TWENTY-SEVENTH ANNUAL REPORT

1975

Research Report No. 97

Northwestern Agricultural Research Center
of the
Agricultural Experiment Station
Montana State University

1570 Montana 35
Kalispell, Montana

Prepared By

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Associate Professor of Agronomy and Superintendent

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Instructor in Agronomy

FISCAL PROJECT REPORT FOR 1975

ADMINISTRATION 750

Activities in this project are concerned with personnel and direction of research projects. We have also included a list of activities by the professional staff members.

Employees during the year of 1975 are listed herein with a brief narration about each.

Vern Stewart - Associate Professor of Agronomy and Superintendent. Began his duties April 1, 1952 at the Northwestern Agricultural Research Center and will complete 24 years April 1, 1976.

Leon Welty - Instructor in Agronomy. Began his duties January 15, 1973 at the Northwestern Agricultural Research Center. In his three years at the research center he has conducted significant research to warrent promoting him to the rank of Assistant Professor.

Jeanette Calbick - Secretary. Jeanette began her duties with the Northwestern Agricultural Research Center September 1963 as a part-time secretary. The job became full-time in November 1974. The State Pay Plan did give Jeanette a significant salary increase which was long overdue.

Nancy Campbell - Ag Research Spec. I. Nancy started on August 15, 1974. She is a very capable young person and does "research detail" very carefully. It has been my attempt to increase her responsibilities each year as she becomes more familiar with the total program.

Harold Gullickson - Farm/Ranch Hand III. Harold's title is a bit misleading in that he really preforms the duties of a foreman. He is very capable in the maintenance of all equipment and seems to have a natural ability to build research equipment when given instructions or plans. Harold has completed two seasons work and will have been with the Northwestern Agricultural Research Center two years in May 1976.

The following persons worked under the Title VI (CTPSA) Program in 1975. This program is to give employment to persons unable to find work. They are encouraged to seek full-time employment while working in this program. In 1975 we had four individuals working in this program at different times.

John Fitzsimmons - a very talented young man. He gave real assistance in two major remodeling programs, which are described later in this report. Because of his mechanical ability we were able to preform a major overhaul on a station pickup. He would have been a very desirable young man to have on the staff if funds were available. John worked from January 22 to April 30, 1975. John went to work for the Bureau of Reclamation.

Greg Price - a novice about farm work in general, but an eager learner, a very competant young man. Employment period was May 12, thru June 5, 1975. Greg left to work for the Anaconda Aluminum Company.

Rick Bark - very young and immature for his age. When working with the "SPEDY" employees (see later) he was more like a "kid" than an adult. He was hard on equipment, did not always arrive to work on time and had many other problems. He worked from June 16, thru August 1, 1975. He found employment at the Superior Lumber Co. in Columbia Falls.

Administration (con't)

Calvin Westphal - is quite talented with his hands. Although slightly built, this does not seem to affect his ability to do the job. He has been a real asset to our program. Calvin began August 11, 1975 and will continue under the program until June 30, 1976 unless he finds employment elsewhere. If funds are available and he has not found other employment, we plan to put him on station funds until October 1976.

Summer employees - this group are usually college students or persons who have completed high school. There were four in this group in 1975.

Ken Kephart - worked a total of four seasons and will complete the requirements for a BS in Agronomy in 1976. Ken increased his value to the research center each year of employment. He was a work study employee.

Norman Sheldon - finished high school in the spring of 1975. This was his first season with us. He was a hard working lad, with a good knowledge of mechanics. He had a few personal problems which I hope I was able to help him overcome. Norman is a work study employee and is majoring in Plant Science at MSU.

Nanette Linke - does excellent work. She has been one of our better employees. Nanette is majoring in Biology at the University of Montana.

Jerrian Robinson - was a very mature individual and very capable. Jerrian will complete the requirements for the BS degree in Animal Science at MSU in 1976.

SPEDY employees - these employees are allowed to work only four days per week. This program is sponsored by the Federal Government to give employment to under privileged young people.

Lyle Barker - (June 23 thru August 14, 1975) I rated him as a fair employee.

Jay Reibe - (June 23 thru August 14, 1975) This was Jay's second year with us. There was some improvement, but we did have to spend some time with him to get him to work.

Rin Smith (July 9 thru August 28, 1975) Rin was not overly ambitious.

Bill Thomas (July 9 thru August 28, 1975) Bill was a good employee. Caused no problems.

Heidi Williams (April 19 and 26, June 30 thru July 9, 1975) Heidi was a good girl, but did not like the work and asked to be moved to another position with another agency.

Terry Braaten (April 26) Terry was to have worked on the program during the summer, but moved and was unable to continue.

Under close supervision most of the young people worked fairly well, however when assigned together they were not too productive. Thus, this program, to be effective, must be closely supervised.

Activities participated in during the calendar year 1975 are made a part of this report. Also a list of the visitors at the research center. This is probably not complete. There are many, many neighbors and farmers that use the truck scale. To date the author has not made a record of the people that have crossed the scale.

ACTIVITIES:

DATE	ACTIVITY	STAFF	LOCATION
Jan. 7	Ag Council	Stewart	Kalispell
9	CRD Meeting	Stewart	Kalispell
13-17	Speaking at Extension Meetings	Welty	Drummond
			Missoula
			Hamilton
			Stevensville
			Plains
			Ronan
			Eureka
			Kalispell
21	Advisory Committee Meeting	Stewart	Polson
		Welty	Polson
Feb. 17-19	Fertilizer-Chemical Meeting	Stewart	Great Falls
21	Potato Growers Meeting	Stewart	Polson
25	Talks at Eastside Grange	Stewart	Creston
		Welty	Creston
Mar. 3- 7	Planning Conference	Stewart	Bozeman
		Welty	Bozeman
14	Talks at County Agents Up-Dating Meeting	Stewart	Ronan
		Welty	Ronan
17-20	Weed Conference	Stewart	Phoenix, AZ
25	Chemical Meeting	Stewart	Kalispell
Apr. 1	Ag Council	Stewart	Kalispell
10	CRD Meeting	Stewart	Kalispell
15	FFA Banquet	Stewart	Kalispell
May 20	Tour by Edgerton Sixth Grade	Stewart	Res. Center
June 18	Talk at Potato Growers Meeting	Stewart	Polson
July 23-24	Summer Staff Conference	Stewart	Corvallis
		Welty	Corvallis
Aug. 26	Harvestor Field Day at Tutvedts	Stewart	Kalispell
26-27	Barley Meeting	Welty	Conrad
Oct. 21	A & I Distributor Meeting	Stewart	Kalispell
		Gullickson	Kalispell
Nov. 11	Ag Council	Stewart	Kalispell
13	Potato Growers Meeting	Stewart	Kalispell
Dec. 5	Talk to Flathead FFA	Welty	Kalispell
8	Ag Res. Center Assoc. Meeting	Stewart	Bozeman
		Welty	Bozeman
9-11	Saline Seep Seminar	Stewart	Bozeman
		Welty	Bozeman

VISITORS:

MONTH	VISITOR	REPRESENTING	ADDRESS
Jan.	Bill Osborne	Liberty Drilling	Kalispell
	Don Mackey	Flathead Rural Electric	Kalispell
	Sam Shafer	Olin Corp.	Bozeman
	P. E. Partello	Olin Corp.	Helena
	Martha Boss	Fuller Brush	Kalispell
	Butch Woolard	Pack & Company	Kalispell
	Alvin Gordon	Farmer	Kalispell
	Jim Christian	Liberty Drilling	Kalispell
	Mable Henry	Liberty Drilling	Kalispell
	Jack Gorton	Equity Supply Co.	Kalispell
	John Fitzsimmins	Job applicant	Columbia Falls
	Les Mahugh	Farmer	Kalispell
	David James	Job applicant	Kalispell
	Peter Weckworth	Job applicant	Kalispell
	Tom Boze	Job applicant	Somers
	Payson Goodwin	Job applicant	Martin City
	Leroy Kaufman	Summer employee	Kalispell
	Paul Tutvedt	Farmer	Kalispell
	John Serquina	Dept. Natural Resources	Helena
	James Lewis	Dept. Natural Resources	Helena
	Clyde Pederson	Farmer	Kalispell
Feb.	Dan Brenneman	Farmer	Kalispell
	Greg Bruyer	Farmer	Kalispell
	Kenneth Odegard	Businessman	Bozeman
	J. A. Asleson	Director Agri. Exp. Sta.	Bozeman
	Dick Fields	Businessman	Kalispell
	Charles Bowman	Ag Engineer	Bozeman
	Don Walker	Well Consultant	Kalispell
	Bill Osborne	Liberty Drilling	Kalispell
	Patricia Barbeaw	Job applicant	Whitefish
	Jim Lewis	Dept. Natural Resources	Helena
	Pete Norbeck	Dept. Natural Resources	Helena
	Tom Smith	Liberty Drilling	Kalispell
	Walt Mangles	Farmer	Polson
Mar.	Jay Yocum	Farmer	Huntley, Wyo.
	Kenneth Kephart	Student	Bozeman
	Orville McCarver	Plant & Soil Science, MSU	Bozeman
	Purl Partello	Olin	Helena
	Mr. & Mrs. Jesse Sparks	Farmers	Columbia Falls
	Mrs. Kephart	Farmer	Kalispell
	Ron Meroney	Student	Bozeman
	Robin Long	Student	Kalispell
	Twed Johnson	Job applicant	Boulder, Colo.
	Frank Park	Kalispell Feed & Grain	Kalispell
	Larry Stidman	Kalispell Livestock News	Kalispell
	Andy & Min Kapra	Retired folk	Seeley Lake
April	Jack Gorton	Equity Supply	Kalispell
	Bill Osborne	Liberty Drilling	Kalispell
	Jim Christian	Liberty Drilling	Kalispell
	Leo Evans	O'Neil Printers	Kalispell
	Ivan Tyler	Part-time farmer	Salt Lake City, UT
	Ian Jeffcock	Farmer	Columbia Falls
	Mike Sargent	Salesman	Polson
	Arnold Grob	Farmer	Kalispell

VISITORS (con't):

