6623										65.8	1	65.8	121	109	121
B 52-91 x KF-CNT	6617										62.3	1	62.3	114	103	114
3718-6-8 x B52-91	6646										59.0	1	59.0	108	97	108
3718-6-8 x B52-91	6647										58.1	1	58.1	106	96	107
Leeds	13768										58.1	1	58.1	107	96	106
B52-91 x K338-Lee	6621										57.9	1	57.9	106	96	106
B52-91 x K338-Lee	6620										56.8	1	56.8	104	94	104
B52-91 x KF-CNT	6618										56.4	1	56.4	104	93	104
KF-CNT x B52-91	6634										54.1	1	54.1	99	89	99
B50-18 x RSC2xB52-91	6678										50.9	1	50.9	93	84	93
5244 x B59-3	6640										48.8	1	48.8	90	81	90

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Table 7. Summary of dryland white spring wheat yields grown at the Northwestern Montana Branch Station, Route 4, Kalispell, Montana from 1957-1967.

Variety	C. I. No.	1957	1958	1959	1960	1961	1962	1963	1964	1966	1967	# Sta. Years	% of Lemhi	% of Idaed 59
Baart	1697	59.5	48.1	41.8	29.1	25.5	41.8	21.8	35.0	32.4	60.9	10	127	75
Federation	4734	40.9	40.5	43.2	30.6	24.9	44.1	21.2	29.5	36.6	43.7	10	114	70
Thatcher	10003	53.5	37.0	45.2	25.5	30.0	50.3	35.2	50.1	72.6	57.4	10	147	97
Lemhi	11415	56.0	54.6	38.7	17.8	18.3	52.4	6.2	14.7	15.7	37.2	10	100	49
Idaed-59	13631				31.8		52.1	29.1	55.7	66.7	59.6	6	205	100
Federation 67	13732							32.3	42.7	60.4	54.2	4	257	90
Idaed x Burt 30-2	13742								53.8	71.8	66.9	3	285	106
Moran	13743								58.6	67.1	65.4	3	283	105
Lee x NO58-TC A61195-46	13979									83.4	67.4	2	285	119
Lemhi 62 x C.I. 13636	13981									80.0	71.5	2	286	120
Eureka-Lemhi x 3 Idaed	13980									78.9	56.6	2	256	107
Idaed x Burt, Pend 111-1	OR671									76.9	55.6	2	250	205
Lemhi 66	13969									74.0	57.2	2	248	104
Premier x 2FR 2 x 5Idaed	13984									73.4	64.3	2	260	109
Lemhi 62 x 2 Idaed	13982									58.5	66.4	2	235	99
Premier x 2FR2 x 5Idaed	13983									57.1	61.0	2	223	94
Burt x Onas 52, Lind 466	4468									45.2	55.4	2	191	79
N10-B2 x 2 12228 3 x L53	13977									41.4	52.6	2	178	74
Aberdeen Sel.	ID0006										77.7	1	209	130
SV x Lee2 x N10-B3 x UT	UT256002										63.3	1	170	106
Ramona 50	ID5009										60.3	1	162	101
SV x Lee2 x N10-B3 x UT	UT256001										59.9	1	113	101
Idaed x Burt, Sel. 111-1	671										55.6	1	150	93
Burt x Onas 52, Lind 168	4740										54.5	1	147	91

WINTER WHEAT

INTRODUCTION:

Winter wheat work was conducted in Western Montana with a primary purpose of introducing varieties that are adapted to the area. Standard nursery techniques are used in the testing program. Varieties that are found to be of high potential for yield and other agronomic and milling and baking characteristics are used in off station testing. In addition to these lines, varieties from neighboring states are included in off station testing if they show promise in the western region.

RESULTS AND DISCUSSION:

Intra-state Hard Red - There were eighteen entries in the intra-state hard red winter wheat nursery. This nursery consisted of thirteen commercial lines that are being grown throughout the pacific northwest and in Montana. The other entries in the nursery consisted of a Burt x P.I. 178383 cross and five lines of Westmont^2 x P.I. 178383.

Delmar was the variety used as a check on yield in the nursery and only one variety, Gaines, was superior. Crest, a new line released by Montana Agricultural Experiment Station, was not significantly less in yield than Delmar, but some two bushels less in yield. Four of the entries in the nursery were free of Dwarf Smut and these were; MT 6646, MT 6642, MT 6634 and the variety Crest. All other entries had some dwarf smut ranging from a mean of 33% found in McCall to 0% in the varieties already mentioned.

One of the high yielding entries MT 6646 has a late heading date, June 17. Crest is one of the earliest heading, it and Westmont heading the 7th day of June. Test weights were good on all of the entries. Only MT 6643 was found completely free of stripe rust. Westmont had the highest infestation of all the entries. Table 1.

Western Regional Hard Red - The western regional hard red winter wheat nursery grown on the L. B. Claridge farm, contained 29 varieties. Dwarf smut and stripe rust were found to be prevelent in this nursery as was snow mold. Only two entries were found to be entirely free of dwarf smut and these were MT 6634 and MT 6619 or Crest. Columbia, one of the most susceptible entries in the nursery had 63% dwarf smut. Stand loss in the nursery was contributed mainly to the snow mold, in that, a perfect stand was obtained in the fall of 1966. The entries showing the most resistance were those crosses of Westmont 2 x P.I. 178383. Two entries ID 0001 and ID 5001 also having a common parent of Turkey, were quite resistant to snow mold. The entries showing the most stripe rust resistance were again the crosses of Westmont 2 x P.I. 178383. The mean yield for the nursery was 43.9 bushels per acre. The test weights were good for all entries. No lodging was noted in this nursery. See Table 2 for complete details.

Winter Wheat Results and Discussion (con't)

Western Uniform White Wheat Nursery - This nursery was grown on the station in Field E-2 and consisted of 15 entries. Yields were about average, with the high being 66.5 bushels per acre for WA 4765. Test weights averaged about 60 pounds. Stripe rust was quite severe on several of the entries with Omar, Elgin and Golden being very severe. Little yield difference was found between Moro and Gaines this season. Moro was one of the entries that had complete stripe rust resistance, and also good dwarf bunt resistance. The dwarf bunt level was not particularly high in the susceptible varieties. Kharkof, a susceptible variety had 21.25% smut. Gaines and Nugaines were also fairly equal in yield in this study. See Table 3.

Elite Stripe Rust Dwarf Bunt Nursery - This nursery consisted of 23 entries, six replications in single row plots. The nursery consisted of five check varieties, remaining entries were lines of Westmont 2 x P.I. 178383 lines, plus one Itana x P.I. 178383 line. These were measured for yield, test weight and dwarf smut. The highest yielding entry in the nursery was the check variety Delmar with 61.53 bushels per acre. Test weights were high in all of the lines, running from 61 to 63 pounds per bushel. The smut level was not exceedingly high, however Westmont which is the most susceptible had a level of 19%. One entry did exceed this, namely MT 6736, an Itana x P.I. 178383 cross. Itana also exceeded Westmont as far as bunt infestation was concerned. There was some material that headed early in this test which may have possibilities in that they had good dwarf bunt resistance. Two entries were found to be completely dwarf bunt resistant, they were 8-6-8 and 8-8-1, however they should be tested further to be assured they were not escapes rather than resistance. Table 4

Off-station - Growing conditions and results about each of the nurseries will be discussed under each individual county heading. A total of four nurseries were seeded in the fall of 1966. Each nursery contained fifteen entries of both hard red and soft white winter wheats.

Missoula County - Good fall moisture resulted in excellent stands in this nursery on the Al Goodan farm. Early spring moisture was adaquate, fertilizer was applied as a top dress in the spring to insure a high level of fertility. The white wheats were the higher yielding entries in the nursery, Gaines being high followed very closely by Moro. They were significantly higher than Delmar, the check, which was equal in yield with Crest. Protein levels were very low, being about the same for the hard reds as they were for the white wheats. This is a traditional history for this area, where proteins seldom get above 9%. Considerable common smut was found in this nursery in 1967, and this is attributed to the fact that the seed had not been treated prior to seeding. Table 5 gives the complete data on this nursery.

Ravalli County - Moisture and late seeding was a contributing factor to low yields on the Gerald Neil farm, in the winter wheat belt, southeast of Stevensville. The highest yielding entry in the nursery was Wanser, no significant difference was found in any of the yields when tested statistically. Protein levels were extremely high, running as high as 18.9% for the variety Omar, which is a soft white wheat. In Table 6 is shown yields, plant height and protein.

Winter Wheat Results and Discussion (con't)

Lake County - Yields were about average for this nursery in Lake County in 1967. Good fall stands were a result of high moisture situation in the fall of 1966, however dry conditions prevailed in the later part of the summer, which may have had some effect on total yields. Common smut was noted in the variety Cheyenne with 70% of the heads smutted. This was attributed to the fact that the seed was untreated before seeding. The highest yielding variety was Moro with 43.93 bushels per acre. It was significantly higher than Delmar which was used as the check variety. These data tend to suggest that the white wheats seem to preform better in this area than the hard reds as based on this nursery. The protein levels are not high, considering that 20 pounds of N was applied to this area in the spring of this season. The white wheat proteins had acceptible levels, however the hard reds did not. Table 7 gives a complete account of the data gathered in the nursery located on the Wayland Johnson farm in Lake County.

Sanders County - Rainfall in this area of Sanders County, the Camas Prairie region, was much higher than normal. Yields were higher than ever before reported by the author in this area. Nugaines was the highest yielding entry with 55.15 bushels per acre, followed by Crest with 52 bushels per acre. Both were found to be significantly higher than the Delmar. Stands were excellent. Complete analysis of this study is found in Table 8.

Tables 9 and 10 give yield and protein summaries for the entries grown in the off station locations and one station nursery. Crest is the highest yielding variety in the summary, followed by Wanser in second place for the hard red wheats. The highest yielding entry for the soft white wheats was Moro followed by Nugaines and then Gaines. Protein levels were high in Ravalli County, low in Missoula County and fair in Lake County. The average of all entries are almost equal in all cases, however Rego is the highest with 11.7% protein.

Table 11 is a ten year summary of winter wheats grown in the intra-station nursery at the Northwestern Montana Branch Station and the averages for two, three and four years and ten years are included. The percentage is based on Westmont and several entries are found to be considerably greater in yield than Westmont, check variety for this study. For a three year period Crest is slightly behind Delmar, however this difference probably is not significant.

Breeding Nursery - The intra-state stripe rust and dwarf smut nursery was grown on the Claridge farm northwest of Kalispell. In addition to rust and smut observations, snow mold readings were made. Yield determinations were also made in this single plot nursery. One hundred and thirty-four rows were included. A complete listing is on file.

Forty of the rows were harvested for yield. Other evaluations listed are snow mold, stripe rust and dwarf smut. These are found in Table 12. P.I. 178383 provided excellent resistance to snow mold and dwarf bunt. Number 21-1-6 gave good smut resistance, but poor snow mold resistance. Yields were good however.

Winter Wheat (con't)

SUMMARY AND CONDLUSION:

1. Intrastate nursery - Delmar exceeded in yield only by Gaines. Crest within two bushels of Delmar, not significantly less.

2. Western regional hard red - Snow mold was a factor in stands and yields. MT 6634 and Crest were found to be entirely free of dwarf smut.

3. Western regional white - Moro and Gaines about equal in yield. Moro was resistant to stripe rust and dwarf smut.

4. Elite stripe rust nursery - Twenty-three entries of P.I. 178383 x Westmont[2] and five check varieties were included in this nursery. Delmar, a check, was highest yielding entry in the nursery.

5. Off-station nurseries - Crest is the highest yielding entry grown (see summary). Protein levels vary greatly at each location.

6. Breeding nurseries - One hundred and thirty-four lines tested, forty were harvested for yield. All were evaluated for snow mold and dwarf smut.

Table 1. Agronomic data from intra-state yield nursery grown at the Northwestern Montana Branch Station, Field E-2, in 1967. Random block design, Six replications.

Date Seeded: September 21, 1966
Date Harvested: August 10, 1967
Size of Plot: 16 square feet

Variety	C.I. No.	Yield Bu/A.	Test Weight Lbs/Bu	Heading Date	Pl. Ht.	Stripe Rust Sever	Stripe Rust Type	Lodging Prev	Lodging Sever	% Dwarf Smut
Gaines	13448	62.84*	62.2	6/11	28	9.3	2.8	0.0	0.0	5.3
Burt x 83 C63-11	6646	58.41	60.4	6/17	31	.3	.3	0.0	0.0	0.0
Delmar	13442	55.89	61.5	6/12	39	5.1	2.8	0.0	0.0	.3
WMT-2 x 83 16-1-8	6641	54.81	63.1	6/12	43	.2	.3	0.0	0.0	16.7
Itana 65	13846	53.66	63.6	6/11	40	7.0	3.2	1.7	1.2	22.5
Crest	6619	53.53	62.2	6/ 7	36	.8	1.5	44.2	3.3	0.0
WMTx83 1-1-6	6643	52.71	62.0	6/ 9	39	0.0	0.0	61.7	3.2	1.8
McCall	13842	51.89	62.6	6/10	36	11.7	2.7	0.0	0.0	33.3
Wanser	13844	51.68	62.6	6/ 9	39	7.5	2.7	0.0	0.0	17.5
Westmont	12930	50.36	62.6	6/ 7	38	97.0	9.0	1.7	.8	13.3
WMT-2x83 12-1-1	6631	49.53	62.6	6/ 7	40	.3	.3	44.2	1.3	8.3
Cheyenne	8885	46.39[1]	62.2	6/ 9	39	8.5	4.3	5.8	.3	13.3
WMT x 83 1-1-3	6642	45.96[1]	63.2	6/ 8	38	.3	.5	20.8	1.3	1.0
WMT-2x83 7-14-4	6634	45.79[1]	61.9	6/ 8	36	1.5	1.3	2.5	1.7	0.0
Winalta	13670	44.89[1]	63.2	6/ 9	41	3.8	2.7	15.8	.3	23.3
Rego	13181	43.63[1]	60.4	6/ 8	43	3.7	2.0	57.5	3.3	2.7
Warrior	13190	43.46[1]	61.9	6/ 8	39	94.7	9.0	26.7	.7	20.0
Lancer	13547	41.66[1]	61.9	6/ 6	38	2.2	1.3	0.0	0.0	21.7

NOTE: Delmar is used as the check in this nursery
*: Varieties yielding significantly more than the check (.05)
[1]: Varieties yielding significantly less than the check (.05)

$\bar{x}$.....	50.4
S.E.x.....	2.4
L.S.D.(.05)..	6.75
C.V.%.....	4.76

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	5	120.3	3.48*
Varieties	17	196.4	5.68*
Error	85	34.5	
Total	107		

Table 2. Agronomic data fraom western regional hard red winter wheat nursery grown on the Lance B. Claridge farm in 1967. Random block design, four replications.

Date Seeded: September 21, 1966 Date Harvested: August 10, 1967 Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Heading Date	Plant Height	Stripe Rust Sever	Stripe Rust Type	% Dwarf Smut	% Stand	Snow Mold 1/
Wmt-2 x 83 7-14-4	6634	62.57*	60.2	6/25	30	.3	.3	0.0	91.0	1.3
Wmt x 83 1-1-6	6643	60.12*	61.7	6/25	40	7.5	1.8	7.5	76.3	2.0
Wmt x 83 1-1-3	6642	57.67	61.8	6/24	39	0.0	0.0	6.8	77.5	2.0
Wmt-2 x 83 7-14-5	6635	56.95	59.0	6/24	42	0.0	0.0	13.8	92.3	1.3
Clm x Utah 175A-53	275002	49.97	58.9	6/26	42	29.5	3.3	28.8	72.5	2.0
Crest	6619	49.12	59.6	6/23	38	0.0	0.0	0.0	61.3	2.5
Colorow	12865	48.00	59.9	6/25	44	1.8	1.8	32.5	65.0	1.8
A1150(R10-Rex/2Cnn2/4Tk)	0001	47.22	60.7	6/26	38	30.0	4.0	37.5	75.0	2.0
A 5598-36-3	13870	46.05	60.8	6/25	42	6.3	2.3	40.0	63.8	2.3
Wanser	13844	46.00	59.3	6/26	40	12.5	4.5	25.0	43.8	2.8
Wmt-2 x 83 12-1-1	6631	45.90	60.4	6/23	38	12.5	1.0	27.5	58.8	2.0
Delmar	13442	45.27	59.6	6/28	41	2.0	2.0	31.3	62.5	2.3
Bezosztaja 2/Sel B	4836	45.00	60.1	6/24	34	3.0	2.3	17.5	65.0	1.8
Columbia	12928	44.92	60.3	6/23	40	90.0	7.8	63.8	81.0	1.8
Clm x Utah 175A-53	275001	44.82	60.9	6/26	44	16.3	3.3	47.5	65.0	1.5
Cheyenne	8885	43.37	61.1	6/27	42	10.0	6.5	31.3	57.5	2.0
(Rex-Rio/6Cnn)/A.F. Tk	5001	43.05	60.5	6/26	43	3.0	2.0	51.3	72.5	2.3
Kharkof	1442	41.92	60.9	6/26	42	33.8	4.5	27.5	57.5	1.8
CI 12932 x Burt 2 Sel 1	4756	40.45	60.8	6/27	35	23.8	5.8	32.5	46.3	3.0
Tendoy	13426	39.92	60.9	6/26	43	16.3	6.3	37.5	61.3	2.0
CI 12932 x Burt 2 Sel 17	4878	39.50	60.0	6/27	37	16.3	4.3	35.0	48.8	2.8
Rio	10061	38.45	60.2	6/27	41	21.3	4.8	43.8	47.5	2.5
Orfed/Wsc2/Burt	0002	38.22	60.1	6/27	40	47.5	5.8	16.3	51.3	2.8
(Rex-RioxCnn2)xCnn3	13867	37.82	59.9	6/23	41	10.0	4.8	38.8	43.8	2.5
McCall	13842	36.70	61.7	6/27	37	26.3	3.5	42.5	56.3	2.3
Itana 65	13846	35.12	60.6	6/28	38	18.8	4.8	35.0	33.8	3.0
Itana	12933	31.40	61.0	6/27	41	90.0	7.8	41.3	46.3	2.8
Wmt-2 x 83 16-1-8	6641	29.20	60.1	6/28	40	0.0	0.0	16.3	27.5	2.8
Orfed/Wsc2/Burt	0003	28.35	61.0	6/26	40	45.0	5.8	17.5	36.3	3.0

NOTE: Delmar used as a check
* Varieties yielding significantly more than the check (.05)
1/ 1 = Good tolerance; 2 = Fair; 3 = Poor

Table 2. (con't) Statistical Analysis

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	970.6	9.04*
Varieties	28	282.2	2.63*
Error	84	107.2	
Total	115		

$\bar{x}$..... 43.9
S.E.$\bar{x}$..... 5.1
L.S.D..... 14.56
C.V.%..... 11.79

Table 3. Agronomic data from the western regional uniform white winter wheat nursery. Field E-2 at the Northwestern Montana Branch Station. Random block design, four replications.

Date Seeded: September 21, 1966 Date Harvested: August 10, 1967 Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Heading Date	Plant Height	Lodging		Stripe Rust		% Smut
						Prev	Sever	Sever	Type	
(14-53 x Odin) x 13431	4765	66.55	60.2	6/15	29	0.0	0.0	0.0	0.0	10.0
Suwon 92 x Omar, BC-3	4762	61.40	61.4	6/ 8	28	0.0	0.0	0.0	0.0	8.8
Gaines	13448	60.25	62.5	6/12	27	0.0	0.0	11.3	2.8	7.5
PI 178383/4 Omar	88	60.07	60.9	6/12	40	.8	3.8	0.0	0.0	0.0
Brevor	12385	59.97	60.7	6/13	37	0.0	0.0	86.2	6.0	4.0
Suwon 92/Omar, BC4	4962	58.80	61.6	6/12	32	0.0	0.0	0.0	0.0	1.5
Nugaines	13968	58.65	63.6	6/12	28	23.8	.8	1.0	1.5	10.0
HH/2 Elgin 2/2 Omar	5002	57.50	60.8	6/13	37	0.0	0.0	98.0	9.0	.5
Moro	13740	57.20	60.4	6/12	36	4.5	3.8	0.0	0.0	.3
Omar	13072	51.40	60.6	6/14	36	0.0	0.0	98.0	7.8	3.0
Elgin	11755	49.55*	60.4	6/14	38	0.0	0.0	98.0	7.8	7.5
Triplet	5408	47.37*	62.1	6/ 9	44	11.3	3.0	93.5	8.5	12.5
Kharkof	1442	47.35*	61.9	6/11	45	71.3	2.5	61.3	5.3	21.3
Golden	10063	46.30*	60.2	6/13	40	1.3	.3	98.0	7.8	10.0
Burt	12696	46.00*	61.6	6/ 9	34	0.0	0.0	58.8	5.5	8.8

NOTE: Gaines is used as the check
* Varieties yielding significantly less than the check (.05)

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	169.4	3.26*
Varieties	14	173.2	3.33*
Error	42	51.8	
Total	59		

$\bar{x}$..... 55.2
S.E.$\bar{x}$..... 3.6
L.S.D..... 10.29
C.V.%..... 6.52

Table 4. Agronomic data from the elite stripe rust and dwarf bunt nursery. Field E-3, Northwestern Montana Branch Station. Random block design, six replications.

Date Seeded: September 21, 1966 Date Harvested: August 10, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Heading Date	Plant Height	% Dwart Smut
Delmar	13442	61.53	61.9	6/14	41	1.5
2 Itana/PI 178383 14-2-2	6736	57.89	63.3	6/11	41	21.7
Westmont	12930	56.94	62.9	6/ 7	39	19.2
2 Wmt/PI 178383 8-10-6	6726	56.21	62.3	6/ 7	36	1.8
2 Wmt/PI 178383 14-1-7	6728	53.96	63.0	6/10	42	6.0
2 Wmt/PI 178383 8-1-5	6724	52.34	62.5	6/ 8	39	2.7
2 Wmt/PI 178383 8-1-2	6723	51.41	62.1	6/ 7	37	15.8
2 Wmt/PI 178383 13-4-11	6735	50.96	62.8	6/13	39	12.5
2 Wmt/PI 178383 13-8-4	6727	50.43	62.4	6/14	40	.5
2 Wmt/PI 178383 8-6-8	6725	49.91	62.2	6/ 7	38	0.0
2 Wmt/PI 178383 7-6-4	6738	49.86	62.9	6/ 9	39	7.0
2 Wmt/PI 178383 12-6-3	6734	49.61	63.7	6/10	40	.5
2 Wmt/PI 178383 7-7-3	6730	47.76	63.5	6/ 7	40	7.8
2 Wmt/PI 178383 8-3-2	6731	47.64	62.8	6/ 8	39	3.7
Cheyenne	8885	47.14	62.9	6/11	41	14.2
Itana	12933	46.86	62.8	6/11	43	20.0
2 Wmt/PI 178383 8-8-1	6732	46.49	62.2	6/ 9	38	0.0
2 Wmt/PI 178383 7-13-3	6722	46.24	62.9	6/ 9	37	11.2
2 Itana/PI 178383 16-1-1	6737	46.21	62.7	6/13	41	6.8
2 Wmt/PI 178383 7-10-3	6721	45.74	62.5	6/10	38	1.0
2 Wmt/PI 178383 14-11-3	6729	44.39	63.5	6/12	42	3.0
2 Wmt/PI 178383 8-8-6	6733	42.93	63.0	6/ 7	37	.5
Rego	13181	40.36	61.0	6/ 9	44	4.2

$\bar{x}$..... 49.6
S.E.$\bar{x}$..... 2.9
L.S.D..... 8.22
C.V.%..... 5.96

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	5	1007.6	19.08
Varieties	22	154.3	2.92
Error	110	52.7	
Total	137		

Table 5. Agronomic data from the off-station yield nursery grown on the Al Goodan farm, Missoula County in 1967. Random block design, four replications.

Date Seeded: September 28, 1966
Date Harvested: August 8, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Plant Height	% Common Smut	% Protein
Gaines	13448	52.77*	60.3	28	.3	6.4
Moro	13740	52.30*	56.9	36	0.0	6.5
McCall	13842	47.37*	61.5	36	0.0	7.4
Nugaines	13968	46.45	61.3	28	0.0	6.8
Omar	13072	46.20	58.4	37	.3	6.6
Burt x 83 C 63-11	6646	45.05	58.0	32	0.0	6.8
Wanser	13844	43.47	60.3	39	0.0	7.4
Crest	6619	38.52	60.4	35	.3	7.9
Delmar	13442	38.22	61.0	38	.3	8.2
Westmont	12930	38.02	59.7	37	0.0	7.3
Winalta	13670	36.17	61.5	39	20.0	8.6
Rego	13181	36.10	59.8	43	2.3	8.2
Lancer	13547	34.25 1/	60.1	37	36.7	7.8
Cheyenne	8885	32.30 1/	58.8	38	30.0	6.2
Warrior	13190	31.67 1/	60.1	41	11.7	8.4

NOTE: Delmar is used as the check
* Varieties yielding significantly more than the check (.05)
1/ Varieties yielding significantly less than the check

$\bar{x}$.....	41.2
S.E.$\bar{x}$.....	2.1
L.S.D.(.05)...	6.1
C.V.%.....	5.14

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	219.3	12.17 *
Varieties	14	189.5	10.52 *
Error	42	18.0	
Total	59		

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Table 6. Agronomic data from off station yield nursery grown on the Gerald Neil farm in Ravalli County in 1967. Random block design, four replications.

Date Seeded: September 28, 1966 Date Harvested: August 9, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Plant Height	% Protein
Wanser	13844	17.52	27	14.6
Rego	13181	16.67	28	16.6
Westmont	12930	15.92	26	14.3
Lancer	13547	15.37	26	15.8
Crest	6619	15.27	24	16.9
Burt x 83 C63-11	6646	14.95	23	16.5
Cheyenne	8885	14.52	27	16.4
Warrior	13190	14.20	27	16.2
Delmar	13442	14.07	27	12.6
Winalta	13670	14.00	26	14.6
Moro	13740	13.02	24	17.3
Nugaines	13968	12.07	18	16.0
Omar	13072	11.72	23	18.9
McCall	13842	11.47	23	17.4
Gaines	13448	10.82	19	15.7

NOTE: Delmar is used as the check in this nursery

$\bar{x}$.....	14.1
S.E.$\bar{x}$.....	1.8
L.S.D.(.05)..	N.S.
C.V.%.....	13.34

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	48.3	3.40
Varieties	14	15.4	1.09
Error	42	14.1	
Total	59		

Table 7. Agronomic data from off station yield nursery grown on the Wayland Johnson farm in Lake County in 1967. Random block design, three replications.