MONTH	VISITOR	REPRESENTING	ADDRESS
April	Karl Schrade	Farmer	Kalispell
	Cliff Swallow	Kalispell Feed & Grain	Kalispell
	Jack Gorton	Equity Supply Co.	Kalispell
	Worden Hardy	Rancher	McGregor Lake
	Mr. & Mrs. Stedman	Retired folk	Columbia Falls
	Jim Rodebush	Stauffer Chemical	Three Forks
	Eyler Adams	Rancher	Kalispell
	Robert Carlstrom	Tree & Landscape Ser.	Kalispell
	Dave Dauch	Lockwood Corp.	Woodland, CA
	Dave Hanson	Monsonto	St. Louis, MO
	Louis Middaugh	Farmer	Marion
	Scott Middaugh	Farmer	Marion
	D. D. Brenneman	Farmer	Kalispell
	C. W. Roath	Retired agronomist	Bigfork
	Bill Ambrose	Farmer	Bigfork
May	Lee Tower	Kalispell Feed & Grain	Kalispell
	Cliff Swallow	Kalispell Feed & Grain	Kalispell
	Tom O'Hare	American Cyanamid Co.	Pocatello, ID
	Harry Collier	Personnel Dept., MSU	Bozeman
	Neil Danford	Farmer	Kalispell
	Jack Gorton	Equity Supply	Kalispell
	Thad Wojciechowski	Extension Coordinator	Missoula
	Charles Bowman	Ag Engineer	Bozeman
	Jerrian Robinson	Job applicant	Bigfork
	Sharon Rivarel	Job applicant	Kalispell
	Mary Stedje	Job applicant	Kalispell
	Keven Kephart	Student	Kalispell
	Jim Rodebush	Stauffer Chemicals	Three Forks
	Earnest O'Brien & Son	Farmers	Whitefish
	Guy Stewart	Salesman	Seattle, WA
	Roy Demming	Ag Representative	Kalispell
	Tom Tolsom	Contractor	Kalispell
	Don Graham	Western Agri. Res. Center	Corvallis
	Clyde & Jeanne Pederson	Farmers	Kalispell
	Myron Mast	Farmer	Kalispell
	Leroy Kauffman	Farmer	Kalispell
	John Olson	Orchardist	Polson
	Bill Edelman	Nursery Owner	Ronan
	Phillip Keathley	Gulf Oil Chemical Company	Concord, CA
	John Fitzsimmons	Former employee	Columbia Falls
	Mr. & Mrs. Bob Stonebrook	Farmers	Plains
June	Phillip Keathley	Gulf Oil Chemical Co.	Concord, CA
	Burton Isch	Farmer	Kalispell
	John Olson	Orchardist	Polson
	Gordon Harris	U.S. Borax Research	Anaheim, CA
	Ray Ditterline	Plant & Soil Science,MSU	Bozeman
	Dick Ault	Plant & Soil Science,MSU	Bozeman
	Jack Carlson	Plant & Soil Science,MSU	Bozeman
	Charles Bowman	Ag Engineer, MSU	Bozeman
	Don Graham	Western Agri. Res. Center	Corvallis
	Dan Schwennesen	Salesman	Missoula
	Chuck & Art Schaffer	Farmers	Marion
	John & Mark Dalimata	Farmers	West Glacier
	J. A. Sirockman	VWR Scientific	Missoula

VISITORS (con't):

MONTH	VISITOR	REPRESENTING	ADDRESS
June	Forest Peters	Chem Agro	Wenatchee, WA
	Hank Ramsey	Chem Agro	Yakima, WA
	Homer Metcalf	Plant & Soil Science, MSU	Bozeman
	Bill Edelman	Nursery owner	Ronan
July	Jack White	U of Wisconsin	Green Bay, WI
	Paul Mayland	American Hoechst Corp.	Fargo, ND
	Robin Walker	SPEDY Councilor	Kalispell
	Don Graham	Western Agri. Res. Center	Corvallis
	Charles Bowman	Ag. Engineer, MSU	Bozeman
	Boyd Hartman	U. of Nevada	Reno, NV
	Chuck Smith	Ext. Soil Scientist, MSU	Bozeman
	Mr. & Mrs. Schumacher	Former employee	Hingham
	Wes Roath	Retired agronomist	Bigfork
	Neal Corb	Retired farmer	Portland, OR
	Joe Klempel	Farmer	Bigfork
	Terry Gregoire	The Ansul Co.	Fargo, ND
	Sam Bartee	The Ansul Co.	Weslaco, TX
	Charles Loewen & daughter	Former employee	Portland, OR
	Barbara Nordtome & boys	Housewife	Kalispell
	Henry Ficken Sr.	Farmer	Kalispell
	Henry Ficken Jr. & son	Farmer	Kalispell
	Joe Klempel	Farmer	Bigfork
	Bill Smith	Mobil	Omaha, NE
	John Tyler	Frontier Airlines	Salt Lake City, UT
	Jim Hoffmann	Utah State University	Logan, UT
	Jerry Bergman	Agronomist, EARC	Sidney
	Raymond Austin	Farmer	Columbia Falls
	John Fitzsimmons	Former employee	Hungry Horse
	Phillip Keathley	Gulf Oil Chem. Co.	Concord, CA
	Lloyd Hall	Farmer	Kalispell
	Jesse Sparks	Farmer	Columbia Falls
	Bill Osborne	Liberty Drilling	Kalispell
	Myron Mast	Farmer	Kalispell
	John Heffley	A. M. Todd Co.	Sunnyside, WA
	Allen Taylor	Plant & Soil Science, MSU	Bozeman
	Hollis Spitler	Plant & Soil Science, MSU	Bozeman
	Roger Smith	Wilber Ellis	Spokane, WA
	Forrest Peters	Chemagro	Wenatchee, WA
August	Ray Ditterline	Plant and Soil Science, MSU	Bozeman
	Jack Carlson	Plant and Soil Science, MSU	Bozeman
	Bill Knipe	Northrup King	Woodland, CA
	Willis Gorton	Farmer	Kalispell
	Vern Woestemeyer	U.S. Borax	Anaheim, CA
	Helen Callihan	Social Worker	Lakewood, OH
	Johnny Thomas	N. American Plant Breeders	
	Michael Sandine	CIBA-Geigy	Lakeworth, FL
	Jim Oman	U. S. Forest Service	Eureka, CA
	John M. Person	FMC Corp.	Absarokee
	Robert L. O'Toole	Dept. of Agriculture	Portland, OR
	Norman Goetze	Oregon State University	Corvallis, OR
	John A. Browning	Wheat Association	Portland, OR
	Mike Ford	U. S. Weather Bureau	Great Falls
	Jack McPhee	U. S. Weather Bureau	Orvando

VISITORS (con't):

MONTH	VISITOR	REPRESENTING	ADDRESS
August	LeRoy Hellen	Farmer	Bigfork
	John Heikens	Farmer	Bigfork
	Robert T. England	Lettuce Grower	CA & AZ
	C. I. King	Farmer	High River, Alberta
	Arnold Grob	Farmer	Kalispell
	Glee Bratt	Farmer	Kalispell
	Paullete Lawrence	SPEDY Councilor	Kalispell
Sept.	Leland Cade	Montana Farmer Stockman	Great Falls
	Frank Pelino	Farmer	Columbia Falls
	Frank Shepherd	Shepherd's Glass	Kalispell
	Gordon Grier	Farmer	Bigfork
	Dale Howell	Valley Glass	Kalispell
	Norman Sundholm	Aluminum Products	Kalispell
	Walley Michotte	A & I Distributors	Billings
	Harold Small	Farmer	Kalispell
	Orville McCarver	Plant & Soil Science, MSU	Bozeman
	Mr. & Mrs. Geo. Judy	Tomato Growers	North Ridgeville, OH
Oct.	Bill Ambrose	Farmer	Bigfork
	Don Douglas		Helena
	Jim Keithley	Farmer	Kalispell
	Robert Coe	Farmer	Bigfork
	Ivan Tyler	Farmer	Columbia Falls
Nov.	Forrest Peters	Chemagro Co.	Yakima, WA
	Al Scoggan	Chemagro Co.	Boise, ID
	Bill Osborne	Liberty Drilling	Kalispell
	Charles Rust	Extension Ser., MSU	Bozeman
	Bill Beasley	Extension Ser., MSU	Bozeman
	Thad Wojciechowski	Extension Coordinator	Missoula
	Charles Schweigert	Northrup King	Billings
	Cliff Swallow	Kalispell Feed & Grain	Kalispell
	Jim Gowin	Kalispell Feed & Grain	Lakeside
	Jim Rieben	Dept. Natural Resources	Kalispell
Dec.	Kenneth Kephart	Student, MSU	Bozeman

September 1975: The August rains carried over into September, and it finally quit raining about the 3rd of the month. There were some dry days for harvest, but the harvest was made more difficult because of the very heavy dews in the morning. The winter wheat was seeded during the month and resulted in excellent stands in most locations.

Temperatures were very close to the long term average. Our maximum temperature may have been slighly higher, but our mean average temperature was somewhat lower. This occurred because our minimum was about four degrees lower. Frost occurred (32 degrees) on the 12th of September, which is about the average date.

PHYSICAL PLANT - 751

Improvements and additions to the physical plant are reported under this project. No specific funds were allowed for physical plant improvements in 1975, but with funds from the Directors Reserve and research grants, we were able to make the following improvements:

Crops Research Building - The office was remodeled by research center personnel. This was done under the direction of John Fitzsimmons who is mentioned earlier in this report. The remodeling consisted of moving the two inside walls toward the center of the office, 16 inches. The superintendents office was increased in size from 8' x 9' to 11' x 10'. In the process of doing this one room was made smaller. The two offices on the east side are 8' x 11'. All the office walls were extended to the ceiling. The exterior north and east sides of the building were painted. Total cost- $469.93.

Residence #2 - The upstairs was remodeled at a cost of $1533.98. Remodeling consisted of paneling the walls, putting in a false ceiling and installing new lights. The large windows in the living room and front bedroom were replaced with insulated glass at a cost of $166.00. This improvement should reduce fuel consumption. The hot water tank was rewired at a cost of $108.96. Total cost - $1808.94.

Residence #1 - Some plumbing work was done in this residence which included replacing the kitchen sink faucet and shut-off valves were placed on water lines where needed. The interior of this residence was painted. Total cost - $132.20.

Fencing - Three thousand feet of fence was built between the research center property and the property owned by Larry Johnson southwest of the center. This fence consisted of a 39 inch woven wire and two barbed wires. Posts were spaced 16 feet. Materials for the fence were supplied by Mr. Johnson and all the labor was supplied by the research center. Total labor cost - $1048.

GENERAL FARM 752

This is the supportive project for all research projects. In this report general farm activities and all equipment purchased are listed. The major improvement at the research center was the irrigation system well. In the 1974 report there is listed the discription of the well and work done.

Irrigation well - The irrigation well continued to leak at a rate of about 10-15 gallons per minute. An objection filed by Mr. Mahugh as regards the well was a factor in the irrigation well activities during the year. The department of Natural Resources issued a preliminary order saying we had to have the leak repaired by August 15. Since this was impossible during the middle of the irrigation season we requested an extension until October 15. During the ensuing months we had many conversations with the driller of the well, Mr. Osborne. He agreed verbally to try a technique to stop the leak. If this technique did not work there would be no charge, otherwise there would be a charge of $1500 to $2000. If this technique did not work he would use an oil field technique proposed by the Halliburton people which would cost in the neighborhood of $5000 to $8000. Many delays occurred during the fall season and as of December 31, the repairs of the well had not been made. We now have a verbal agreement with Mr. Osborne that he will continue as soon as possible in early spring.

Irrigation system - Kalispell Feed and Grain sublet the installation of the system to Tom Tolsom. We had considerable trouble getting Tolsom to follow our specifications. This was mainly due to the help he employed. A spring was hit when digging the trench for the west mainline. This made it necessary to make a trench to the

General Farm (con't)

county road and drain the water away. The contractor was able to lay the pipe and backfill without installing a drain system. One break occurred in the line following testing. This was repaired by the contractor. Because of the delays in work the contract was not completed on time, therefore the penalty clause in the contract was evoked. A total of $500 was withheld from the contract payment. Total cost - $21,319.30.

Irrigation pump - Installation was made by the Equity Supply Company. The pump is a 50 hp centrifugal pump and capable of irrigating approximately 120 acres, running 100 sprinkler heads at a time. During the 1975 season the pump was not used at capacity. Total cost - $3090.00.

It should be noted that this is the first module of the total system. The second module is planned and will be completed when funding becomes available.

Vehicles - A new 1975, 10,000 GVW Dodge truck with grain box, stock rack and hoist was added to the fleet of vehicles. A 1950, three cubic yard Ford dump truck was traded in on this unit. Total cost - $5343.

The engine of the 1965 Dodge was overhauled. The work was done by research center employees.

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DISTRIBUTION OF THE
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Copies	
2	Office of Director, Montana Agricultural Experiment Station
1	Plant and Soil Science Department - Dr. K. C. Feltner
4	Research Staff at Northwestern Agricultural Research Center
	C. W. Roath Vern R. Stewart Leon E. Welty Library
11	County Extension Agents in Northwestern Montana
	Program Coordinator - Thaddeus Wojciechowski Deer Lodge - Powell - Robert E. Durham Flathead - Merle Lyda Granite - Richard L. Lovec Lake - G. Edward Bratton Lincoln - Robert E. Wilson Mineral - Robert Wagner Missoula - Gerald W. Marks Ravalli - G. Robert Johnson Sanders - Alan D. Knudson Silver Bow - David O. Dickens
5	Northwest Montana Banks
	Bank of Columbia Falls Conrad National Bank - Kalispell The First Northwestern National Bank of Kalispell Valley Bank - Kalispell Western Montana National Bank - Missoula
1	Agricultural Stabilization and Conservation - Don Hughes
1	Farmers Home Administration - Marvin Jones
1	Federal Land Bank Association - Dennis Robinson
1	Soil Conservation Service - Oscar Pederson
4	Feed Mills
	Equity Supply Company - Kalispell Kalispell Feed & Grain Supply Inc. - Kalispell Peavey Company Producer Service - Ronan Western Seed and Supply Company - Charlo

PUBLICATIONS and TALKS 1975

1. Stewart, Vern R., January 1975, Northwestern Agricultural Research Center and Western Agricultural Research Center Advisory Committee Meeting, Polson.
Topic: Report on Research at the Northwestern Agricultural Research Center.

2. Stewart, Vern R., February 1975, Eastside Grange, Creston.
Topic: Research Highlights

3. Stewart, Vern R., March 1975, County Agents Up-Dating Meeting, Missoula.
Topic: Small Grain Varieties and Weed Control Research.

4. Stewart, Vern R., May 1975, Grade 6 from Edgerton School Tour.

5. Stewart, Vern R., June 1975, Potato Growers Meeting, Polson.
Topic: Sencor for Weed Control in Potatoes.

6. Stewart, Vern R., July 1975, Summer Staff Conference, Corvallis.
Topic: Herbicides in Legumes.

7. Stewart, Vern R., August 1975, Harvestor Meeting, Outlaw Inn, Kalispell.
Topic: Highlights of High Moisture Barley Studies.

8. Stewart, Vern R., November 1975, Potato Growers Meeting, Kalispell.
Topic: Chemical Control of Weeds in Potatoes.

9. Stewart, Vern R. and Leon E. Welty, 1975 Northwestern Agricultural Research Center Twenty-Sixth Annual Report (1974) Research Report No. 80.

10. Stewart, Vern R. and Leon E. Welty, 1975 1975 Crop Varieties For Western Montana, Capsule Information Series No. 9.

11. Welty, Leon E., 1975 Irrigated Pastures, NOW Spring 1975 pg. 10.

12. Welty, Leon E., January 1975, Extension Meetings; Drummond, Missoula, Hamilton, Stevensville, Plains, Ronan, Eureka, Kalispell.
Topic: Seedling Establishment and Irrigated Pastures.

13. Welty, Leon E., January 1975, Advisory Committee Meeting, Polson.
Topic: Irrigated Pastures and Annual Forages.

14. Welty, Leon E., February 1975, Eastside Grange, Creston.
Topic: Irrigated Pastures.

15. Welty, Leon E., March 1975, County Agents Up-Dating Meeting, Missoula.
Topic: Forages and Irrigated Pasture Management.

16. Welty, Leon E., December 1975, Flathead Chapter Future Farmers of America, Flathead High School, Kalispell.
Topic: Forages and Irrigated Pasture Management.

CLIMATOLOGICAL DATA

Northwestern Agricultural Research Center
Kalispell, Montana

Since 1949 the Northwestern Agricultural Research Center has cooperated with the United States Weather Service in securing the weather data. Maximum and minimum temperatures, amount of precipitation and amount of snow on the ground are data which are recorded daily. Also, maximum and minimum soil temperatures at the four and eight inch level are recorded. Each morning at 8:00 these readings are made.

Summary for 1974-75 Crop Year

There were 109 frost free days during the 1974-75 crop year, which is one day more than average from 1949 to 1975. The last killing frost occurred on May 25, 1975 (32 degrees) and the first killing frost (32 degrees) on September 12, 1975.

Total precipitation for the 1974-75 crop year was 16.98 inches. This is 3.37 inches less than the previous year (1973-74) and 2.0 inches less than the long time average of 18.98 inches.

The mean temperature was 42.2 degrees for the crop year (1974-75). This is 1.1 degree less than the long term average of 43.3 degrees.

Following is a brief summary for each month of the crop year. These summaries are recorded in the Northwestern Agricultural Research Center monthly letter.

September 1974: Precipitation for the month was .80 inch which was .66 inch below the 26 year average. On the 10th and 11th, .50 inch fell which aided materially in building seed beds. On the station we did get excellent stand of winter wheat. On the 27th there were high winds with gusts up to 50 miles per hour. This caused considerable errosion in our lighter soils and considerable damage was done to the new seedlings of winter barley. Temperatures during the month were about average. Our first frost occurred on the 2nd, but caused little crop injury. There was not any crop injury until September 13, when the temperature dropped to 27 degrees F.

October 1974: The month was very, very dry, with only .12 of an inch precipitation for the whole month. The long term average for October is 1.46 inches. The winter wheat on the station appeared to be in fair condition, but it does need moisture. Fields are very soft and anyone who has done any spraying has left deep ruts in the field.

November 1974: Another month with below normal rainfall. Soil moisture conditions are fair. Winter wheat stands on fallow look good. Wheat planted on recrop is poor, and in one location we do not have any emergence.

Thirty-three hundreds of moisture fell November 7, the first moisture of any consequence since September 27. Precipitation for November was only .43 below normal, with temperatures just slightly above normal.

The weather during the month allowed us to preform many outside functions sometimes left until spring.

December 1974: Little or no snow cover during the month. On December 27, there was two inches of snow on the ground. Temperatures were four degrees above the long term mean. Precipitation was .34 inch below the mean. Winter wheat when visible during the month continues to look healthy.

January 1975: For the last two winters we have had very mild weather. This has been changed this year. We are even having a little snow fall upon us. At one time we had seven inches of snow on the ground and the last day of the month we had five and one-half inches of snow on the ground. On the 9th of January we had some pretty high winds and some drifting snow, with five inches of snow on the ground that day.

January 1975 (con't)

The low occurred January 12th, minus 16 degrees. The high was on January 19th at +46 degrees. We do have good snow cover and so the crops should be fairly well protected. The average mean temperature was 21.5 which is close to the average of 21.8. The minimum average temperature was about four degrees less, 10.9 vs 14.3. The precipitation level was about average, only off about .06 inch, which is somewhat encouraging.

February 1975: We had a good snow cover throughout the month of February. Temperatures were below the long time average. The average mean was 21.5. For the 25 years it is 28 degrees. The mean maximum was five degrees below the normal, and the mean minimum was eight degrees. Precipitation for the month of February was near normal, .03 of an inch below the long term average.

March 1975: There was snow cover for about one-half of the month as recorded at the weather station. However, field conditions were somewhat different. In March some areas of the fields on the station had little or no snow cover. Temperatures dropped to three degrees on March 28. Wheat, which was exposed now has a very brown color. Winter barley still appears green on March 31.

Temperatures were below the long time average. The lowest temperature occurred March 28, which is a record broken here at the station. Precipitation is above ave.

April 1975: For April the United States Weather Service forecasted below normal temperatures and below normal precipitation in western Montana. Almost true to form the mean temperatures were below normal for the month. Precipitation was just .02 of an inch above the long time average. The forepart of the month was cold and very dry. We did not received any precipitation until the 17th. From April 27 through April 29 we had .93 of an inch precipitation. Our weather at the research center has been very different than other areas of the state. One might say we live in the "banana belt".

May 1975: During May temperatures were below normal as was precipitation. During this month crops looked very well and winter wheat looked excellent at the end of the month.

June 1975: Probably the outstanding feature during the month of June was the high winds we had the latter part of the month. Another feature of June was the departure from normal precipitation, when only 1.59 inches fell. This June was the third lowest in precipitation ever recorded since we began keeping records in 1949. The lowest precipitation occurred in June 1960, .69 of an inch and in 1962, 1.15 inches. The highest level of rainfall in the month of June occurred in June 1966 when we obtained 6.57 inches. In spite of the low rainfall crops look very good but the spring grain is in need of moisture at this writing.

July 1975: July was a month of gusty winds, sometimes exceeding 30 miles per hour. These occurred in the forepart of the month and again about mid-month. The temperatures were a little higher than the long time average. Precipitation was .20 of an inch below average. The majority of the moisture received came at the end of the month. The dryland crops were very short on moisture throughout the month. This will result in lower yields this season.

August 1975: The first part of the month was very dry and moderately warm. On the first of August .46 of an inch of precipitation fell, and again on the fourth and fifth we had measureable precipitation. On August 17, it began raining and it rained every day until the end of the month with the exception of August 22. As a result of this continuous rain, the winter wheat,which was nearly ripe, began to sprout. Some grain ran as high as 50-60 percent "sprouted". Needless to say this was quite a loss to the valley as far as revenue was concerned.