Date Seeded: September 28, 1966
Date Harvested: August 8, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Plant Height	% Common Smut	% Protein
Moro	13740	43.93*	58.3	34	0.0	7.9
Burt x 83 C63-11	6646	42.93*	58.3	28	0.0	7.4
Omar	13072	41.99	58.2	36	0.0	7.7
Nugaines	13968	41.03	62.7	26	0.0	9.2
McCall	13842	40.03	62.1	32	0.0	8.4
Crest	6619	39.49	61.0	34	0.0	9.5
Wanser	13844	37.86	60.4	35	0.0	8.3
Westmont	12930	37.23	60.6	35	0.0	8.8
Lancer	13547	36.33	60.5	36	5.0	9.3
Delmar	13442	34.99	61.6	36	0.0	9.5
Warrior	13190	34.49	60.9	36	.3	10.0
Gaines	13448	33.33	61.5	25	.3	8.4
Winalta	13670	32.63	61.9	35	5.3	9.1
Cheyenne	8885	25.26 1/	0.0	35	70.0	10.2
Rego	13181	23.76 1/	0.0	35	0.0	10.3

NOTE: Delmar is used as the check
* Varieties yielding significantly more than the check (.05)
1/ Varieties yielding significantly less than the check (.05)

$\bar{x}$.....	36.3
S.E.$\bar{x}$.....	4.6
L.S.D.(.05)..	7.8
C.V.%.....	7.36

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	16.6	.77
Varieties	14	105.1	4.89*
Error	28	24.4	
Total	44		

Table 8. Agronomic data from off station yield nursery grown on the Ray Jorgenson farm in Sanders County in 1967. Random block design, four replications.

Date Seeded: September 29, 1966
Date Harvested: August 24, 1967
Size of Plot: 16 sq. ft.

Variety	C.I. Number	Yield Bu/A.	Test Wt. Lbs/Bu.	Plant Height
Nugaines	13968	55.15*	60.0	27
Crest	6619	52.25*	60.2	36
Moro	13740	50.32	56.9	35
Gaines	13448	49.75	55.5	26
Wanser	13844	47.60	61.0	37
McCall	13842	45.52	60.7	35
Lancer	13547	45.37	62.3	35
Westmont	12930	44.72	61.5	36
Delmar	13442	41.80	59.7	35
Omar	13072	41.50	56.0	35
Burt x 83 C63-11	6646	41.47	53.5	29
Rego	13181	40.87	59.3	40
Cheyenne	8885	39.65	59.5	36
Warrior	13190	38.30	59.8	38
Winalta	13670	36.72	59.9	36

NOTE: Delmar is used as the check in this nursery
* Varieties yielding significantly more than the check (.05)

$\bar{x}$.....	44.7
S.E.x.....	2.8
L.S.D.(.05)..	8.3
C.V.%.....	6.47

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	155.4	4.62
Varieties	14	116.1	3.54*
Error	42	33.5	
Total	59		

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Table 9. Summary of winter wheat grown in Western Montana in 1966-67.

Variety	C.I. Number	Yield Bushels per Acre — Location: NWMBS	Missoula County	Ravalli County	Lake County	Sanders County	$\bar{x}$
HARD RED WHEATS							
Crest	MT6619	53.5	38.5	15.3	39.5	52.3*	39.8
Wanser	13844	51.7	43.4	17.2	37.9	47.6	39.6
McCall	13842	51.9	47.8*	11.5	40.0	45.5	39.3
Westmont	12930	50.4	38.0	15.9	37.2	44.7	37.2
Delmar	13442	55.9	38.2	14.0	35.0	41.8	37.0
Lancer	13547	41.7 1/	34.2 1/	15.4	36.3	45.4	34.6
Winalta	13670	44.9 1/	36.2	14.0	32.6	36.7	32.9
Warrior	13190	43.5 1/	31.7 1/	14.2	34.5	38.3	32.4
Rego	13181	43.6 1/	36.1	16.7	23.7 1/	40.9	32.2
Cheyenne	8885	46.4 1/	32.3	14.5	25.3 1/	39.7	31.6
WHITE WHEATS							
Moro	13740	57.2	53.3*	13.0	43.9*	50.3	43.5
Nugaines	13968	58.7	46.4	12.1	41.0	55.2*	42.7
Gaines	13448	60.2	52.8*	10.8	33.3	49.8	41.4
BurtxPI178383 C63-11	MT6646	58.4	45.1	15.0	42.9*	41.5	40.6
Omar	13072	51.4	46.2	11.7	42.0	41.5	38.6
$\bar{x}$		50.4	41.2	14.1	36.3	44.7	
S.E.$\bar{x}$		2.4	2.1	1.8	2.6	2.8	
L.S.D.(.05)		6.8	6.1	N.S.	7.8	8.3	
C.V.%		4.76	5.14	13.34	7.36	6.47	

NOTE: Delmar is used as the check in this nursery
* Varieties yielding significantly more than the check (.05)
1/ Varieties yielding significantly less than the check (.05)

Table 10. Protein percentage of winter wheat grown at three locations in Western Montana in 1966-67.

Variety	C.I. Number	Location: Missoula County	Location: Ravalli County	Location: Lake County	$\bar{x}$
		HARD RED WHEAT			
Rego	13181	8.2	16.6	10.3	11.7
Warrior	13190	8.4	16.2	10.0	11.5
McCall	13842	7.4	17.4	8.4	11.1
Lancer	13547	7.8	15.8	9.3	11.0
Cheyenne	8885	6.2	16.4	10.2	10.9
Crest	MT6619	7.9	16.9	9.5	10.9
Winalta	13670	8.6	14.6	9.1	10.8
Delmar	13442	8.2	12.6	9.5	10.1
Westmont	12930	7.3	14.3	8.8	10.1
Wanser	13844	7.4	14.6	8.3	10.1
		WHITE WHEAT			
Omar	13072	6.6	18.9	7.7	11.1
Nugaines	13968	6.8	16.0	9.2	10.7
Moro	13740	6.5	17.3	7.9	10.6
Gaines	13448	6.4	15.7	8.4	10.2
Burt x PI178383 C63-11	MT6646	6.8	16.5	7.4	10.2
$\bar{x}$		7.9	17.1	9.5	

Table 11 . Summary of winter wheat data from intrastate yield nurseries, 1958-1967, Northwestern Montana Branch Station, Kalispell, Montana.

Variety	C.I. Number	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	$\bar{x}$	No. Sta. Yrs.	% West-mont	Average Bu/A 2 Yrs.	3 Yrs.	4 Yrs.	10 Yrs.
Cheyenne	8885	49.0	51.8	41.4	49.5	55.5	61.9	57.5	48.7	59.3	46.4	52.1	10	110	52.9	51.5	53.0	52.1
Westmont	12930	64.9	53.3	34.3	51.1	57.2	45.6	41.5	42.4	30.2	50.4	47.1	10	100	40.3	41.0	41.1	47.1
Rego	13181	59.8	55.6	35.5	46.7	60.6	60.2	49.9	42.5	62.4	43.6	51.7	10	108	53.0	49.5	49.6	51.7
Delmar	13442					55.3	71.8	51.4	47.3	64.2	55.9	57.7	6	129	60.1	55.8	54.7	
Gaines	13448						91.7	68.0	24.7	74.0	62.8	64.2	5	153	68.4	53.8	57.4	
Itana 65	13846						76.6	54.1	42.0	65.4	53.7	58.4	5	139	59.6	53.7	53.8	
Winalta	13670							54.4	31.4	67.4	44.9	49.5	4	120	56.1	47.9	49.5	
Warrior	13190							45.8	37.1	59.5	43.5	46.5	4	113	51.5	46.7	46.5	
BurtxPI178383 C63-11	6646								50.1	81.8	58.4	63.4	3	155	70.1	63.4		
Crest	6619								40.8	73.4	53.5	55.9	3	136	63.5	55.9		
McCall	13842									56.4	51.9	54.2	2	134	54.2			
Lancer	13547									57.0	41.7	49.4	2	123	49.4			
Wanser	13844									73.9	51.7	62.8	2	155	62.8			
Wmt-2x8316-1-8	6641										54.8	54.8	1	109				
Wmt- x 83 1-1-6	6643										52.7	52.7	1	105				
Wmt-2 x 83 12-1-1	6631										49.5	49.5	1	98				
Wmt x 83 1-1-3	6642										46.0	46.0	1	91				
Wmt-2 x 83 7-14-4	6643										45.8	45.8	1	91				

Table 12. Agronomic data from the intra-state stripe rust and dwarf bunt nursery, grown at the Northwestern Montana Branch Station and Stillwater area in 1966-67.

Variety	Row No. Years 66	67	Stillwater Snow-mold	Stillwater % Stand	% Smut Still-water	Cres-ton	Hoff-mann	x̄	Yield Grams Still-water	Cres-ton	Yield Bushel per Acre
Itana		1	F	80	40	30		35	444	313	37.9
Westmont		2	G	99	40	25		33	508	348	42.8
P. I. 178383		3	VG	99	0	0		0	542	406	47.4
(W-5x83-7xW-3)-1xW-47-2xW) 2-2-3	8	10	F	90	15	45	45	35	493	294	39.4
" " " " " -4	9	11	F	95	30	40	50	40	482	276	37.9
" " " " " -2	11	12	G	90	15	25	40	27	482	311	39.7
" " " " " -4	13	13	G	90	0	15	30	23	481	249	36.5
" " " " " -6	15	14	P	95	5	20	35	20	439	314	37.7
" " " " " -9	18	15	G	95	5	20	45	23	591	318	45.5
(W-5x83-7xW-3)-1xW-157-1xW)-4-2-2	38	25	F	95	0	15	55	23	721	507	61.4
Itana		31	P	75	10	20		15	437	291	36.4
Westmont		32	P	60	10	20		15	339	490	41.5
P.I. 178383		33	G	99	0	0		0	585	318	45.2
(W-3x83-7)-1-1F$_2$xW-197-2xW)-8-1-3	49	34	F	55	5	15	30	17	515	481	49.8
" " " -4	50	35	P	65	15	10	80	35	374	345	36.0
" " " -8	54	38	F	85	30	10	70	37	342	383	36.3
" " " -2	57	41	P	90	25	35	60	40	637	356	49.7
" " " -7	65	43	F	75	45	25	70	47	445	329	38.7
(W-3x83-7)-2-1F$_2$xW-197-2xW)-11-4-5	96	45	G	95	45	10	20	25	649	514	58.2
(W-3x83-7)-1-2F$_2$xW-187-2xW)-20-3-14	167	51	F	95	20	1	15	12	589	443	51.6
Itana		61	P	80	25	20		23	357	396	37.7
Westmont		62	P	85	65	20		43	355	495	42.5
P.I. 178383		63	VG	99	0	0		0	569	569	56.9
(W-2x83-1)-1-2F$_2$xW-187-3xW)21-1-6	259	78	P	85	0	1	10	5	627	467	54.7
" " " -13	266	84	F	70	0	10	25	12	582	455	51.9
" " -8xW)-24-2-1	278	88	F	60	10	10	25	15	290	437	36.4
" " " -2	279	89	F	85	5	35	20	20	516	480	49.8
Itana		91	P	30	1	25		13	185	424	30.5
Westmont		92	P	75	10	10		10	489	463	47.6
P.I. 178383		93	VG	95	0	0		0	580	529	55.5
(Wx2x83-1)-4-1F$_2$xW-157-5xW)36-2-1	306	102	P	90	10	25	70	35	395	457	42.6

Table 12 . (con't)

Variety	Row No. Years 66	67	Stillwater Snow-[1] mold	% Stand	% Smut Still-water	Cres-ton	Hoff-mann	$\bar{x}$	Yield Grams Still-water	Cres-ton	Yield Bushel per acre
(Wx2x83-1)-4-1F$_2$xW-157-5xW)36-3-3	309	103	P	50	25	30	50	35	219	533	37.6
" " " -7	313	105	P	40	30	2	55	29	259	318	28.9
" " " -8	314	106	P	40	5	25	65	32	272	715	49.4
(Wx2x83-1)-4-2F$_2$xW-197-1xW)37-8-4	319	110	P	80	15	35	30	27	546	584	56.5
Itana		121	F	65	40	10		25	219	602	42.1
Westmont		122	P	65	40	20		30	266	427	34.7
P. I. 178383		123	G	95	0	20		10	581	531	55.6
(83-4xSt-12xIt-6)-1xIt7-12xIt)55-3-5	368	126	P	60	10	0	30	13	273	466	37.0
Uniform mildew 48(?)-23	470	133	missing	0	[2]	20	20	20	40	544	29.2

[1] VG = very good; G = good; F = fair; P = poor
[2] Not much stand

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YEAR: 1967

TITLE: Plant Growth Regulators on Sheridan Spring Wheat

PROJECT: Small Grain Investigations MS 756

PERSONNEL: Leader - Vern R. Stewart
Cooperators -K. W. Dunster, Amchem Products Inc.

LOCATION: Northwestern Montana Branch Station Field No. Y-6

DURATION: Three to five years

OBJECTIVES: To determine the effect of a growth regulator on the yield of Sheridan Spring Wheat

ABSTRACT: A plant growth regulator - Amchem 66-329 was applied to Sheridan spring wheat, at three stages of growth. Earlier work has shown yield increase of some grasses when sprayed with this compound.