High gusty winds occurred throughout the month.

Table 1. Summary of climatic data by months for the 1974-75 crop year (September to August) and average for the period 1949-75 at the Northwestern Agricultural Research Center, Kalispell, Montana.

Item	Sept. 1974	Oct. 1974	Nov. 1974	Dec. 1974	Jan. 1975	Feb. 1975	Mar. 1975	Apr. 1975	May 1975	June 1975	July 1975	Aug. 1975	Total or Average Growing Season
Precipitation (inches)													
Current Year	.80	.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	16.98
Ave. 1949 to 1974-75	1.47	1.47	1.53	1.65	1.62	1.11	1.07	1.25	1.98	2.99	1.28	1.56	18.98
Mean Temperature (F)													
Current Year	52.8	43.5	35.2	30.2	22.0	21.5	29.8	37.6	48.7	55.9	69.1	59.8	42.2
Ave. 1949 to 1974-75	53.8	43.5	32.9	26.4	21.8	28.0	32.9	42.8	51.6	58.4	64.4	63.0	43.3
Last killing frost in spring*													
1975									May 25 (32 degrees)				
Ave. 1949-75									May 27				
First killing frost in fall*													
1975											September 12 (32 degrees)		
Ave. 1949-75											September 12		
Frost-free period													
1975											109 days		
Ave. 1949-75											108 days		
Maximum summer temperature											96 degrees F on July 12, 1975		
Minimum winter temperature											16 degrees below zero on January 12 and February 9, 1975		

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

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Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1975.

	Average temperature by month and year Degrees Fahrenheit												
Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	$\bar{x}$ for Year
1949-50	54.1	41.5	38.5	25.0	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	41.3
1950-51	53.8	45.9	31.5	29.5	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	42.3
1951-52	50.6	40.8	30.8	16.9	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	41.0
1952-53	56.0	45.5	30.4	27.6	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	44.9*
1953-54	56.1	46.2	37.0	31.3	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	43.7*
1954-55	52.9	41.5	38.8	28.8	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	42.1
1955-56	52.5	44.6	23.5	21.8	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	41.8
1956-57	55.2	44.1	30.9	28.5	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	42.7
1957-58	55.8	41.4	32.1	32.4	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	46.0*
1958-59	55.5	44.6	32.8	28.2	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	43.6*
1959-60	53.0	43.9	25.5	27.6	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	42.6
1960-61	55.0	45.2	34.4	24.9	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	46.3*
1961-62	49.6	42.3	28.2	23.6	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	41.6
1962-63	54.7	44.7	38.0	32.5	11.8	33.1	38.7	43.2	51.4	59.4	63.0	64.9	44.6*
1963-64	58.7	47.4	35.8	24.0	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	44.1*
1964-65	51.2	43.7	33.7	22.1	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	43.3*
1965-66	46.4	47.6	35.0	28.8	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	43.8*
1966-67	59.3	43.4	33.4	30.2	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	45.7*
1967-68	61.0	45.9	33.8	25.1	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	45.0*
1968-69	53.8	42.9	33.4	19.9	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	41.9
1969-70	56.0	40.0	35.2	27.7	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	43.9*
1970-71	48.7	40.1	31.3	26.2	23.6	29.8	33.2	43.6	52.5	54.8	61.9	68.2	42.8
1971-72	49.5	40.4	34.1	22.2	17.4	27.3	38.5	40.4	52.0	59.4	61.4	65.9	42.4
1972-73	50.2	40.3	33.7	19.9	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	42.6
1973-74	53.3	44.2	29.3	30.9	21.2	32.4	33.6	42.8	48.0	61.6	64.8	61.6	43.6*
1974-75	52.8	43.5	35.2	30.2	22.0	21.5	29.8	37.6	48.7	55.9	69.1	59.8	42.2
$\bar{x}$	53.8	43.5	32.9	26.4	21.8	28.0	32.9	42.8	51.6	58.4	64.4	63.0	

Mean temperature for all years = 43.3

* Denotes years above average temperature.

Table 3. Summary of temperature data obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1975

	Average Maximum temperature by month and year Degrees Fahrenheit												$\bar{x}$ for
Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Year
1949-50	71.4	52.4	45.7	32.1	14.4	34.6	38.4	52.3	63.1	70.1	78.6	79.5	52.7
1950-51	70.9	55.8	32.2	36.3	28.7	36.6	37.3	57.9	63.2	66.6	82.4	77.0	54.2
1951-52	64.2	47.5	37.2	23.6	25.9	35.7	39.5	61.8	65.7	70.2	79.2	79.5	52.5
1952-53	73.4	62.6	40.6	33.2	41.3	39.1	46.8	51.5	62.5	66.8	83.3	79.5	56.7*
1953-54	72.3	61.0	45.6	36.7	29.1	38.4	40.0	51.0	67.2	67.0	80.1	74.4	55.2*
1954-55	66.4	53.4	45.9	34.9	31.8	31.2	33.9	48.1	60.5	74.7	76.9	82.4	53.3
1955-56	67.6	55.5	30.8	29.2	30.7	30.1	39.7	57.4	67.5	73.3	81.2	77.8	53.4
1956-57	71.0	53.7	37.6	35.5	19.0	33.2	43.3	55.3	70.2	72.4	82.1	80.0	54.4
1957-58	74.3	50.5	40.1	38.5	33.7	37.9	43.5	54.4	77.5	75.7	80.8	85.5	57.7*
1958-59	69.7	57.9	39.6	34.1	31.8	31.9	43.9	57.9	61.5	74.3	83.2	76.3	55.2*
1959-60	64.0	53.6	33.9	33.3	27.5	34.1	43.4	56.1	63.0	74.8	88.7	74.1	53.9
1960-61	72.1	57.8	41.1	29.8	35.0	43.1	48.2	51.6	65.3	82.0	83.7	86.3	58.0*
1961-62	62.3	53.3	35.1	30.4	26.0	33.4	40.5	60.7	62.7	74.2	79.2	77.5	52.9
1962-63	71.7	54.7	43.8	37.9	19.9	41.4	48.9	55.7	67.1	71.8	79.6	82.5	56.2*
1963-64	74.6	59.4	43.4	30.2	35.1	37.7	39.7	53.3	63.5	71.4	80.3	72.9	55.1*
1964-65	63.9	55.0	41.0	28.9	35.1	36.9	41.0	57.6	64.3	71.4	80.8	77.1	54.4
1965-66	57.5	61.1	42.6	35.4	31.8	35.3	45.4	54.8	69.8	69.1	81.2	78.4	55.2*
1966-67	74.9	55.1	41.1	35.8	36.7	40.9	41.3	52.6	66.0	73.3	84.8	87.2	57.5*
1967-68	78.9	55.8	41.3	30.8	31.5	40.8	52.6	54.2	63.4	72.2	82.7	75.7	56.6*
1968-69	65.9	53.1	40.6	27.3	20.8	32.5	40.9	59.5	68.7	72.0	78.9	83.0	53.6
1969-70	70.4	49.7	43.0	32.8	28.5	36.2	42.5	49.7	67.9	75.5	79.1	80.9	54.7
1970-71	62.5	52.2	40.0	34.1	30.6	38.6	41.6	56.2	66.4	67.3	78.0	87.5	54.6
1971-72	64.2	53.1	41.2	30.9	27.1	35.9	47.9	51.7	64.7	72.4	76.9	83.3	54.1
1972-73	64.0	51.3	41.4	28.6	30.6	38.5	47.7	53.8	65.8	69.6	83.7	83.2	54.9*
1973-74	67.6	56.3	36.8	36.5	28.7	39.6	43.5	53.1	59.2	76.2	80.0	77.6	54.6
1974-75	70.9	61.4	43.2	37.4	32.0	31.5	39.4	48.1	61.2	68.5	85.5	79.6	54.8
$\bar{x}$	68.7	55.1	40.2	32.9	29.4	36.4	42.7	54.5	65.3	72.0	81.2	80.0	

Mean temperature for all years: 54.9

* Denotes years above average.

Table 4. Summary of temperature data obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1975

Year	Average minimum temperature by month and year, Degrees Fahrenheit												$\bar{x}$ for Year
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	
1949-50	36.7	35.0	31.2	17.8	-6.0	16.6	23.9	31.5	36.3	43.9	49.4	45.5	30.2
1950-51	36.6	36.0	24.8	22.6	11.7	18.8	16.6	26.2	36.7	41.7	46.9	43.7	30.2
1951-52	37.0	34.0	24.4	10.1	10.0	17.4	19.1	29.8	39.1	43.1	44.3	46.1	29.5
1952-53	38.6	28.3	20.2	21.9	30.6	26.7	27.5	30.9	36.5	42.3	45.3	46.7	33.0*
1953-54	39.8	31.4	28.4	25.9	13.1	24.0	19.2	30.6	37.7	42.8	46.7	45.7	32.1*
1954-55	39.3	29.5	31.6	22.7	19.5	13.0	15.0	30.0	34.9	42.8	48.5	42.0	30.7
1955-56	37.3	33.6	16.1	14.4	15.9	11.7	23.3	30.9	40.5	44.7	48.2	46.1	30.2
1956-57	39.4	34.4	24.2	21.5	1.4	13.6	23.2	32.0	40.9	47.0	48.7	44.8	30.9
1957-58	37.2	32.3	24.1	26.2	24.5	22.8	20.9	32.8	41.7	48.8	49.5	50.3	34.3*
1958-59	41.2	31.2	26.0	22.2	17.5	14.2	26.6	32.4	34.7	45.4	45.8	45.6	31.9*
1959-60	42.0	34.1	17.0	21.8	11.2	16.3	21.1	32.4	38.1	44.3	48.8	47.0	31.2
1960-61	37.9	32.5	27.6	19.9	20.6	30.9	28.4	32.3	39.8	47.4	48.7	49.2	34.6*
1961-62	36.8	31.2	21.2	16.8	8.7	17.9	21.2	33.7	40.3	43.0	45.0	46.6	30.2
1962-63	37.6	34.6	32.2	27.1	3.7	24.7	28.4	30.6	35.7	47.0	46.4	46.9	32.9*
1963-64	42.7	35.3	28.1	17.7	21.8	18.9	21.4	32.2	38.6	46.0	48.3	44.9	33.0*
1964-65	38.4	32.3	26.4	15.3	25.3	20.4	16.2	32.7	36.9	43.8	48.4	50.0	32.2*
1965-66	35.2	34.0	27.4	22.1	20.8	20.0	23.6	30.9	38.7	42.8	47.7	45.0	32.4*
1966-67	43.6	31.7	25.6	24.6	25.3	25.5	24.5	28.6	38.4	45.4	47.4	47.2	34.0*
1967-68	43.1	35.9	26.3	19.4	15.0	24.8	29.7	29.8	36.1	45.7	46.4	46.8	33.3*
1968-69	41.7	32.6	26.1	12.5	5.4	15.4	18.2	34.6	39.0	45.5	45.7	43.5	30.0
1969-70	41.6	30.3	27.4	22.6	15.3	23.4	23.0	30.7	38.5	48.2	50.5	44.3	33.0*
1970-71	34.9	27.9	22.5	18.3	16.5	21.0	24.8	31.0	38.6	42.3	45.7	48.8	31.0
1971-72	34.7	27.6	26.9	13.5	7.7	18.6	29.0	29.0	39.2	46.3	45.8	48.5	30.6
1972-73	36.4	29.2	25.9	11.1	11.0	17.4	27.8	29.6	36.4	44.4	46.5	45.8	30.1
1973-74	38.9	32.0	21.8	25.2	13.6	25.1	23.6	32.4	36.7	46.9	49.5	45.6	32.6*
1974-75	34.7	25.7	26.3	22.9	32.0	11.5	20.4	27.1	36.1	43.3	52.7	46.2	31.6
$\bar{x}$	38.7	32.0	25.4	19.9	15.1	19.6	22.9	31.0	37.9	44.8	47.6	46.3	

Mean temperature for all years: 31.8

* Denotes years above average temperature.

Table 5. Summary of precipitation records obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1975

Year	Total precipitation in inches by month and year												Total for Year
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	
1949-50	1.03	1.05	1.67	.92	2.62	1.13	2.31	.84	.15	3.90	3.12	.75	19.49*
1950-51	.52	2.30	1.16	2.48	.94	1.29	.62	2.32	3.77	2.26	1.03	2.86	21.55*
1951-52	1.49	5.62	1.01	3.31	1.03	.98	.97	.17	1.32	3.95	.56	.69	21.10*
1952-53	.13	.05	.60	.98	1.84	1.14	.98	2.07	2.00	3.31	T	1.62	14.72
1953-54	.71	.03	.87	1.30	2.65	.79	.83	.79	1.52	2.98	2.91	3.79	19.17*
1954-55	1.09	.54	1.00	.43	1.00	1.31	.44	.82	1.18	1.86	3.08	.00	12.75
1955-56	1.64	1.89	1.97	2.38	1.76	1.53	.87	1.28	1.06	4.20	2.13	3.21	23.92*
1956-57	1.16	1.10	.53	.96	1.47	1.14	.75	1.22	1.75	2.51	.52	.78	13.89
1957-58	.10	1.59	.96	1.76	1.56	2.67	.97	1.47	2.20	2.56	.84	.58	17.26
1958-59	1.99	1.16	2.90	2.77	1.95	1.33	.75	1.62	4.10	1.75	T	.91	21.23*
1959-60	4.22	3.36	4.32	.34	1.67	1.10	1.01	1.23	3.27	.69	.13	2.43	23.77*
1960-61	.55	1.44	1.72	1.24	.65	1.46	1.96	2.26	4.02	1.45	.76	.64	18.15
1961-62	3.40	1.22	1.77	2.09	1.33	1.15	1.59	.96	2.59	1.15	.11	.72	18.08
1962-63	.58	1.85	1.31	.91	1.69	1.21	.85	1.07	.57	5.00	1.44	2.10	18.58
1963-64	1.46	.75	.95	1.70	1.46	.41	1.57	.87	3.33	3.86	3.01	1.64	21.01*
1964-65	2.27	.85	1.62	3.62	2.25	.64	.24	2.55	.81	2.30	1.15	4.74	23.04*
1965-66	1.72	.21	1.31	.55	1.42	.67	.53	.76	1.18	6.57	2.49	1.64	19.05*
1966-67	.79	1.34	3.33	1.68	1.50	.62	1.27	.99	1.30	2.53	.02	.01	15.38
1967-68	.91	1.88	.62	1.16	.79	1.15	.68	.57	3.92	2.22	1.00	3.42	18.32
1968-69	4.51	2.39	1.59	3.12	3.05	.75	.69	1.39	1.19	5.21	.70	.09	24.68*
1969-70	1.54	1.90	.31	1.14	3.10	.89	1.49	.76	1.97	4.37	3.08	.44	20.99*
1970-71	1.79	1.38	1.75	.99	1.84	.77	.69	.58	2.45	4.42	1.31	1.11	19.08*
1971-72	.94	.87	1.70	1.62	1.10	1.65	2.11	.95	1.48	3.28	1.77	.98	18.45
1972-73	1.38	1.84	.80	2.19	.52	.56	.70	.45	1.13	2.14	.01	.63	12.35
1973-74	1.37	1.41	2.95	1.94	1.35	1.32	1.40	3.36	1.82	1.80	1.01	.62	20.35*
1974-75	.80	.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	16.98
$\bar{x}$	1.47	1.47	1.53	1.65	1.62	1.11	1.07	1.25	1.98	2.99	1.28	1.56	

Mean precipitation for all crop years: 18.98

* Denotes years above average precipitation.

Table 6. Precipitation by day for crop year, September 1, 1974 thru August 31, 1975. Northwestern Agricultural Research Center, Kalispell, Montana.

Date	Sept. 1974	Oct. 1974	Nov. 1974	Dec. 1974	Jan. 1975	Feb. 1975	Mar. 1975	Apr. 1975	May 1975	June 1975	July 1975	Aug. 1975
1	.06						.23	T			.04	.46
2						.10	.14					
3		.01		T		.06	.15		T	.27		
4					.06		T		.47	.07	.05	
5	.03	.09		T	.01				.30			.01
6					.13		T		.18			.03
7			.33	.15		.34					.01	T
8					.12	.09			.01	T	.08	
9			.03			.16	.21	T		.08		
10	.25		.18	T		.16	.18					
11	.25			.20			.25					
12			.12	.10	.07	T			.09			
13			.17	.11	.10	.14						
14					.20	T				T	T	
15				.13						.11	.03	
16				.06						T	.12	
17					.43			.18		.35		.08
18					.25		T	T		T		.58
19			.04	.10			.05	.02	.07	.01		.30
20			.07	.14		T	T	.05	.30	T		.32
21			.12	.14		.03	T		T	T		T
22			.01	T	.01		.21			.02		
23							.03		.04	T		.34
24			.03		.15	T	.05		.02			.64
25				.03				.05	.02	.23		.45
26								.55	T			.13
27	.19			.14				.07		.10		.01
28		.02	T		T	T		.31	T	.16		.02
29	.02				.03			.04		T	.05	.41
30											.52	.23
31				.01							.18	.25
Total	.80	.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1975.

Year	Date Last Freeze	Temperature	Date First Freeze	Temperature	Frost Free Season
1950	June 10	32	Sept. 11	29	92
1951	June 1	29	Sept. 15	29	106
1952	June 14	32	Sept. 8	29	85
1953	May 23	32	Sept. 16	31	108
1954	May 29	31	Sept. 30	26	123
1955	May 25	28	Sept. 13	31	108
1956	May 3	26	Sept. 2	32	122
1957	May 23	30	Sept. 9	30	109
1958	May 14	31	Sept. 27	31	136
1959	June 11	32	Aug. 30	30	80
1960	June 18	32	Sept. 6	32	80
1961	May 6	32	Sept. 12	29	129
1962	May 30	32	Sept. 3	25	96
1963	May 22	28	Sept. 18	32	119
1964	May 25	26	Sept. 11	28	109
1965	June 7	30	Sept. 6	31	91
1966	May 18	26	Sept. 30	28	135
1967	May 26	28	Sept. 23	32	120
1968	May 20	32	Sept. 21	32	124
1969	June 13	28	Sept. 6	32	85
1970	May 11	32	Sept. 10	31	122
1971	July 7	32	Sept. 14	28	69
1972	May 4	32	Sept. 12	32	131
1973	May 22	31	Sept. 2	31	103
1974	May 18	31	Sept. 2	30	107
1975	May 25	32	Sept. 12	32	109
$\bar{x}$ for all years	May 27	30	Sept. 12	30	108

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, Montana, from 1950 thru 1975.

Year	Minimum		Maximum	
	Date	Temperature Degrees F	Date	Temperature Degrees F
1950	Jan. 30	-40	Aug. 31	88
1951	Jan. 28	-25	Aug. 2	92
1952	Jan. 1	-14	Aug. 31	90
1953	Jan. 6	8	July 12	97
1954	Jan. 20	-32	July 6	90
1955	Mar. 5	-20	June 22	96
1956	Feb. 16	-25	July 22	90
1957	Jan. 26	-34	July 13	91
1958	Jan. 1	2	Aug. 11	94
1959	Nov. 16	-30	July 23	96
1960	Mar. 3	-32	July 19	98
1961	Jan. 2	0	Aug. 4	100
1962	Jan. 21	-32	Aug. 16	92
1963	Jan. 30	-24	Aug. 9	94
1964	Dec. 17	-28	July 8	91
1965	Mar. 24	-10	July 31	89
1966	Mar. 4	- 7	Aug. 2, 25	91
196	Jan. 24	2	Aug. 19	95
1968	Jan. 21	-23	July 7	94
1969	Jan. 25	-13	Aug. 24	97
1970	Jan. 15	-14	Aug. 21, 25	92
1971	Jan. 12	- 8	Aug. 6, 9	96
1972	Jan. 28	-24	Aug. 9, 10	92
1973	Jan. 11	-22	July 11	97
1974	Jan. 5	-18	June 16, 20	93
1975	Jan. 12 & Feb. 9	-16	July 12	96

Table 9. Summary of temperature records obtained at the Northwestern Agricultural Research Center, January 1950 thru December 1975.

	Average Temperature by Month and Year Degrees Fahrenheit												x for
Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1950	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	53.8	45.9	31.5	29.5	41.4
1951	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	50.6	40.8	30.8	16.9	40.5
1952	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	56.0	45.5	30.4	27.6	42.7
1953	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	56.1	46.2	37.0	31.3	45.8*
1954	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	52.9	41.5	38.8	28.8	42.9
1955	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	52.5	44.6	23.5	21.8	40.4
1956	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	55.2	44.1	30.9	28.5	43.2
1957	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	55.8	41.4	32.1	32.4	42.8
1958	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	55.5	44.6	32.8	28.2	46.0*
1959	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	53.0	43.9	25.5	27.6	42.7
1960	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	55.0	45.2	34.4	24.9	43.3*
1961	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	49.6	42.3	28.2	23.6	45.0*
1962	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	54.7	44.7	38.0	32.5	43.8*
1963	11.8	33.1	38.7	43.2	51.4	59.4	63.0	64.9	58.7	47.4	35.8	24.0	44.3*
1964	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	51.2	43.7	33.7	22.1	42.8
1965	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	46.4	47.6	35.0	28.8	43.9*
1966	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	59.3	43.4	33.4	30.2	44.5*
1967	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	61.0	45.9	33.8	25.1	45.7*
1968	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	53.8	42.9	33.4	19.9	43.7*
1969	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	56.0	40.0	35.2	27.7	42.6
1970	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	48.7	40.1	31.3	26.2	42.8
1971	23.6	29.9	33.2	43.6	52.5	54.9	61.9	68.2	49.5	40.4	34.1	22.0	42.8
1972	17.0	27.3	38.5	40.6	51.9	59.3	61.5	65.9	52.0	40.0	33.7	19.9	42.3
1973	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	53.3	44.1	29.3	30.8	43.7*
1974	21.0	32.3	33.6	42.7	48.0	61.5	64.8	61.6	52.8	43.5	34.8	30.1	43.9*
1975	22.0	21.5	29.8	37.6	48.7	55.9	69.1	59.8	52.1	42.9	35.4	27.5	41.9
$\bar{x}$	21.8	28.0	32.9	42.8	51.7	58.5	64.4	63.0	53.7	43.6	32.8	26.5	

Mean Temperature For All Years = 43.3

* Denotes years above average mean.