Plant height was reduced when the growth regulator was applied to the wheat plant in the late boot and fully tillered stage of growth. No significant yield changes were noted.

FUTURE PLANS:

This study is to be continued in 1968. Refinements will be made in application techniques. Timing of applications are to be more closely controlled.

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PLANT GROWTH REGULATORS ON SHERIDAN SPRING WHEAT

INTRODUCTION:

A growth regulator coded Amchem 66-329 was used in a study on spring wheat. Previous work by Amchem has shown that lateral bud stimulation results in many plant species when ½ to 4 pounds per acre of the material is applied as a spray. On young grass plants this has resulted in increased tillering. Some of their preliminary data indicates yield increases of 15 to 30 per cent in wheat and barley.

This study was designed to measure the effect 66-329 would have on the high yielding variety Sheridan spring wheat.

MATERIAL & METHODS:

Sheridan wheat was seeded for this study in twelve row plots, 20 feet long. The seeding rate was sixty pounds per acre.

The growth regulator compound, ACP 66-329 was applied with a small boom type research sprayer. The boom covered a swath of ten feet, using five noozles, spaced twenty inches. Noozle size was 8003. The machine was calibrated to apply 44.5 gallons per acre volume. The boom was set from 19-21 inches above the grain, depending on the stage of growth.

Applications were made at three stages of plant growth, 2-4 leaf stage, tillering and late boot stage. Three rates were used and are seen in the tables that follow.

Measurements made were yield, plant height, lodging, bushel weight and heads per thirteen inches (estimated) of row length.

RESULTS & DISCUSSION:

Noted during the growing season was a delay in maturity of applications made at the tillering and late boot stage of growth. Noted also in these same treatments were a reduction in overall height of the plants. In Table 3 are the data for plant height. These differences were found to be significant when analyzed statistically. The two pound rate applied late boot caused the greatest reduction in plant height. Plants in the area where some lap over of spray occurred were somewhat shorter than rows adjacent to them.

No significant differences were found in yields in the study, nor were any great differences found in bushel weight.

Plant counts made were found to be non-significant as it related to treatment.

Lodging percentages were reduced when the growth regulator was applied at the late boot stage. This reduction could possibly be due to the plant shortening, thus reducing the lodging tendency found in the tall variety Sheridan.

Table 1 Agronomic data from growth regulator study grown at the Northwestern Montana Branch Station in 1967. Twelve row plots, five replications, randomized block design. Field No. Y-6.

Date Seeded: May 8, 1967 Date Harvested: September 1, 1967

Stage of Growth	Treatment Rate		Grams Per Plot I	II	III	IV	V	Total	x̄	Bushel Weights I	II	III	IV	V	Total	x
2-4 leaf	1#	A	684	693	658	649	679	3363								
		B	665	623	802	777	727	3594								
		C	704	670	647	482	636	3139								
		Total	2053	1986	2107	1908	2042	10096	673	60.6	61.2	60.7	59.9	60.4	302.8	60.6
2-4 leaf	2#	A	646	684	656	804	830	3620								
		B	694	688	626	767	760	3535								
		C	548	550	587	707	614	3006								
		Total	1888	1922	1869	2278	2204	10161	677	60.9	61.1	60.8	61.2	60.3	304.3	60.9
2-4 leaf	0	A	716	539	793	654	786	3488								
		B	756	608	676	703	714	3457								
		C	495	542	598	717	569	2921								
		Total	1967	1689	2067	2074	2069	9866	658	61.0	61.4	60.7	60.7	61.3	305.1	61.0
Tillering	1#	A	661	670	674	709	894	3608								
		B	762	695	788	710	709	3664								
		C	704	326	736	439	719	2924								
		Total	2127	1691	2198	1858	2322	10196	680	60.7	60.9	60.7	60.8	61.4	304.5	60.9
Tillering	2#	A	673	557	689	641	628	3188								
		B	762	677	625	689	684	3437								
		C	723	549	480	439	747	2938								
		Total	2158	1783	1794	1769	2059	9563	638	60.5	59.9	58.6	61.5	61.9	302.4	60.5
Tillering	0	A	696	660	551	823	780	3510								
		B	682	770	677	733	811	3673								
		C	353	649	347	690	649	2688								
		Total	1731	2079	1575	2246	2240	9871	658	61.2	61.0	61.2	61.0	61.2	305.6	61.1

Table 1 . (con't) Yields and Bushel Weights

Stage of Growth	Treatment Rate		Grams Per Plot I	II	III	IV	V	Total	$\bar{x}$	Bushel Weights I	II	III	IV	V	Total	$\bar{x}$
Late Boot	1#	A	647	563	735	646	787	3378								
		B	587	715	701	754	798	3555								
		C	645	718	780	687	737	3567								
	Total		1879	1996	2216	2087	2322	10500	700	60.7	60.7	60.5	61.6	61.1	304.6	60.9
Late Boot	2#	A	657	647	729	643	537	3213								
		B	616	644	764	648	836	3508								
		C	686	580	570	678	598	3112								
	Total		1959	1871	2063	1969	1971	9833	656	60.5	59.7	59.8	62.0	61.0	303.0	60.6
Late Boot	0	A	638	620	698	658	585	3199								
		B	638	526	771	717	609	3261								
		C	739	588	765	759	791	3642								
	Total		2015	1734	2234	2134	1985	10102	673	61.0	60.9	61.0	61.8	60.8	305.5	61.1

Table 1 . (con't) Height in Inches, % Lodging, Prevalence and Severity

Stage of Growth	Treatment Rate		Height in Inches I	II	III	IV	V	Total	$\bar{x}$	% Lodging-Prevalence I	II	III	IV	V	Total	% Lodging-Severity I	II	III	IV	V	Total
2-4 leaf	1#	A	51	51	52	50	49	253													
		B	52	50	51	51	49	253													
		C	51	50	51	52	50	254													
	Total		154	151	154	153	148	760	50.6	95	95	95	99	99	483	4	8	8	9	9	38
2-4 leaf	2#	A	54	54	50	53	49	260													
		B	51	52	53	53	51	260													
		C	53	53	51	54	49	260													
	Total		158	159	154	160	149	780	51.9	95	95	30	99	99	418	7	9	7	9	9	41
2-4 leaf	0	A	54	50	52	52	52	260													
		B	53	51	52	53	52	261													
		C	52	54	54	52	53	265													
	Total		159	155	158	157	157	786	52.4	50	20	95	99	99	363	4	5	8	9	9	35
Tillering	1#	A	49	52	50	51	47	249													
		B	50	49	52	51	47	249													
		C	50	51	53	52	49	255													
	Total		149	152	155	154	143	753	50.2	10	00	20	95	25	150	3	0	7	4	3	17
Tillering	2#	A	49	51	45	50	46	241													
		B	50	49	39	46	50	234													
		C	51	48	36	46	48	229													
	Total		150	148	120	142	144	704	46.9	00	00	00	00	65	65	0	0	0	0	2	2
Tillering	0	A	51	53	52	52	50	258													
		B	52	54	50	52	51	259													
		C	48	53	52	53	50	256													
	Total		151	160	154	157	151	773	51.5	00	80	80	95	95	350	0	8	8	8	9	33

Table 1 . (con't) Height & Lodging

Stage of Growth	Treatment Rate		Height in Inches I	II	III	IV	V	Total	$\bar{x}$	% Lodging-Prevalence I	II	III	IV	V	Total	% Lodging-Severity I	II	III	IV	V	Total
Late Boot	1#	A	51	47	44	47	43	232													
		B	46	42	41	43	42	214													
		C	50	49	46	45	45	235													
	Total		147	138	131	135	130	681	45.4	00	00	00	00	00	00	0	0	0	0	0	0
Late Boot	2#	A	47	45	45	42	45	224													
		B	40	44	39	37	40	200													
		C	43	47	36	45	45	216													
	Total		130	136	120	124	130	640	42.7	00	00	00	00	00	00	0	0	0	0	0	0
Late Boot	0	A	53	54	50	52	53	262													
		B	49	50	53	50	47	249													
		C	53	53	52	48	50	256													
	Total		155	157	155	150	150	767	51.1	00	45	20	00	65	130	0	5	5	0	9	19

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Table 2. Head counts of wheat from growth regulator study. Area counted thirteen inches.

Stage of Growth	Treatment Rate		Head Counts per Replication I	II	III	IV	V	Total	$\bar{x}$
2-4 leaf	1#	A	41	58	42	53	45	239	47.8
		B	42	51	29	47	52	221	44.2
		C	40	70	54	46	42	252	50.4
		Total	123	179	125	146	139	712	47.5
2-4 leaf	2#	A	48	51	43	63	45	250	50.0
		B	31	43	35	45	61	215	43.0
		C	45	63	40	53	34	235	47.0
		Total	124	157	118	161	140	700	46.7
2-4 leaf	0	A	50	36	38	69	46	239	47.8
		B	30	50	41	54	39	214	42.8
		C	44	73	57	52	35	261	52.2
		Total	124	159	136	175	120	714	47.6
Tillering	1#	A	53	53	53	52	33	244	48.8
		B	78	63	36	58	44	279	55.8
		C	64	54	51	52	41	262	52.4
		Total	195	170	140	162	118	785	52.3
Tillering	2#	A	41	46	50	43	33	213	42.6
		B	36	39	33	66	44	218	43.6
		C	59	43	42	59	41	244	48.8
		Total	136	128	125	168	118	675	45.0
Tillering	0	A	51	50	56	44	38	239	47.8
		B	54	52	38	58	24	226	45.2
		C	56	41	41	50	35	223	44.6
		Total	161	143	135	152	97	688	45.9
Late Boot	1#	A	43	46	45	54	40	228	45.6
		B	35	59	51	65	57	267	53.4
		C	42	53	39	60	62	256	51.2
		Total	120	158	135	179	159	751	50.1
Late Boot	2#	A	33	40	43	42	57	215	43.0
		B	40	54	48	50	57	249	49.8
		C	41	62	43	50	49	245	49.0
		Total	114	156	134	142	163	709	47.3
Late Boot	0	A	45	43	34	37	46	205	41.0
		B	33	50	40	66	50	239	47.8
		C	51	56	33	37	53	230	46.0
		Total	129	149	107	140	149	674	44.9

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Table 3. Summary of data from growth regulator study, Northwestern Montana Branch Station in 1967.

Stage of Growth	Treatment Rate	Yield	Bu. Wt. in Lbs.	Height Inches	% Lodging Prevalence	% Lodging Severity	Head Counts[1]
2-4 leaf	1#	67.3	60.6	50.6a [2]	97a [2]	8a [2]	47.5
2-4 leaf	2#	67.7	60.9	51.9a	84ab	8a	46.7
2-4 leaf	0	65.8	61.0	52.4a	73 b	7a	47.6
Tillering	1#	68.0	60.9	50.2ab	30 c	3 b	52.3
Tillering	2#	63.8	60.5	46.9 b	13 c	4 b	45.0
Tillering	0	65.8	61.1	51.5a	74ab	7a	45.9
Late Boot	1#	70.0	60.9	45.4 c	00 c	0 c	50.1
Late Boot	2#	65.6	60.6	42.7 d	00 c	0 c	47.3
Late Boot	0	67.3	61.1	51.1a	26 c	4 b	44.9
	$\bar{x}$	66.8	60.8	49.2	44.1	4.1	47.5
	S.E.$\bar{x}$	4.14109	.26303	.89938	11.42241	.87544	3.81672
	C.V.%	6.19	.43	1.82	26.23	21.29	8.04
	F (.05)	<1 N.S.	<1 N.S.	42.96*	10.71*	14.94*	1.20N.S.

1/ Counts made from 13 inches in a row
2/ Multiple range test

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TITLE: Fertilizer Study on Gaines Winter Wheat

PROJECT: Small Grains Investigations MS 756

YEAR: 1967

PERSONNEL: Vern R. Stewart, Don R. Graham, Mr. Erickson

LOCATION: Clarence Popham farm, Corvallis, Montana

DURATION: Three years

OBJECTIVES: To determine proper fertilizer levels for semi-dwarf wheat in the Bitterroot River Valley in Ravalli County when grown under irrigation.

ABSTRACT: The study was designed to test the productivity of Gaines wheat. High rates of N (100-150#/a) decreased yields. Protein percentage increased in a linear relationship to nitrogen rate increases. High rates of nitrogen tended to decrease the test weight.

FUTURE PLANS: This study is to be continued in the 1968 season.

FERTILIZER STUDY ON GAINES WINTER WHEAT

INTRODUCTION:

Considerable research has been done on the production of Gaines wheat throughout the Pacific Northwest. Acreage of this semi-dwarf is on the increase in all parts of Western Montana. Therefore, this study was designed to determine the best fertility program for Western Montana.

MATERIAL AND METHODS:

A twenty treatment study was designed by Don Graham, Soil Scientest at the Western Montana Branch Station. The treatments of the study are found in Table 1.

The fertilizers were applied to an established stand of Gaines wheat, seeded by Mr. Erickson. Plots were 10 x 20 feet. Yields were obtained by harvesting two rows, spaced 7 inches apart and 8 feet long. Three samples were secured from each plot for yield determinations.

Bushel weights were obtained for each plot.

Protein analysis were obtained for each treatment in all three replications.

The data were analyzed using the analysis of variance. Twelve of the treatments were analyzed separately from the total, to measure the interaction between phosphorus and nitrogen.