Table 10. Summary of precipitation records obtained at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1975.

Date	Total Precipitation (Inches) by Months and Years												Total for Year
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1950	2.62	1.13	2.31	.84	.15	3.90	3.12	.75	.52	2.30	1.16	2.48	21.28*
1951	.94	1.29	.62	2.32	3.77	2.26	1.03	2.86	1.49	5.62	1.01	3.31	26.52*
1952	1.03	.98	.97	.17	1.32	3.95	.56	.69	.13	.05	.60	.98	11.43
1953	1.84	1.14	.98	2.07	2.00	3.31	T	1.62	.71	.03	.87	1.30	15.87
1954	2.65	.79	.83	.79	1.52	2.98	2.91	3.79	1.09	.54	1.00	.43	19.32*
1955	1.00	1.31	.44	.82	1.18	1.86	3.08	-	1.64	1.89	1.97	2.38	17.57
1956	1.76	1.53	.87	1.28	1.06	4.20	2.13	3.21	1.16	1.10	.53	.96	19.79*
1957	1.47	1.14	.75	1.22	1.75	2.51	.52	.78	.10	1.59	.96	1.76	14.55
1958	1.56	2.67	.97	1.47	2.20	2.56	.84	.58	1.99	1.16	2.90	2.77	21.67*
1959	1.95	1.33	.75	1.62	4.10	1.75	T	.91	4.22	3.36	4.32	.34	24.65*
1960	1.67	1.10	1.01	1.23	3.27	.69	.13	2.43	.55	1.44	1.72	1.24	16.48
1961	.65	1.46	1.96	2.26	4.02	1.45	.76	.64	3.40	1.22	1.77	2.09	21.68*
1962	1.33	1.15	1.59	.96	2.59	1.15	.11	.72	.58	1.85	1.31	.91	14.25
1963	1.69	1.21	.85	1.07	.57	5.00	1.44	2.10	1.46	.75	.95	1.70	18.79
1964	1.46	.41	1.57	.87	3.33	3.86	3.01	1.64	2.27	.85	1.62	3.62	24.51*
1965	2.25	.64	.24	2.55	.81	2.30	1.15	4.74	1.72	.21	1.31	.55	18.47
1966	1.42	.67	.53	.76	1.18	6.57	2.49	1.64	.79	1.34	3.33	1.68	22.40*
1967	1.50	.62	1.27	.99	1.30	2.53	.02	.01	.91	1.88	.62	1.16	12.81
1968	.79	1.15	.68	.57	3.92	2.22	1.00	3.42	4.51	2.39	1.59	3.12	25.36*
1969	3.05	.75	.69	1.39	1.19	5.21	.70	.09	1.54	1.90	.31	1.14	17.96
1970	3.10	.89	1.49	.76	1.97	4.37	3.08	.44	1.79	1.38	1.75	.99	22.01*
1971	1.84	.77	.69	.58	2.45	4.42	1.31	1.11	.94	.87	1.70	1.62	18.30
1972	1.10	1.65	2.11	.95	1.48	3.28	1.77	.98	1.38	1.84	.80	2.19	19.53*
1973	.52	.56	.70	.45	1.13	2.14	.01	.63	1.37	1.41	2.95	1.94	13.81
1974	1.35	1.32	1.40	3.36	1.82	1.80	1.01	.62	.80	.12	1.10	1.31	16.01
1975	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	1.18	2.96	.85	1.39	20.03*
$\bar{x}$	1.62	1.11	1.07	1.25	1.98	2.99	1.28	1.56	1.47	1.54	1.50	1.67	

Mean annual precipitation for 26 years = 19.04

* Denotes years above average.

YEAR: 1975

TITLE: Chemical control of wild oats (Avena fatua) in spring wheat and spring barley MS 754

LOCATION: Paul Boss farm, Kalispell, MT

PERSONNEL: Vern R. Stewart, Leader
Cooperators - Weed Research Committee, MAES, MSU

OBJECTIVES:

1. To find a herbicide or herbicides that will effectively control wild oats (Avena fatua) in spring wheat, spring barley and winter wheat.
2. To determine the effect of herbicides on crop plants, as it relates to yield.

MATERIALS AND METHODS:

Two separate experiments were conducted in 1975. Experiment No.1 included only post emergence treatments, whereas experiment No.2, included both post emergence and pre emergence applications. Herbicides used in this study are listed in Table 1.

The studies were grown in a clay loam soil. Barley (Ingrid) and wheat (Norana) were seeded in rows 20 feet long, spaced one foot. The total plot width was 10 feet. Four rows of barley and four rows of wheat were seeded in the given area. Herbicides were applied in varying volumes of water, depending on the herbicide being applied. These rates are found in the tabulated data.

Thirty-two square feet of row was harvested for yield determinations. A one-hundred gram sample was taken from each harvested sample to determine the percent of wild oats and clean grain. The data tabulated gives percent wild oats, percent grain, total of both in bushels and the total bushels of clean grain.

All data were analysed statistically using the analysis of variance.

RESULTS AND DISCUSSION:

Experiment I - Post emergence type herbidies.

(a) Spring wheat - variety Norana

HOE 23408 applied at the three to five leaf stage resulted in the highest yield (24.2 bu/a) in this experiment. This treatment also resulted in the lowest percent of wild oats, however it was not significantly higher in yield than the HOE 23408 at one pound per acre applied at the one to three leaf stage of the wild oats. The yield was 22.3 bushels per acre.

The barban treatment did increase yields significantly over the non-weeded check, but the percent of wild oat seeds was about equal to the non-weeded check.

MSMA did not give any wild oat control in this study.

Avenge alone at the eight and ten ounce rate resulted in significant yield increase above the non-weeded check. However, the wild oat seed percentage was greater than the non-weeded check. This could be due in part, to the fact that the wild oats are formed when Avenge is applied, but they do not germinate when planted. Thus this may not be a criteria for evaluating this product. The combination of Avenge and MCPA gave significant increases in yield over the non-weeded check, however when combined with 2,4-D amine, or bromoxynil, or bromoxynil + MCPA, yields were found not to be significantly higher. Table 2.

(b) Spring barley - variety Ingrid

Barley is much more competitive with wild oats than spring wheat as seen when comparing the two studies. Again, we find HOE 23408 applied at two pounds per acre in the three to five leaf stage of growth of wild oats giving us the greatest yield increase and excellent control of wild oats. This is followed with HOE 23408 at one pound per acre applied at the one to three leaf stage.

Barban at .375 pounds per acre, controlled wild oats quite effectively and yields were not significantly different from the hand weeded check. However, we found the yields to be significantly higher than the non-weeded check.

MSMA did not give us adequate wild oat control. Yields were less or non-significant when compared to the non-weeded check.

Avenge at eight and ten ounces per acre did not increase yields when used alone, however at the 10 ounce rate plus MCPA at six ounces per acre, a significant yield increase was noted. As in the wheat study, the combination of Avenge with bromoxynil, or 2,4-D, or bromoxynil plus MCPA, did not provide a high level of wild oat control, or result in significant yield increases. Table 3.

Experiment II - Wheat Section

This experiment included preplant incorporate, post plant pre emergence incorporated, and post emergence herbicides. The preplant incorporate herbicides were incorporated with a tandam disk following application and then harrowed. The post plant pre emergence products were incorporated with a spike tooth harrow.

Vernolate at four pounds per acre practically eliminated the wheat stand. Using vernolate + R 32882 we did obtain a very light stand of wheat. Wild oat control was fair with the yield being about the same as the non-weeded check.

The post plant incorporation of HOE 23408 did not give us adequate wild oat control. Yields were just slightly higher than our non-weeded check, but not significantly higher.

The various formulations of triallate did increase yields signifi- in most cases over the non-weeded check. However, the yields were not significantly greater than the weeded check, but about equal. Our best control with the granular trillate was at one and one-half pounds of the "old" formulation. The "new" granular formulations did not seem to yield as great as the"old"in this study. The EC formulation was the highest yielding treatment in the study.

HOE 23408 in combination with 2,4-D amine and in combinatio with MCPA + bromoxynil as tank mixes, resulted in lower yields and less wild oat control than where the herbicides were applied as split applications. In the split application HOE 23408 was applied first and five days later the broadleaf herbicide was applied. In the later technique, wild oat control yields were very similar to the hand weeded check.

Barban treatments exceeded our hand weeded check yields. The high rate of barban at one pound per acre resulted in a 16.5 bushels per acre yield.

Avenge applied in the three to five leaf stage at one pound per acre did give us three bushel per acre higher yield than our non-weeded check. The number of seeds of wild oats were not particularly reduced in this treatment.

Penoxalin applied pre emergence did not give us adequate wild oat control. Where the penoxalin was applied post plant pre emergence the yields were higher, less wild oats, but these differences were not statistically significant. Table 4.

Experiment II - Barley Section

Vernolate at four pounds per acre did not reduce the stand of barley as much as it did spring wheat. The yield of barley was 13.2 bushels per acre, however with vernolate plus the safner the yield was almost doubled to 27.5 bushels per acre. These yields were not significantly greater than the non-weeded check, but the vernolate plus safner did equal the hand weeded check.

HOE 23408 applied post plant pre emergence did not result in yield increases and wild oat control was not significant.

In the triallate compounds the EC formulation resulted in the highest yield in the experiment. This yield was not significantly higher than the non-weeded check, but it was 6.9 bushels per acre higher. The "old" granular formulations were higher in yield than the "new" formulations.

HOE 23408 in combination with the broadleaved weed killers, as a tank mix, did not give as good weed control as when they were applied as a split application. Yields and wild oat control were better where HOE 23408 was applied first and then the broadleaf killers applied five days later.

Barban at one-half and one pound per acre gave equal wild oat control, and yields were the same.

Avenge at the one pound per acre rate provided good wild oat control. Yields were higher than the hand weeded check, but not statistically significant. This was the second highest yielding treatment in the experiment.

Penoxalin did not provide adequate weed control either as a pre emergence or a post plant pre emergence product.

The rather higher C.V. for this study can be attributed in part, to the lack of an uniform stand of wild oats or the technique in which we obtained the data. Table 5.

Table 1. Products used in these experiments.

Common Name	Trade Name or Other	Chemical Name	Company
barban		4-chloro-2-butynyl m-chlorocarbanilate	Gulf Chem.
bromoxynil	Brominal Buctril	3,5-dibromo-4-hydroxybenzonitrile	Amchem Rhodia
difenzoquat	Avenge	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium	American Cyanamid
	HOE 23408	methyl[2- 4-(2,4-dichorophenoxy)phenoxy] propanote	American Hoechst
MCPA		[(4-chloro-o-tolyl)oxy]acetic acid	Amchem
MSMA	Ansar 529HC	Monosodium methanearsonate	Ansul
penoxalin	Prowl	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	American Cyanamid
triallate	Fargo	S-(2,3,3-trichloroally)diisopropylthiocarbamate	Monsanto
2,4-D	2,4-D	(2,4-dichlorophenoxy)acetic acid	-
vernolate	Vernam	S-propyl dipropylthiocarbamate	Stauffer

Table 2. Summary of results of a selective herbicide experiment for the control of wild oats in spring wheat; conducted by the Northwestern Agricultural Research Center on the Paul Boss farm, Kalispell, MT., 1975. Experiment #1.

Date seeded: May 14,1975 Date harvested: September 10, 1975 Size of plot: 32 sq. ft.

Herbicide	Rate/Acre	% Wild Oats	% Wheat	Yield Bu/A 2/	Yield Bu/A 3/	Comments
			1-3 leaf stage of wild oats			
HOE 23408	0.75#	5.9	93.5	16.4	15.4b	many wild oats, some stunted, wheat stand a little thin
HOE 23408	1.00#	3.9	95.8	23.3	22.3ab	most wild oats stunted
HOE 23408	1.50#	3.6	95.8	22.9	21.4ab	most wild oats stunted
			2 leaf stage of wild oats			
Barban	0.375#	5.4	94.2	16.8	15.9b	most wild oats stunted, wheat stand a little thin
			2 leaf stage of grain			
MSMA	2.0#	10.3	89.5	6.9	6.1	wheat stand thin, wild oats stunted for several weeks
MSMA	3.0#	13.0	87.0	8.1	7.3	after being sprayed, now no control evident
			4 leaf stage of grain			
MSMA	2.0#	8.5	91.5	12.3	11.3	same as above
MSMA	3.0#	12.6	87.3	9.0	7.9	same as above
			3-5 leaf stage of wild oats			
Avenge	8oz	5.7	90.5	14.2	13.4b	wheat stand thin, limited control
Avenge	10oz	7.5	91.7	14.2	13.1b	wheat stand a little thin, some wild oats stunted
Avenge + MCPA	10oz + 6oz	4.5	93.2	17.3	15.9b	many wild oats, some stunted
Avenge + MCPA	12oz + 6oz	6.9	92.5	14.1	13.1b	wheat stand a little thin, wild oats stunted
Avenge + bromoxynil	12oz + 6oz	8.8	90.3	7.1	6.5	wheat stand thin, wild oats stunted
Avenge + 2,4-D amine	12oz + 6oz	13.1	86.2	9.5	8.3	wheat stand thin, limited control
Avenge + bronate	12oz + 4oz	6.4	92.9	10.2	9.6	wheat stand thin, some wild oats stunted
HOE 23408	0.75#	6.5	92.8	12.7	11.9	wheat stand thin, wild oats stunted
HOE 23408	1.00#	4.7	95.0	18.4	17.6b	wheat stand a little thin, wild oats stunted
HOE 23408	2.00#	2.4	96.7	24.8	24.2a	wild oats present are stunted
Check (hand weeded)	0.0	1.2	98.3	15.9	15.7	
Check (not weeded)	0.0	6.0	94.0	7.7	7.3	many wild oats, wheat stand thin
$\bar{x}$		6.8	92.4		13.2	
F 1/		4.17**	2.76**		8.20**	
S.E.$\bar{x}$		1.65	1.96		1.88	
L.S.D. (.05)		4.72	5.62		5.39	
C.V.%		24.07	2.12		14.27	

Table 2 . (con't)

Application Information:

Date of application	6-4-75[4/]	6-5-75[5/]	6-10-75[6/]
Temperature	60 (F)	50 (F)	50 (F)
Humidity	68%	60%	60%
Wind velocity	calm	0-5 mph	0-5 mph
Cloud cover	P/C	P/C	clear
Soil type	clay loam	clay loam	clay loam
Spray volume	5.5 gpa	11.33 gpa	11.33 gpa
Stage of growth	1-2 leaf	1-2 leaf	3-5 leaf

1/ Value for treatment comparison
2/ Includes wheat and wild oats
3/ Wild oat free wheat
4/ Barban applications
5/ HOE 23408, MSMA, applications
6/ HOE 23408, MSMA, Avenge and combinations of herbicides
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Yields significantly greater than the hand weeded check
b/ Yields significantly greater than the non-weeded check

Table 3. Summary of results of a selective herbicide experiment for the control of wild oats in spring barley; conducted by the Northwestern Agricultural Research Center on the Paul Boss farm, Kalispell, MT, 1975. Experiment #1.

Date seeded: May 14, 1975 Date harvested: September 10, 1975 Size of plot: 32 sq. ft.

Herbicide	Rate/Acre	% Wild Oats	% Barley	Yield Bu/A 2/	Yield Bu/A 3/	Comments
			1-3 leaf stage of wild oats			
HOE 23408	0.75#	2.4	97.0	29.7	28.9 b	many wild oats, some stunted
HOE 23408	1.00#	2.5	97.1	31.9	31.2 b	most wild oats stunted
HOE 23408	1.50#	2.9	96.9	31.3	30.5 b	wild oats stunted
			2 leaf stage of wild oats			
Barban	0.375#	2.2	96.9	28.1	27.4 b	many stunted wild oats
			2 leaf stage of grain			
MSMA	2.0#	5.4	94.6	11.8	11.2	barley stand thin, wild oats stunted for several weeks
MSMA	3.0#	4.9	95.1	17.5	16.9	after being sprayed, now no control evident
			4 leaf stage of grain			
MSMA	2.0#	5.7	94.3	19.9	19.0	same as above
MSMA	3.0#	6.5	93.5	20.7	19.4	same as above
			3-5 leaf stage of wild oats			
Avenge	8oz	3.2	96.3	15.9	15.4	barley stand thin, limited control
Avenge	10oz	2.8	96.9	23.7	23.0	barley stand a little thin, some wild oats stunted
Avenge + MCPA	10oz + 6oz	1.8	97.9	30.7	30.2 b	many wild oats, some stunted
Avenge + MCPA	12oz + 6oz	3.0	96.8	24.5	23.8	barley stand a little thin, wild oats stunted
Avenge + bromoxynil	12oz + 6oz	7.5	91.4	10.2	9.2	barley stand thin, wild oats stunted
Avenge + 2,4-D amine	12oz + 6oz	7.4	91.8	16.4	15.3	barley stand thin, limited control
Avenge + bronate	12oz + 4oz	3.6	95.1	16.8	16.3	barley stand thin, many wild oats, some stunting
HOE 23408	0.75#	4.0	95.7	18.8	18.0	barley stand thin, wild oats stunted
HOE 23408	1.00#	3.0	96.8	24.4	23.7	barley stand a little thin, wild oats stunted
HOE 23408	2.00#	1.1	98.6	37.8	37.4 b	wild oats present are stunted
Check (hand weeded)	0.0	0.7	98.9	32.8	32.6 b	
Check (not weeded)	0.0	4.7	95.3	15.6	15.0	many wild oats, barley stands thin
$\bar{x}$		3.8	95.8		22.2	
F 1/		2.24*	2.04*		5.68**	
S.E.$\bar{x}$		1.31	1.41		3.28	
L.S.D. (.05)		3.76	4.03		9.40	
C.V. %		34.90	1.47		14.78	

Table 3 . (con't)

Application Information:

Date of application	6-4-75 4/	6-5-75 5/	6-10-75 6/
Temperature	60 (F)	50 (F)	50 (F)
Humidity	68%	60%	60%
Wind velocity	calm	0-5 mph	0-5 mph
Cloud cover	P/C	P/C	clear
Soil type	clay loam	clay loam	clay loam
Spray volume	5.5 gpa	11.33 gpa	11.33 gpa
Stage of growth	1-2 leaf	1-2 leaf	3-5 leaf

1/ Value for treatment comparison
2/ Includes barley and wild oats
3/ Wild oat free barley
4/ Barban applications
5/ HOE 23408, MSMA applications
6/ HOE 23408, MSMA, Avenge and combination of herbicides
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
b/ Yields significantly greater than the non-weeded check

Table 4. Summary of results of a selective herbicide experiment for the control of wild oats in spring wheat; conducted by the Northwestern Agricultural Research Center on the Paul Boss farm, Kalispell, MT, 1975. Experiment #2

Date seeded: May 14, 1975 Date harvested: September 10, 1975 Size of plot: 32 sq. ft.