RESULTS AND DISCUSSION:

In the overall analysis of the study yields were found to be significantly different. It was noted as the nitrogen rates increased the yields tended to decrease, whether applied in the spring or the fall. The highest yielding treatment was 50 N + 40 P_2O_5, fall applied, the lowest yield was 150 N + 40 P_2O_5, applied in the fall.

The analysis of the twelve fall treatments, inclusive of the check, indicate a significant difference in yield because of nitrogen. Fifty pounds of nitrogen gave a 6.9 bushel increase over the check, however the 100 & 150 pound rates of nitrogen caused considerable reduction in yields. The phosphorus rates had no effect on yield. Table 2

Significant differences were measured in test weights. As nitrogen rates were increased, test weights tended to decrease. Phosphorus had no effect on test weight. Table 3

Results and Discussion (con't)

Protein levels were affected considerably by nitrogen rates. The highest protein levels were obtained when 150 N + 40 P_2O_5 were applied in the fall or 50 N + 40 P_2O_5 in the fall with 100 N applied in the spring. Both treatments had a percentage of 11.9. Table 4

Comparing the twelve fall treatments the analysis show considerable effect due to Nitrogen application. In fact, the protein increased in a linear relationship to the rate of nitrogen. Phosphorus rates had no significant effect on protein level. Table 5

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Table 1. Agronomic data from fertilizer study on Gaines wheat grown on the Clarence Popham farm by Erickson, Corvallis, Montana 1966-67.
Size of Plot: 9.3 square feet

Treatment N	Treatment P		Grams I	Grams II	Grams III	Grams Total	Yield Bu/A.	Bushel Weights I	Bushel Weights II	Bushel Weights III	Bushel Weights Total	Bushel Weights x̄
0	40	A	597	704	603	1904						
		B	622	578	565	1765						
		C	219	595	657	1471						
		Total	1438	1877	1825	5140	98.3	57.7	58.6	59.3	175.6	58.5
100	40	A	583	530	634	1747						
		B	629	576	801	2006						
		C	453	676	698	1827						
		Total	1665	1782	2133	5580	106.7	54.3	56.6	57.7	168.6	56.2
0	0	A	595	621	725	1941						
		B	716	710	577	2003						
		C	644	741	594	1979						
		Total	1955	2072	1896	5923	113.3	53.4	58.1	59.2	170.7	56.9
100	40	A	430	618	683	1731						
50	Fall	B	488	545	661	1694						
		C	491	616	711	1818						
		Total	1409	1779	2055	5243	100.3	52.3	54.9	57.8	165.0	55.0
50	20	A	602	682	570	1854						
		B	580	697	772	2049						
		C	538	791	770	2099						
		Total	1720	2170	2112	6002	114.8	54.8	57.8	58.7	171.3	57.1
100	0	A	468	616	772	1856						
		B	524	625	744	1893						
		C	444	594	599	1637						
		Total	1436	1835	2115	5386	103.0	52.0	55.3	58.7	166.0	55.3
150	40	A	426	484	628	1538						
50	Fall	B	359	528	494	1381						
		C	341	661	457	1459						
		Total	1126	1673	1579	4378	83.7	49.9	53.9	54.2	158.0	52.7
150	40	A	384	474	707	1565						
		B	424	469	566	1459						
		C	329	446	645	1420						
		Total	1137	1389	1918	4444	84.9	51.5	52.6	57.5	161.6	53.9
100	40	A	496	624	692	1812						
90	K_2O	B	513	487	745	1745						
		C	677	462	644	1783						
		Total	1686	1573	2081	5340	102.1	55.3	54.0	57.7	167.0	55.7

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Table 1 . (con't)

Treatment N	P		Grams I	II	III	Total	Yield Bu/A.	Bushel Weights I	II	III	Total	x̄
50	0	A	513	657	780	1950						
		B	582	617	696	1895						
		C	667	644	803	2114						
		Total	1762	1918	2279	5959	113.9	52.9	59.4	58.8	171.1	57.0
100	20	A	570	598	646	1814						
		B	429	485	701	1615						
		C	559	562	741	1862						
		Total	1558	1645	2088	5291	101.8	55.2	54.8	59.6	169.6	56.5
100	40	A	576	529	622	1727						
Spr. N		B	507	547	692	1746						
		C	540	622	663	1825						
		Total	1623	1698	1977	5298	101.3	54.7	53.9	56.5	165.1	55.0
100	40	A	638	715	763	2116						
200#		B	568	604	547	1719						
		C	543	681	581	1805						
		Total	1749	2000	1891	5640	107.8	55.8	57.3	56.7	169.8	56.6
150	40	A	550	468	537	1555						
Spr. N		B	448	406	626	1480						
		C	442	648	554	1644						
		Total	1440	1522	1717	4679	89.5	53.2	52.0	55.3	160.5	53.5
0	0	A	626	625	719	1970						
		B	673	679	673	2025						
		C	702	713	664	2079						
		Total	2001	2017	2056	6074	116.1	58.8	58.3	59.0	176.1	58.7
50	40	A	647	668	735	2050						
		B	595	733	716	2044						
		C	635	642	853	2130						
		Total	1877	2043	2304	6224	119.0	57.7	56.5	59.3	173.5	57.8
150	0	A	506	443	614	1563						
		B	544	597	662	1803						
		C	578	373	521	1472						
		Total	1628	1413	1797	4838	92.5	54.1	53.7	56.6	164.4	54.8
150	20	A	574	493	620	1687						
		B	515	542	520	1577						
		C	440	606	618	1664						
		Total	1529	1641	1758	4928	94.2	54.1	55.2	54.0	163.3	54.4

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Table 1 (con't)

Treatment N	P		Grams I	II	III	Total	Yield Bu/A.	Bushel Weights I	II	III	Total	$\bar{x}$
0	20	A	672	713	652	2037						
		B	635	642	743	2020						
		C	671	607	697	1975						
		Total	1978	1962	2092	6032	115.3	58.8	57.8	59.0	175.6	58.5
50	40	A	585	589	569	1743						
	Spr. N	B	683	717	771	2171						
		C	543	591	715	1849						
		Total	1811	1897	2055	5763	110.2	57.0	57.3	59.6	173.9	58.0

$\bar{x}$.....	103.4	$\bar{x}$.....	56.1
S.E.$\bar{x}$.....	7.12418	S.E.$\bar{x}$.....	.83688
C.V.%.....	6.89	C.V.%.....	1.49

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	216273.85	42.06*
Treatment	19	34133.13684	6.64*
Trt. x Rep.	38	7239.90263	1.41
Error	120	5141.38917	
Total	179		

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	48258.25	22.97*
Treatment	19	9.34326	4.45*
Error	38	2.10114	
Total	59		

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Table 2. Summary data from fertilizer study grown on the Popham farm by Erickson, Corvallis Montana, in 1967. Gaines winter wheat (Fall applications only)

N #/Acre	Bushels per Acre P_2O_5 #/Acre			
	0	20	40	$\bar{x}$ N
0	113.3	115.3	98.3	108.9
50	113.9	114.8	119.0	115.8
100	103.0	101.2	106.7	103.6
150	92.5	94.2	84.9	90.5
$\bar{x}$ P_2O_5	105.7	106.4	102.2	104.8

S.E.$\bar{x}$..... 7.3077
C.V.%..... 6.97

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	149,717.36	27.67
Trt. x Rep.	22	7,987.65363	1.48
Nitrogen	3	104,696.24	19.35
P_2O_5	2	5,950.71	1.10
N x P	6	10,792.76333	2.00
Error	72	5,409.68611	
Total	107		

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Table 3. Data from fertilizer study grown on the Popham farm by Erickson, Corvallis, Montana in 1967. Gaines winter wheat. (Fall application only)

N #/Acre	Bushel Weights			
	P_2O_5 #/Acre			
	0	20	40	$\bar{x}$ N
0	56.9	58.5	58.5	58.0
50	57.0	57.1	57.8	57.3
100	55.3	56.5	56.2	56.0
150	54.8	54.4	53.9	54.4
$\bar{x}$ P_2O_5	56.0	56.6	56.6	56.4

S.E.$\bar{x}$..... .91172
C.V.%..... 1.60

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	36.605	14.67*
Nitrogen	3	22.94916	9.20*
P_2O_5	2	1.5580	N.S.
N x P	6	1.18916	N.S.
Error	22	2.49371	
Total	35		

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Table 4. Protein data from fertilizer study on Gaines wheat grown on the Popham farm by Erickson at Corvallis, Montana in 1967.

N	P	Percent Protein I	II	III	Total	$\bar{x}$
0	0	9.9	8.7	7.1	25.7	8.6
50	0	10.1	10.2	8.4	28.7	9.6
100	0	12.3	11.4	9.7	33.4	11.1
150	0	11.2	12.3	10.8	34.3	11.4
0	20	7.7	8.2	8.3	24.2	8.1
0	40	9.8	7.7	7.2	24.7	8.2
50	20	11.4	9.7	8.2	29.3	9.8
50	40	9.6	10.2	8.2	28.0	9.3
100	20	11.0	12.0	10.0	33.0	11.0
100	40	11.4	10.4	10.3	32.1	10.7
150	20	11.5	11.1	10.4	33.0	11.0
150	40	12.5	12.4	10.9	35.8	11.9
50	40 Spr. N	10.3	9.9	6.3	26.5	8.8
100	40 Spr. N	11.2	11.9	10.1	33.2	11.1
150	40 Spr. N	11.5	11.8	11.7	35.0	11.7
100	40 50 N Fall	11.8	10.6	9.7	32.1	10.7
150	40 50 N Fall	12.4	12.0	11.2	35.6	11.9
100	40 200 # gyp	10.3	9.2	10.5	30.0	10.0
100	40 90 K_2O	11.1	12.0	8.6	31.7	10.6
0	0	8.3	8.2	7.3	23.8	7.9

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	8.76844	14.64*
Treatments	19	5.12262	8.56*
Error	38	.59880	
Total	59		

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Table 5. Protein data from twelve treatments in the fertilizer study on Graines wheat grown on the Popham farm by Erickson, Corvallis, Montana in 1967.

N #/Acre	Protein in Percent			
	P_2O_5 #/Acre			$\bar{x}$ N
	0	20	40	
0	8.6	8.1	8.2	7.7
50	9.6	9.8	9.3	9.6
100	11.1	11.0	10.7	10.9
150	11.4	11.0	11.9	11.5
$\bar{x}$ P_2O_5	10.2	10.0	10.1	)10.1

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	8.23697	17.38*
N	3	18.36334	38.74*
P	2	.14196	N.S.
N x P	6	.33193	N.S.
Error	22	.47391	
Total	33		

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TITLE: Fertilizer Study on Ingrid Barley at High Levels of Fertility

PROJECT: Small Grains Investigations MS 756

YEAR: 1967

PERSONNEL: Vern R. Stewart, Don R. Graham

LOCATION: Harold Small Farm, Route 4, Kalispell, Montana and the Quast Farm, Corvallis, Montana

DURATION: Three years

OBJECTIVE: To determine the optimum fertilizer levels for the production of Ingrid barley under irrigation.

ABSTRACT:

(Small Farm) This fertilizer study was designed to obtain maximum yields from the variety Ingrid. High moisture and mature harvest were made. Yield and chemical analysis were made of the data where applicable.

Grain yields between treatments were not statistically significant at high moisture harvest, but quite significant at mature harvest. The addition of potassium to each treatment gave a small increase in yield. Without potassium both nitrogen and potassium affected yields significantly, with potassium, only nitrogen rates affected yields significantly.

Protein levels were affected by nitrogen rates but no response from phosphorus levels. The reverse of the foregoing was true for phosphorus content of mature grain.

(Quast Farm) Good moisture and soil conditions were found on the Quast farm for seeding of a maximum yield fertility study. High moisture harvest resulted in an 11.4 bushel increase over the mature harvest. Nitrogen increased barley yields at mature harvest and also increased protein levels. Phosphorus had no effect on yield, protein levels or phosphorus content of barley seed. Potassium had no significant effect on yields.

FUTURE PLANS: This study to be continued in its present form one more season.

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FERTILIZER STUDY ON INGRID BARLEY AT HIGH LEVELS OF FERTILITY

INTRODUCTION:

Maximum yields of Ingrid barley are being studied in this fertilizer study. The studies were located in two areas in 1967. One on the Harold Small farm near the Northwestern Montana Branch Station, the second in Ravalli County on the Quast farm near Corvallis, Montana.

MATERIAL AND METHODS:

Commercial fertilizers used were measured by volume and applied to an area 20 x 12 feet prior to seeding. The materials were applied by hand spreading. Combinations of materials were mixed before application.

Ingrid barley was seeded in 12 row plots, 20 feet long, with a nursery type seeder, with a seeding rate of 50 pounds per acre.

The plots were harvested with a power harvester. Two adjacent rows were harvested at high moisture, and bundles weighed to determine total bundle weight. These were threshed following harvest. The grain was cleaned and weighed and a sample taken to determine moisture content.

For the mature harvest, rows six and nine in each plot were harvested for yield, giving two samples (cells) per plot. Moisture determinations were made on these at harvest time following cleaning and weighing.

Samples from three replications were taken from each plot for chemical analysis. This sample consisted of the total plant (50 stems). Grain samples were also analyzed chemically.

The data were analyzed using the analysis of variance technique. Where possible interaction between nitrogen and phosphorus levels were calculated.

RESULTS AND DISCUSSION:

Study on the Small Farm:

Seeding of this study was made May 17, 1967, which is twelve days later than the optimum seeding date for this area of Montana. The seed bed was excellent and moisture good. The study was irrigated once during the growing season.

The harvest of the total barley plant at the high moisture stage did not result in differences that were statistically significant. However, the highest dry weight was secured from the 120-0-K treatment. This was 3348 pounds per acre more than the 120-0-0 treatment. Table 1. Grain yields on a dry matter basis at this stage of harvest were not found to be significant. However, the highest grain yield was from the 40-46-0 treatment. This was 19.4 bushels above the check treatment. Table 2 gives the complete data of the high moisture grain harvest.

Results and Discussion (con't) (Small Farm)

A comparison of potassium treatments is made in Table 3, from grain yields obtained at a high moisture harvest. The data are not statistically significant, however a slight yield increase is noted when potassium is added to the treatments.

In an overall analysis of the data yields of mature harvested grain were found to be significant. Because of this evidence a further analysis was made to determine the interaction between nitrogen and phosphorus. Then analysis were made with potassium and without potassium. Table 4

Using six treatments in the analysis with potassium, the yields were 2.6 bushels per acre higher than the same six treatments without potassium. Response to nitrogen and phosphorus were significant when potassium was not included in the treatments. With potassium the phosphorus response is not significant, also a slight reduction in yield is noted. Table 5

An analysis of bushel weight data shows no significant difference between treatments. Table 4

Chemical analysis for nitrogen, phosphorus and potassium of total plant at the high moisture harvest showed no significant difference between treatments. Protein difference in treatments was found to be significant in mature harvested grain. Using six treatments with potassium and six without potassium analysis were made. The data show that nitrogen was statistically significant in its effect on nitrogen, both with and without potassium. The highest protein was obtained with 80 pounds of nitrogen per acre. Phosphorus levels did not affect the protein levels in the study. Table 8

The phosphorus content of the mature barley was affected significantly by the rate of phosphorus fertilizer applied. The nitrogen rates had no effect on the phosphorus content.

A yield increase of 4.2 bushels per acre of barley was obtained with the high moisture harvest when compared with the mature harvest. Table 2 and 3.

Study on the Quast Farm:

An early seeding date of May 2, 1967 established this study. Moisture was good and there was an excellent seed bed.

The first replication of the study was abandoned because of a soil variation running through it. This was also found in all replications, but in the harvesting of the plot these areas were avoided.

Total plant weights were secured. The analysis of these data show a high error factor. These variations are due in part to the variation between plots, however no significant variation is indicated by replications. Forty pounds of nitrogen plus forty-six pounds of phosphorus plus potassium gave the greatest yield of total plant when harvested at high moisture. Table 9

An overall analysis of the total study indicated no significant differences in yield of grain harvested at high moisture. The mean for the harvest was 99.0 bushels per acre which is 11.4 bushels per acre more than the yield at mature harvest.

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Results and Discussion (con't) (Quast Farm)

Differences due to treatment were found in the overall analysis of the mature harvested barley. The highest yielding treatment was 80 nitrogen alone. The over all data is seen in Table 10. Only 1.1 bushel difference was found between all potassium treatments and those with no potassium.

Using six treatments with potassium in an analysis it was found that nitrogen affected the yield of mature harvested barley. Phosphorus had no effect that was statistically significant. This was also true of the plots which received no potassium. See Table 12 for details of these calculations.

The protein analysis are found in Table 13 and 14. No significant differences in protein were found in the high moisture harvest of Ingrid barley. Protein levels were increased because of nitrogen rates in a linear relationship with or without potassium.when harvested as mature barley.

Fertilizer rates did not affect significantly the phosphorus or potassium level of mature harvested grain or when harvested at high moisture levels.

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Table 1. Bundle weight from fertilizer study on Ingrid barley grown on the Harold Small farm, Route 4, Kalispell, Montana.

Seeded: May 17, 1967 Harvested: August 18,1967
Size of Plot: 132 square feet

Treatment N	P	K	Bundle Weights in Pounds (Green) I	II	III	IV	Total	$\bar{x}$	Pounds Dry Matter	#/Acre
0	0	0	16.50	11.00	7.25	9.25	44.00	11.00	5.18	7051
0	0	K	12.75	9.25	7.75	10.75	40.50	10.12	5.40	7350
40	0	K	12.25	11.25	8.25	12.25	44.00	11.00	5.87	7990
80	0	K	13.50	8.25	12.00	10.00	43.75	10.94	5.59	7609
120	0	K	12.00	12.25	12.50	17.00	53.75	13.44	8.01	10903
40	46	K	15.50	10.50	11.50	9.00	46.50	11.62	5.44	7405
80	46	K	8.75	11.75	9.00	11.25	40.75	10.19	5.60	7623
120	46	K	13.00	10.00	12.75	12.50	48.25	12.06	6.40	8712
40	0	0	14.75	8.50	13.25	9.25	45.75	11.44	5.72	7786
80	0	0	12.25	10.75	11.75	8.75	43.50	10.87	5.34	7269
120	0	0	15.75	15.00	8.50	11.00	50.25	12.56	5.55	7555
40	46	0	16.00	11.50	10.00	8.25	45.75	11.44	6.01	8181
80	46	0	9.50	9.50	7.50	14.25	40.75	10.19	5.92	8059
120	46	0	15.25	9.00	13.50	10.75	48.50	12.12	6.00	8168

$\bar{x}$..... 7975
S.E.$\bar{x}$..... 790
L.S.D..... N.S.
C.V.%..... 10.09

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	27.17262	5.04
Treatments	13	3.65247	N.S.
Error	39	5.38736	
Total	55		

Table 2. Grain yields of barley harvested at high moisture. Grown on the Harold Small farm, Route 4, Kalispell, Montana in 1967.
Plot Size: 32 square feet

Treatment			Yield Grams per Plot Dry Weight					% Moisture					Dry	
N	P	K	I	II	III	IV	Total	I	II	III	IV	$\bar{x}$	Bu/A	Bu/A[1]
0	0	0	1629	1402	994	925	4950	41	34	32	47	38.5	77.4	86.7
0	0	K	1518	1275	960	1282	5035	34	29	18	32	28.3	78.7	88.1
40	0	K	1501	1373	1115	1444	5433	34	30	19	34	29.3	84.9	95.0
80	0	K	1542	1063	1008	1230	4843	37	25	45	30	34.3	75.7	84.8
120	0	K	1156	1377	1379	1678	5590	40	36	32	34	35.5	87.4	97.9
40	46	K	1708	1215	2053	1080	6056	35	35	30	28	32.0	94.7	106.1
80	46	K	1003	1115	981	888	3987	29	43	23	45	35.0	62.3	69.8
120	46	K	1390	1187	1338	1323	5238	37	27	35	27	31.5	81.9	91.7
40	0	0	1616	876	1489	1182	5163	38	42	35	30	36.3	80.7	90.4
80	0	0	1348	1371	1074	1001	4794	40	30	43	36	37.3	74.9	83.9
120	0	0	1493	1647	937	1128	5205	41	38	34	36	37.3	81.4	91.2
40	46	0	1517	1334	1174	1083	5108	41	39	39	24	35.8	79.8	89.4
80	46	0	1068	1065	933	1521	4587	33	42	24	37	34.0	71.7	80.3
120	46	0	1517	1013	1477	1111	5118	40	33	38	39	37.5	80.0	89.6

1/ Corrected to 12% moisture

$\bar{x}$.....	79.4	88.9
S.E.$\bar{x}$....	7.6282	
C.V.%....	9.61	

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	160,565.7666	2.69
Treatment	13	57,337.82307	N.S.
Error	39	59,547.9743	
Total	55		

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Table 3. Summary of fertilizer data from the Harold Small farm, Route 4, Kalispell, Montana in 1967. (High moisture grain harvest)

N/Acre	Yield Bushels per Acre P_2O_5		
	0	46	x N
	WITHOUT K		
40	90.4	89.4	89.9
80	83.9	80.3	82.1
120	91.2	89.6	90.4
$\bar{x}$ P_2O_5	88.5	86.4	/$\bar{x}$ 87.5 Check - 86.7
	WITH K		
40	95.0	106.1	100.6
80	84.8	69.8	77.3
120	97.9	91.7	94.8
$\bar{x}$ P_2O_5	92.6	89.2	/$\bar{x}$ 90.9 Check + K 88.1

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Table 4. Agronomic data from fertilizer study on Ingrid barley grown on the Harold Small farm, Route 4, Kalispell, Montana in 1967. Mature harvest. Plot size: 16 square feet.

Treatment				Grams/Plot					Yield
N	P	K		I	II	III	IV	Total	Bu/A.
0	0	0	A	862	692	588	500	2642	
			B	828	605	475	421	2329	
			Total	1690	1297	1063	921	4971	77.7
0	0	K	A	810	678	501	682	2671	
			B	914	640	525	636	2715	
			Total	1724	1318	1026	1318	5386	84.2
40	0	K	A	643	763	681	815	2902	
			B	757	638	742	753	2890	
			Total	1400	1401	1423	1568	5792	90.5
80	0	K	A	832	586	617	501	2536	
			B	836	634	637	541	2648	
			Total	1668	1220	1254	1042	5184	81.0
120	0	K	A	762	663	605	952	2982	
			B	596	743	759	834	2932	
			Total	1358	1406	1364	1786	5914	92.4
40	46	K	A	880	630	696	551	2757	
			B	817	673	706	422	2618	
			Total	1697	1303	1402	973	5375	84.0
80	46	K	A	674	698	548	751	2671	
			B	524	745	613	685	2567	
			Total	1198	1443	1161	1436	5238	81.9
120	46	K	A	728	584	653	832	2797	
			B	679	608	724	748	2759	
			Total	1407	1192	1377	1580	5556	86.8
40	0	0	A	733	588	639	649	2609	
			B	806	617	808	495	2726	
			Total	1539	1205	1447	1144	5335	83.4
80	0	0	A	841	694	674	618	2827	
			B	807	656	690	570	2723	
			Total	1648	1350	1364	1188	5550	86.8
120	0	0	A	880	874	478	721	2953	
			B	851	744	518	679	2792	
			Total	1731	1618	996	1400	5745	89.8

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Table 4 (con't) Grams per plot

Treatment N	P	K		Grams/Plot I	II	III	IV	Total	Yield Bu/A.
40	46	0	A	903	633	585	427	2548	
			B	888	640	612	506	2646	
			Total	1791	1273	1197	933	5194	81.2
80	46	0	A	558	585	480	815	2438	
			B	579	520	442	704	2245	
			Total	1137	1105	922	1519	4683	73.2
120	46	0	A	825	579	772	662	2838	
			B	894	440	821	587	2742	
			Total	1719	1019	1593	1249	5580	87.2

$\bar{x}$..... 84.3
S.E.$\bar{x}$..... 3.5520
C.V.%..... 4.21

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	130,198.8066	4.03*
Treatments	13	13,788.08461	4.26*
Treatment x Reps.	39	25,487.64051	7.89*
Error	57	3,229.88596	
Total	112		

Table 4. Bushel Weights and Sieve Size

Treatment N	P	K	Bushel Weights I	II	III	IV	Total	$\bar{x}$	Sieve Size I	II	III	IV	$\bar{x}$
0	0	0	54.7	53.7	54.1	51.3	213.8	53.5	97	98	98	97	98
0	0	K	55.5	54.2	54.4	55.1	219.2	54.8	97	97	97	97	97
40	0	K	54.1	54.9	55.0	54.5	218.5	54.6	97	98	99	95	97
80	0	K	54.8	54.2	52.5	53.0	214.5	53.6	97	97	97	98	97
120	0	K	53.8	54.5	54.3	55.7	218.3	54.6	94	96	99	99	97
40	46	K	55.4	54.3	55.1	53.7	218.5	54.6	99	97	99	96	98
80	46	K	53.6	54.2	53.7	52.0	213.5	53.4	97	95	93	94	95
120	46	K	53.7	54.3	53.8	55.1	216.9	54.2	95	96	98	97	97
40	0	0	54.5	52.1	54.3	54.0	214.9	53.7	97	97	96	98	97
80	0	0	54.1	54.1	50.4	53.2	211.8	53.0	97	97	90	98	96
120	0	0	54.5	53.7	52.2	53.5	213.9	53.5	97	96	95	92	95
40	46	0	54.8	53.2	53.0	53.6	214.6	53.7	97	98	96	98	97
80	46	0	54.1	52.4	53.0	55.2	214.7	53.7	97	96	97	98	97
120	46	0	55.1	53.2	54.8	53.3	216.4	54.1	99	95	98	98	98

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Table 4 (con't) Bushel Weights and Sieve Size

$\bar{x}$..... 53.9
S.E.$\bar{x}$..... 4.95279
C.V.%..... 9.19

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	3	204.35	2.08
Treatments	13	130.39154	1.32
Error	39	98.1205	
Total	55		

Table 5. Summary of fertilizer data from the Harold Small farm, Route 4, Kalispell, Montana in 1967. (Mature harvest)

N #/Acre	Yields Bu/Acre P_2O_5 0	P_2O_5 46	$\bar{x}$ N	
		WITHOUT K		
40	83.4	81.2	82.3	
80	86.8	73.2	80.0	
120	89.8	87.2	88.5	
$\bar{x}$ P_2O_5	86.6	80.5	/$\bar{x}$ - 83.5	Check 77.7
				C.V.% 3.87
		WITH K		
40	90.5	84.0	87.3	
80	81.0	81.9	81.5	
120	92.4	86.8	89.6	
$\bar{x}$ P_2O_5	87.9	84.2	/$\bar{x}$ - 86.1	Check + K 84.2
				C.V.% 4.39

Analysis of Variance

Source	D.F.	WITH K Mean Square	F.	WITHOUT K Mean Square	F.
Replications	3	11,095.1366	3.03*	88,474.5266	31.04*
Reps. x Trt.	15	23,407.082	6.39*	29,464.64133	10.34*
N	2	18,178.53	4.97*	19,1932.84	6.99
P	1	10,830.04	2.96N.S.	28,665.20	10.06
N x P	2	4,115.25	1.13	10,631.20	3.73
Error	25	3,660.49		2,849.90	
Total	48				

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Table 6. Chemical analysis of Ingrid barley harvest from fertilizer study grown on the Harold Small farm, Route 4, Kalispell, Montana in 1967. Total plants harvested at High Moisture.

Treatment	% Protein					% Phosphorus					% Potassium				
	I	II	III	Total	x	I	II	III	Total	x̄	I	II	III	Total	x̄
0- 0-0	10.0	7.9	9.0	26.9	9.0	.20	.17	.19	.56	.19	1.22	.94	.95	3.11	1.04
0- 0-K	8.1	7.8	9.2	25.1	8.4	.17	.18	.20	.55	.18	1.04	1.08	1.15	3.27	1.09
40- 0-K	9.1	8.8	11.0	28.9	9.6	.19	.17	.19	.55	.18	.89	1.33	1.21	3.43	1.14
80- 0-K	9.4	11.0	10.0	30.4	10.1	.18	.17	.20	.55	.18	.83	1.08	1.26	3.17	1.06
120- 0-K	10.7	9.9	9.7	30.3	10.1	.16	.16	.17	.49	.16	1.19	1.51	1.31	4.01	1.34
40-46-K	9.8	10.7	10.1	30.6	10.2	.19	.19	.20	.58	.19	1.21	1.25	1.22	3.68	1.23
80-46-K	10.9	10.8	9.8	31.5	10.5	.20	.19	.19	.58	.19	1.16	1.35	1.19	3.70	1.23
120-46-K	10.5	10.4	9.9	30.8	10.3	.19	.18	.20	.57	.19	.91	1.20	1.30	3.41	1.14
40- 0-0	7.1	9.4	10.0	26.5	8.8	.20	.17	.17	.54	.18	1.01	1.50	1.25	3.76	1.25
80- 0-0	10.1	9.0	10.0	29.1	9.7	.17	.17	.16	.50	.17	1.06	1.08	1.41	3.55	1.18
120- 0-0	9.8	9.9	9.8	29.5	9.8	.15	.20	.16	.51	.17	1.15	1.02	1.08	3.25	1.08
40-46-0	9.5	9.2	8.2	26.9	9.0	.18	.19	.21	.58	.19	1.45	1.16	1.30	3.91	1.30
80-46-0	11.0	10.3	9.1	30.4	10.1	.20	.16	.17	.53	.18	1.05	1.10	1.22	3.37	1.12
120-46-0	10.0	10.1	9.8	29.9	10.0	.21	.16	.18	.55	.18	1.22	1.14	1.42	3.78	1.26

Analysis of Variance

Source	D.F.	Protein		Phosphorus		Potassium	
		Mean Square	F.	Mean Square	F.	Mean Square	F.
Replications	2	.06857		.00040	1.82NS	.06712	3.01*
Treatment	13	1.25575	1.87NS	.00028	1.27NS	.02676	1.20NS
Error	26	.67267		.00022		.02230	
Total	41						

Table 7. Chemical analysis of Ingrid barley harvested from fertilizer study grown on the Harold Small farm, Route 4, Kalispell, Montana in 1967. (Mature grain)

Treatment	% Protein-Mature Harvest						% Phosphorus-Mature Harvest						% Potassium-Mature Harvest					
	I	II	III	IV	Total	$\bar{x}$	I	II	III	IV	Total	$\bar{x}$	I	II	III	IV	Total	$\bar{x}$
0- 0-0	12.2	10.5	13.8	13.0	49.5	12.4	.33	.26	.28	.28	1.15	.29	.45	.44	.41	.49	1.79	.45
0- 0-K	12.2	11.2	11.7	12.5	47.6	11.9	.27	.30	.28	.29	1.14	.29	.40	.43	.48	.41	1.72	.43
40- 0-K	12.0	12.3	12.9	13.1	50.3	12.6	.28	.27	.27	.29	1.11	.28	.44	.43	.41	.44	1.72	.43
80- 0-K	13.4	13.0	14.2	14.5	55.1	13.8	.30	.26	.27	.26	1.09	.27	.41	.44	.43	.41	1.69	.42
120- 0-K	13.8	13.5	14.5	13.7	55.5	13.9	.31	.27	.29	.27	1.14	.29	.41	.40	.40	.40	1.61	.40
40-46-K	13.1	11.7	13.3	13.3	51.4	12.9	.31	.30	.31	.27	1.19	.30	.40	.44	.44	.42	1.70	.43
80-46-K	14.7	13.7	14.7	13.8	56.9	14.2	.33	.32	.31	.31	1.27	.32	.42	.48	.45	.46	1.81	.45
120-46-K	13.8	14.3	14.4	12.6	55.1	13.8	.32	.28	.32	.32	1.24	.31	.43	.41	.40	.40	1.64	.41
40- 0-0	12.6	13.6	14.4	14.1	54.7	13.7	.29	.27	.31	.27	1.14	.29	.41	.45	.40	.41	1.67	.42
80- 0-0	13.5	12.4	13.8	14.1	53.8	13.5	.33	.27	.28	.25	1.13	.28	.42	.43	.47	.42	1.74	.44
120- 0-0	12.7	13.1	14.1	14.1	54.0	13.5	.30	.32	.27	.28	1.17	.29	.39	.46	.42	.42	1.69	.42
40-46-0	12.3	12.9	13.5	15.2	53.9	13.5	.28	.30	.30	.32	1.20	.30	.45	.46	.45	.42	1.78	.45
80-46-0	14.8	13.6	15.6	13.3	57.3	14.3	.33	.28	.31	.33	1.25	.31	.44	.45	.45	.41	1.75	.44
120-46-0	13.5	14.1	14.1	14.6	56.3	14.1	.32	.27	.32	.31	1.22	.31	.43	.43	.42	.42	1.70	.43
$\bar{x}$						13.4						.29						.43
S.E.$\bar{x}$						.34121						.00948						.01037
L.S.D.						1.0						.03						N.S.
C.V.%						2.54						3.23						2.42

Table 8. Partial summary of chemical analysis from Ingrid barley grown in a fertilizer study on the Harold Small farm, Route 4, Kalispell, Montana in 1967. (Mature Harvest)

N #/Acre	% Protein P_2O_5 0	P_2O_5 46	$\bar{x}$ N
		WITH K	
40	12.6	12.9	12.7
80	13.8	14.2	14.0
120	13.9	13.8	13.8
$\bar{x}$ P_2O_5	13.4	13.6	/$\bar{x}$ 13.5
			Check + K - 11.9
			S.E.$\bar{x}$ .28875
			C.V.% 2.13
		WITHOUT K	
40	13.7	13.5	13.6
80	13.5	14.3	13.9
120	13.5	14.1	13.8
$\bar{x}$ P_2O_5	13.5	14.0	/$\bar{x}$ 13.6
			Check - 12.4
			S.E.$\bar{x}$ .36354
			C.V.% 2.6
		% PHOSPHORUS - WITH K	
40	.28	.30	.29
80	.27	.32	.30
120	.29	.31	.30
$\bar{x}$ P_2O_5	.28	.31	/$\bar{x}$ - .29
			Check + K - .29
			S.E.$\bar{x}$ .00671
			C.V.% 2.28
		WITHOUT K	
40	.29	.30	.29
80	.28	.31	.30
120	.29	.31	.30
$\bar{x}$ P_2O_5	.29	.31	/$\bar{x}$ - .30
			Check - .29
			S.E.$\bar{x}$ .01183
			C.V.% 3.94

Table 9. Bundle weights from fertilizer study grown on the Quast farm, Corvallis, Montana in 1967, variety Ingrid barley.
Plot Size: 32 square feet

Treatment			Bundle Weight in Pounds (Green Wt.)					# Dry	
N	P	K	II	III	IV	Total	$\bar{x}$	Matter	#/Acre
0	0	0	10.75	8.00	12.75	31.50	10.50	7.09	9,651
0	0	K	12.50	7.25	13.75	33.50	11.17	7.23	9,842
40	0	K	9.75	6.75	11.00	27.50	9.17	7.47	10,169
80	0	K	11.25	14.50	8.75	34.50	11.50	7.91	10,767
120	0	K	10.75	17.25	6.50	34.50	11.50	8.52	11,598
40	46	K	13.50	18.50	7.25	39.25	13.08	9.01	12,265
80	46	K	13.00	7.00	19.00	39.00	13.00	8.40	11,435
120	46	K	9.25	12.00	6.25	27.50	9.17	6.97	9,483
40	0	0	8.25	9.25	8.00	25.50	8.50	6.24	8,494
80	0	0	11.75	18.50	11.50	41.75	13.92	9.47	12,891
120	0	0	14.25	8.00	15.00	37.25	12.42	7.53	10,250
40	46	0	11.50	18.75	7.75	38.00	12.67	9.17	12,483
80	46	0	10.25	8.25	14.75	33.25	11.08	8.12	11,053
120	46	0	9.50	12.25	11.75	33.50	11.17	8.66	11,788

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Table 10 . Agronomic data from Ingrid barley fertilizer study on Quast farm, Corvallis, Montana in 1967. Harvested at high moisture level.
Plot Size: 32 square feet

Treatment N	P	K	Yield Grams/Plot Dry II	III	IV	Total	x	% Moisture	Sieve Size	Dry Bu/A	Yield± Bu/A.
0	0	0	1547	1154	1627	4328	1443	16.8	90	90.2	101.0
0	0	K	1582	1182	1702	4466	1489	16.5	71	93.1	104.3
40	0	K	1415	1096	1547	4058	1353	14.0	93	84.6	94.8
80	0	K	1545	1628	1041	4214	1405	17.2	86	87.8	98.3
120	0	K	1368	1602	810	3780	1260	18.3	79	78.8	88.3
40	46	K	1727	1880	935	4542	1514	19.8	82	94.7	106.0
80	46	K	1679	904	1706	4289	1430	20.5	89	89.4	100.1
120	46	K	1343	1576	733	3652	1217	15.7	74	76.1	85.2
40	0	0	1321	1258	1148	3727	1242	14.9	81	77.7	87.0
80	0	0	1583	1815	1455	4853	1618	21.2	92	101.1	113.2
120	0	0	1669	1016	1674	4359	1453	22.8	84	90.8	101.7
40	46	0	1563	1901	933	4397	1466	19.5	83	91.6	102.6
80	46	0	1451	1148	1660	4259	1420	18.1	88	88.8	99.5
120	46	0	1390	1673	1280	4343	1448	16.7	87	90.5	101.4

1/ Corrected to 12% moisture
No significance when harvested at high moisture

$\bar{x}$.....88.4 99.0
S.E.$\bar{x}$..12.2276
C.V.%..13.83

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	153,831.55	N.S.
Treatment	13	36,709.46923	N.S.
Error	26	114,753.4730	
Total	41		

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Table 11. Agronomic data from the fertilizer study grown on the Quast farm, Corvallis, Montana in 1967. Variety Ingrid, harvest of mature barley.

Treatment				Grams				x̄	Bushel Weight				Seive Size			
N	P	K		I	II	III	Total	Bu/A	I	II	III	x̄	I	II	III	x̄
0	0	0	A	817	606	745	2168									
			B	779	522	770	2071									
			Total	1596	1128	1515	4239	88.3	52.5	52.3	54.0	52.9	91	73	96	87
0	0	K	A	909	464	809	2182									
			B	721	550	892	2163									
			Total	1630	1014	1701	4345	90.6	54.5	52.0	54.3	53.6	98	85	92	92
40	0	K	A	697	591	863	2151									
			B	719	707	711	2137									
			Total	1416	1298	1574	4288	89.4	53.7	53.5	53.5	53.6	93	96	81	90
80	0	K	A	767	877	482	2126									
			B	865	938	311	2114									
			Total	1632	1815	793	4240	88.4	54.2	53.6	48.9	52.2	93	97	66	85
120	0	K	A	758	842	448	2048									
			B	696	870	329	1895									
			Total	1454	1712	777	3943	82.2	52.1	54.6	46.1	50.9	87	95	41	74
40	46	K	A	891	764	361	2016									
			B	865	1035	349	2249									
			Total	1756	1799	710	4265	88.9	55.0	54.0	45.3	51.4	98	94	37	76
80	46	K	A	650	651	723	2024									
			B	817	641	1084	2542									
			Total	1467	1292	1807	4566	95.2	54.1	50.8	54.2	53.0	97	87	94	93
120	46	K	A	711	753	345	1809									
			B	627	720	351	1698									
			Total	1338	1473	696	3507	73.1	51.7	54.0	46.1	50.6	89	92	49	77
40	0	0	A	732	991	574	2297									
			B	615	673	512	1800									
			Total	1347	1664	1086	4097	85.4	53.2	53.9	50.4	52.5	90	81	66	79
80	0	0	A	869	777	733	2379									
			B	746	857	818	2421									
			Total	1615	1634	1551	4800	100.0	54.3	53.7	51.7	53.2	96	95	86	92
120	0	0	A	640	465	873	1978									
			B	776	514	667	1957									
			Total	1416	979	1540	3935	82.0	54.0	48.6	52.7	51.8	94	54	77	75

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Table 11 . (con't)

Treatment N	P	K		Grams I	II	III	Total	$\bar{x}$ Bu/A	Bushel Weight I	II	III	$\bar{x}$	Seive Size I	II	III	$\bar{x}$
40	46	0	A	691	892	388	1971									
			B	778	931	527	2236									
		Total		1469	1823	915	4207	87.7	54.0	54.1	48.4	52.2	91	98	57	82
80	46	0	A	601	532	982	2115									
			B	781	603	969	2353									
		Total		1382	1135	1951	4468	93.1	52.5	50.6	53.8	52.3	78	69	96	81
120	46	0	A	538	613	647	1798									
			B	627	732	594	1953									
		Total		1165	1345	1241	3751	78.2	50.9	52.0	50.5	51.1	66	88	45	66

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	79,726.05	9.57*
Treatment	13	18,321.68461	2.20*
Treatment x Rep.	26	68,526.0115	8.23*
Error	42	8,328.10714	
Total	83		

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Table 12. Summary of fertilizer data from Quast farm, Corvallis, Montana. Mature Harvest.

N #/Acre	Yield Bushel/Acre P_2O_5 #/A 0	46	$\bar{x}$ N
	WITH K		
40	89.4	88.9	89.2
80	88.4	95.2	91.8
120	82.2	73.1	77.7
$\bar{x}$ P_2O_5	86.7	85.7	/$\bar{x}$ 86.2 Check with K - 90.6
	WITHOUT K		
40	85.4	87.7	86.6
80	100.0	93.1	96.6
120	82.0	79.2	80.1
$\bar{x}$ P_2O_5	89.1	86.3	/$\bar{x}$ 87.8 Check without K - 88.3

Analysis of Variance

Source	D.F.	WITH K Mean Square	F.	WITHOUT K Mean Square	F.
Replications	2	230,857.445	25.87*	1,865.445	N.S.
Rep. x Trt.	10	70.887351	7.94*	56,523.67	7.30*
N	2	43,324.36	4.85*	52,971.445	6.84*
P	1	491.36	N.S.	4,578.81	
N x P	2	12,125.165	1.36	4,218.08	
Error	19	8,925.02631		7,741.95315	
Total	36				

S.E.$\bar{x}$..... 6.35204
C.V.%..... 7.24

S.E.$\bar{x}$..... 6.82014
C.V.%..... 7.91

Table 13. Protein analysis of Ingrid barley harvested from fertilizer study grown on the Quast farm, Corvallis, Montana in 1967.

Treatment			High Moisture Harvest					Mature Harvest				
N	P	K	I	II	III	Total	$\bar{x}$	I	II	III	Total	$\bar{x}$
0	0	0	11.2	13.1	12.3	36.6	12.2	9.8	11.0	10.1	30.9	10.3
0	0	K	12.5	10.8	11.3	34.6	11.5	11.9	11.1	12.3	35.3	11.8
40	0	K	11.8	10.3	10.6	32.7	10.9	10.8	10.9	12.6	34.3	11.4
80	0	K	12.4	13.8	13.6	39.8	13.3	11.2	11.9	13.7	36.8	12.3
120	0	K	11.6	12.5	14.1	38.2	12.7	12.8	12.6	15.6	41.0	13.7
40	46	K	13.1	13.0	15.2	41.3	13.8	12.7	11.9	14.7	39.3	13.1
80	46	K	12.7	11.6	12.6	36.9	12.3	12.9	11.7	12.3	36.9	12.3
120	46	K	13.3	12.6	16.6	42.5	14.2	11.7	13.0	15.9	40.6	13.5
40	0	0	10.3	13.6	12.0	35.9	12.0	10.9	11.6	11.8	34.3	11.1
80	0	0	12.0	12.6	12.4	37.0	12.3	11.7	12.6	13.0	37.3	12.4
120	0	0	13.8	14.7	11.6	40.1	13.4	13.5	14.1	13.4	41.0	13.7
40	46	0	11.8	12.7	15.2	39.7	13.2	12.1	13.1	14.0	39.2	13.1
80	46	0	10.9	13.9	12.2	37.0	12.3	13.6	12.1	13.4	39.1	13.0
120	46	0	12.6	12.4	13.3	38.3	12.7	13.2	11.9	14.9	40.0	13.3

$\bar{x}$..... 12.63
S.E.$\bar{x}$.... .6954
L.S.D. 5% N.S.
C.V.%.... 5.50

$\bar{x}$..... 12.52
S.E.$\bar{x}$.... .50038
L.S.D. 5% 1.5
C.V.%.... 4.00

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	3.04667	2.10
~~Varieties~~ Trt	13	2.33076	1.62
Error	26	1.45076	
Total	41		

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	8.20167	10.9*
~~Varieties~~ Trt	13	3.04483	4.05**
Error	26	.75115	
Total	41		

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Table 14. Summary of protein data from Quast farm, Corvallis, Montana. Mature Harvest.

N #/Acre	% Protein		
	P_2O_5 #/A		$\bar{x}$ N
	0	46	
	WITH K		
40	11.4	13.1	12.3
80	12.3	12.3	12.3
120	13.7	13.5	13.6
$\bar{x}$ P_2O_5	12.5	12.9	/$\bar{x}$ - 12.7
	WITHOUT K		
40	11.1	13.1	12.1
80	12.4	13.0	12.7
120	13.7	13.3	13.5
$\bar{x}$ P_2O_5	12.4	13.1	/$\bar{x}$ - 12.8

ANALYSIS OF VARIANCE

Source	D.F.	WITHOUT K Mean Square	F.	WITH K Mean Square	F.
Replications	2	1.57639	2.57	9.03166	12.78*
N	2	2.39305	3.91*	3.51166	4.97*
P	1	1.82333	2.98	1.22722	1.74
N x P	2	1.44250	2.35	1.48389	2.10
Error	10	.61277		.70633	
Total	17				

S.E.$\bar{x}$..... .45090 S.E.$\bar{x}$..... .48522
C.V.%..... 3.51 C.V.%..... 3.82

Table 15. Phosphorous analysis of Ingrid barley harvested from fertilizer study grown on the Quast farm, Corvallis, Montana in 1967.

Treatment			High Moisture Harvest					Mature Harvest				
N	P	K	I	II	III	Total	$\bar{x}$	I	II	III	Total	$\bar{x}$
0	0	0	.37	.38	.34	1.09	.36	.35	.37	.34	1.06	.35
0	0	K	.38	.37	.36	1.11	.37	.35	.36	.31	1.02	.34
40	0	K	.40	.37	.36	1.13	.38	.36	.36	.34	1.06	.35
80	0	K	.40	.34	.38	1.12	.37	.36	.35	.40	1.11	.37
120	0	K	.39	.35	.40	1.14	.38	.36	.35	.39	1.10	.37
40	46	K	.37	.35	.41	1.13	.38	.34	.34	.40	1.08	.36
80	46	K	.34	.39	.33	1.06	.35	.32	.36	.34	1.02	.34
120	46	K	.39	.36	.43	1.18	.39	.37	.34	.41	1.12	.37
40	0	0	.36	.38	.38	1.12	.37	.38	.36	.40	1.14	.38
80	0	0	.37	.40	.36	1.13	.38	.36	.35	.37	1.08	.36
120	0	0	.35	.38	.35	1.08	.36	.33	.39	.37	1.09	.36
40	46	0	.38	.40	.41	1.19	.40	.35	.33	.40	1.08	.36
80	46	0	.37	.40	.34	1.11	.37	.36	.38	.35	1.09	.36
120	46	0	.40	.36	.37	1.13	.38	.35	.37	.39	1.11	.37

$\bar{x}$..... .37428
S.E.$\bar{x}$..... .01437
L.S.D...5%. N.S.
C.V.%..... 3.83

$\bar{x}$..... .36095
S.E.$\bar{x}$..... .01329
L.S.D...5%. N.S.
C.V.%..... 3.68

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	.00005	
~~Varieties~~ Trt	13	.00039	
Error	26	.00062	
Total	41		

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	.00140	2.64
~~Varieties~~ Trt	13	.00039	
Error	26	.00053	
Total	41		

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Table 16. Potassium analysis of Ingrid barley harvested from fertilizer study grown on the Quast farm, Corvallis, Montana in 1967.

Treatment			High Moisture Harvest					Mature Harvest				
N	P	K	I	II	III	Total	$\bar{x}$	I	II	III	Total	$\bar{x}$
0	0	0	.49	.50	.48	1.47	.49	.50	.51	.40	1.41	.47
0	0	K	.51	.53	.48	1.52	.51	.44	.52	.40	1.36	.45
40	0	K	.51	.49	.48	1.48	.49	.48	.51	.40	1.39	.46
80	0	K	.45	.43	.50	1.38	.46	.48	.48	.46	1.42	.47
120	0	K	.50	.47	.56	1.53	.51	.46	.48	.51	1.45	.48
40	46	K	.50	.48	.54	1.52	.51	.44	.49	.50	1.43	.48
80	46	K	.51	.52	.48	1.51	.50	.43	.48	.39	1.30	.43
120	46	K	.52	.45	.59	1.56	.52	.50	.47	.51	1.48	.49
40	0	0	.49	.52	.53	1.54	.51	.50	.51	.50	1.51	.50
80	0	0	.48	.47	.49	1.44	.48	.46	.40	.43	1.29	.43
120	0	0	.48	.51	.49	1.48	.49	.42	.52	.40	1.34	.45
40	46	0	.51	.48	.56	1.55	.52	.49	.47	.51	1.47	.49
80	46	0	.50	.52	.47	1.49	.50	.49	.40	.40	1.29	.43
120	46	0	.52	.48	.49	1.49	.50	.49	.49	.46	1.44	.48

$\bar{x}$..... .49904
S.E.$\bar{x}$.... .01788
L.S.D.5%. N.S.
C.V.%.... 3.58

$\bar{x}$..... .46619
S.E.$\bar{x}$..... .02213
L.S.D...5%. N.S.
C.V.%.....4.75

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	.00152	
~~Varieties~~ Trt	13	.00075	
Error	26	.00096	
Total	41		

Analysis of Variance

Source	D.F.	Mean Square	F.
Replications	2	.00393	2.67
~~Varieties~~ Trt	13	.00180	
Error	26	.00147	
Total	41		

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TITLE: Fertilizers on Winter Annuals

PROJECT: Small Grains Investigations MS 756

YEAR: 1967

PERSONNEL: Vern R. Stewart

LOCATION: Rotation R-8 (Robert's Lease)

DURATION: Indefinite

OBJECTIVES: To measure the long term effect of fertilizer in a field rotation with winter cereal crops.

ABSTRACT: The fertilizer study was made using field equipment for all operations. Moisture was the limiting factor in most plots. This is seen in the comparisons of Nugaines and Delmar, where the yields are almost equal.

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FERTILIZERS ON WINTER ANNUALS

INTRODUCTION:

The field plots have been maintained for several years. It is planned that a summary of these studies be made after a given period of time.

MATERIALS AND METHODS:

All applications of fertilizers are made with field equipment. Harvesting is done with field equipment.

Rates used in each field are found in Table 1. Top dressing of nitrogen was done in the early spring in fields R-3a and R-5a. All other fertilizers were fall applied.

RESULTS AND DISCUSSION:

Moisture was no doubt the limiting factor in production this season. The total precipitation for the crop year was 15.38 inches. This is 3.63 inches below the seventeen year average. The yields of Delmar and Nugaines in Field R-5a and R-3a respectively, illustrate the low precipitation and its effect on yields this season.

This difference between Fields R-1a and R-2a, are in part due to location.

Barley yields are low due to reduction in stand. Snow mold no doubt was responsible for the reduction in stand. See Table 1 for complete data.

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Table 1. Yield of winter annuals grown in rotation R, Northwestern Montana Branch Station, Kalispell, Montana in 1966-67.

Field No.	Acres	Fertilizers Type	Fertilizers Amount	Rate/Acre N	Rate/Acre P	Rate/Acre K	Crop	Variety	Yield Bu/A.
R-1a	2.0	16 -20- 0	400	32.0	17.6	0.0	Wheat	Delmar	63.5
R-2a	2.7	0	0	0.0	0.0	0.0	Wheat	Delmar	32.3
R-3a	3.3	16 -20- 0	640	31.0	17.1	0.0	Wheat	Nugaines	52.7
		33.5- 0- 0	370	37.5	0.0	0.0			
R-4a	2.8	16 -20- 0	640	31.0	17.1	0.0	Wheat	Delmar	31.0
R-5a	3.3	16 -20- 0	720	35.0	19.1	0.0	Wheat	Delmar	52.5
		33.5- 0- 0	370	37.5	0.0	0.0			
R-6a	3.3	17 -17-17	800	41.1	18.2	34.3	Barley	Alpine	24.0
R-7a	3.3	23 -23- 0	660	46.0	20.2	0.0	Wheat	Delmar	26.9
R-8a	3.3	23 -23- 0	770	48.8	21.5	0.0	Wheat	Delmar	47.2