Herbicide	Rate #/A	% Wild Oats	% Wheat	Yield Bu/A[9]	Yield Bu/A[10]	Comments
Preplant Incorporate[1]						
Vernolate	4.0[2]					about 60% control of wild oats, those present healthy
Vernolate+R32882	4.0[3]	13.7	84.6	8.7	7.4	about 50% control of wild oats, those present tall, healthy
Post Plant Incorporate						
HOE 23408	1.0	6.1	93.1	10.2	9.5	little or no control, grain thin, some stunted
HOE 23408	2.0	4.6	95.2	9.4	9.0	little or no control, grain thin, some stunted
HOE 23408	4.0	5.9	92.6	10.3	9.7	little or no control, grain thin, some stunted
Triallate EC	1.25	3.3	96.1	20.5	19.8 e	very little control, wheat stand thin
Triallate gran[4]	1.00	9.8	89.8	15.1	13.6	control limited, some wild oats dwarfed, wheat stand thin
Triallate gran[4]	1.25	7.1	92.4	13.8	12.8	control limited, wheat stand a little thin
Triallate gran[5]	1.50	2.7	96.6	19.3	18.8 e	some control, wild oats appear healthy
Triallate gran[5]	1.00	7.2	92.4	16.7	15.6 e	limited control, wheat stand a little thin
Triallate gran[5]	1.25	6.3	93.1	17.3	16.2 e	limited control, wheat stand a little thin
Triallate gran	1.50	14.7	84.2	11.0	9.6	limited control, wheat stand a little thin
2-3 Leaf Stage						
HOE23408 + 2,4-D amine	1.00 + .375	9.1	88.2	10.4	9.4	very little control, grain stands thin
HOE23408 + MCP + bromoxynil	1.0 + .375 + .375	5.3	94.0	15.4	14.5	very little control, grain stands thin
HOE23408 + 2,4-D amine[6]	1.0 + .375	5.6	93.8	18.5	17.6 e	wild oats dwarfed, about 60% control
HOE23408 + MCP + bromoxynil[6]	1.0 + .375 + .375	4.0	94.8	20.6	19.8 e	wild oats dwarfed, about 55% control
1-2 Leaf Stage						
Barban	0.5	6.7	92.9	18.7	17.5 e	many wild oats present, dwarfed
Barban	1.0	7.7	90.5	17.8	16.5 e	many wild oats present, some grain stunted, stand thin
3-5 Leaf Stage						
Avenge	1.0	8.5	90.3	18.5	17.1	wild oats dwarfed

Table 4 . (con't)

Herbicide	Rate #/A	% Wild Oats	% Wheat	Yield Bu/A 9/	Yield Bu/A 10/	Comments
				Pre emergence		
Penoxalin	1.5	5.8	93.1	10.0	9.4	little or no control, grain stands thin
Penoxalin	2.0	4.4	94.9	10.9	10.4	little or no control, grain stands thin
Penoxalin	3.0	6.5	92.4	9.1	8.4	little or no control, grain stands thin
Penoxalin 7/	2.0	6.9	92.3	13.0	12.1	little or no control, grain stands thin
Check, hand weeded	0.0	0.9	98.4	14.8	14.7	wheat stands a little thin
Check, not weeded	0.0	8.6	90.6	8.3	7.7	many wild oats, grain stands thin
$\bar{x}$ 8/		6.7	92.4		13.2	
F 8/		2.02*	2.04*		2.89**	
S.E.$\bar{x}$		2.18	2.34		2.40	
L.S.D. (.05)		6.20	6.67		6.81	
C.V. %		32.45	2.54		18.15	

1/ Incorporated with tiller
2/ No wheat to harvest
3/ Seed treated with R32882
4/ Old granular formulation
5/ New granular formulation
6/ Applied 5 days after application of HOE23408
7/ Post plant, pre emergence
8/ Value for treatment comparison
9/ Includes wheat and wild oats
10/ Wild oat free wheat
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Application Information

	(a)	(b)	(c)	(d)
Date of application	5-14-75	6-4-75	6-5-75	6-10-75
Temperature	65 (F)	60 (F)	50 (F)	50 (F)
Humidity	60%	68%	60%	60%
Wind velocity	2-3 mph	calm	0-5 mph	0-5 mph
Cloud cover	P/C	P/C	P/C	clear
Soil type	Clay loam	Clay loam	Clay loam	Clay loam
Stage of growth	-	1-2	1-3	3-5
Spray volume	11.33	5.5	11.33	11.33

(a) Preplant incorporated materials
Post plant incorporated materials
(b) Barban applications
(c) HOE 23408 and combination applications
(d) Avenge applications
(e) Yields significantly greater than the non-weeded check

Table 5. Summary of results of a selective herbicide experiment for the control of wild oats in spring barley; conducted by the Northwestern Agricultural Research Center on the Paul Boss farm, Kalispell, MT, 1975. Experiment #2.

Date seeded: May 14, 1975 Date harvested: September 10, 1975 Size of plot: 32 sq. ft.

Herbicide	Rate #/A	% Wild Oats	% Barley	Yield Bu/A[6/]	Yield Bu/A[9/]	Comments
Preplant Incorporate[1/]						
Vernolate	4.0	10.0	88.6	14.5	13.2	about 60% wild oats controlled, those present healthy
Vernolate + R32882[2/]	4.0	3.4	96.1	28.4	27.5	about 50% control on wild oats, those present tall, healthy
Post Plant Incorporate						
HOE 23408	1.0	2.1	97.3	18.9	18.6	little or no control, grain thin, some stunting
HOE 23408	2.0	1.9	97.8	14.0	13.7	little or no control, grain thin, some stunting
HOE 23408	4.0	3.1	96.0	16.6	16.2	little or no control, grain thin, some stunting
Triallate EC	1.25	1.5	97.8	33.9	33.4	very little control
Triallate gran[3/]	1.00	1.9	97.3	33.7	33.0	control limited, some wild oats dwarfed
Triallate gran[3/]	1.25	3.8	95.7	24.3	23.6	control limited
Triallate gran[4/]	1.50	1.2	98.2	33.8	33.4	some control
Triallate gran[4/]	1.00	2.4	97.1	30.1	29.3	limited control of wild oats
Triallate gran[4/]	1.25	2.5	96.7	28.8	28.1	limited control
Triallate gran	1.50	4.5	94.3	22.8	22.2	limited control
2-3 leaf stage						
HOE23408 + 2,4-Damine	1.0 + .375	8.0	91.6	15.7	14.5	very little control, grain stands thin
HOE23408 + MCP + bromoxynil	1.0 + .375 + .375	2.6	96.9	23.3	22.7	very little control, grain stands thin
HOE23408+2,4-Damine[5/]	1.0 + .375	2.2	97.2	29.4	28.8	wild oats dwarfed, about 60% control
HOE23408 + MCP + bromoxynil[5/]	1.0 + .375 + .375	1.2	98.1	31.4	31.2	wild oats dwarfed, about 55% control
1-2 leaf stage						
Barban	0.5	2.5	97.3	29.6	28.9	many wild oats present, dwarfed
Barban	1.0	2.5	97.2	29.1	28.4	many wild oats present, dwarfed, some stunting and thinning of grain
3-5 leaf stage						
Avenge	1.0	2.2	97.1	32.9	32.3	wild oats dwarfed

Table 5. (con't)

Herbicide	Rate #/A	% Wild Oats	% Barley	Yield Bu/A 8/	Yield Bu/A 9/	Comments
			Pre emergence			
Penoxalin	1.5	2.0	97.6	18.6	18.2	little or no control, grain stands thin
Penoxalin	2.0	2.3	97.5	17.8	17.4	little or no control, grain stands thin
Penoxalin	3.0	3.4	96.2	17.4	16.8	little or no control, grain stands thin
Penoxalin 6/	2.0	3.1	96.0	21.8	21.3	little or no control, grain stands thin
Check (hand weeded)	0.0	1.0	98.5	26.7	26.5	
Check (not weeded)	0.0	3.6	95.6	20.6	20.0	many wild oats, grain stands thin
$\bar{x}$ 7/		3.0	96.4		24.0	
F 7/		2.64**	2.05*		1.94*	
S.E.$\bar{x}$		1.24	1.51		4.79	
L.S.D. (.05)		3.52	4.29		13.63	
C.V. %		41.37	1.57		20.01	

1/ Incorporated with tandam disk
2/ Seed treated with R32882
3/ Old granular formulation
4/ New granular formulation
5/ Applied 5 days after application of HOE 23408
6/ Post plant, pre emergence
7/ Value for treatment comparison
8/ Includes barley and wild oats
9/ Wild oat free barley
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Application Information

	(a)	(b)	(c)	(d)
Date of application	5-14-75	6-4-75	6-5-75	6-10-75
Temperature	65 (F)	60 (F)	50 (F)	50 (F)
Humidity	60%	68%	60%	60%
Wind velocity	2-3 mph	calm	0-5 mph	0-5 mph
Cloud cover	P/C	P/C	P/C	clear
Soil type	clay loam	clay loam	clay loam	clay loam
Stage of growth	-	1-2	1-3	3-5
Spray volume	11.33	5.5	11.33	11.33

(a) Preplant incorporated materials
Post plant incorporated materials
(b) Barban applications
(c) HOE 23408 and combination applications
(d) Avenge applications

YEAR: 1975

TITLE: Chemical control of weeds in small grains

LOCATION: Northwestern Agricultural Research Center, MAES, MSU, Kalispell, MT, Field Nos. R-9, R-13
William Ambrose farm, Kalispell MT

PERSONNEL: Vern R. Stewart
Cooperators - Weed Research Committee, MAES, MSU

OBJECTIVES: To find a herbicide or herbicides that will effectively and economically control annual weeds in winter and spring grains, with little or no deleterious effect on small grain yields.

SIGNIFICANT FINDINGS:

Experiment I -

Bentazon gave the best weed control. The combination of bromoxynil plus 69-1299 provided excellent weed control. The standard treatment of bromoxynil plus MCPA at 6 oz. each was fairly effective, but the weeds were too large at time of application.

Experiment II -

We obtained the best weed control, which was not too good, with R31401 at 2 lbs/a. We did see a yield reduction. This was the first year we have seen a yield reduction when using bentazon.

Experiment III -

Bentazon at 4 lbs/a gave us the best weed control and bentazon at 2 lbs/a caused a significant reduction in the test weight of barley.

MATERIALS AND METHODS:

Three separate experiments were conducted in 1975. They were: (1) control of winter annuals in winter wheat; (2) control of spring annuals in spring wheat; and (3) control of spring annuals in spring barley. All herbicides used were post emergence treatments. Herbicides used are listed in Table 1.

Herbicides were applied at right angles to the seeded grain to established stands of winter wheat, spring wheat and spring barley. Plot size was 10 x 20 feet. Yields were secured by harvesting 32 sq. ft. from the area sprayed.

Weed species found in a natural state were: field gromwell (Lithospermum arvense (L)); false flax (Camelina microcarpa (Andz)); tumble mustard (Sisymbrium altissimum (L.)); field pennycress (fanweed) (Thlaspi arvense (L.)); chickweed (Stellaria media (L.)); tansy mustard (Descurainia sophia (Walt)); henbit (Lamium amplexicaule (L.)); lambsquarter (Chenopodium album (L.)); plantain (Plantago sp); wild buckwheat (Polygonum convolvulus(L.)); shepherdspurse (Capella bursa-pastoris (L.)Medic); catchfly group (Silene conidea).

Where applicable data was analysed statistically using the Analysis of Variance.

RESULTS AND DISCUSSION:

Experiment I - Winter Wheat

Herbicide applications were somewhat late for optimum weed control. The wheat was fully tillered, approximately six inches tall, and excellent moisture conditions at time of application. The fanweed was approximately seven inches tall

Results and Discussion (con't)

and the gromwell four inches. Weeds were too far advanced in growth for the usual treatment of bromoxynil plus MCPA to be effective. Weeds should have been still in the rosette stage for this product to be effective. Therefore, the results as far as some products are concerned, are not really too relative to their ability to perform.

Bifenox gave very unsatisfactory control. Bentazon was the best product we used giving us almost complete weed control with little or no effect on yield. No additional weed control was gained by the combination of MCPA and bentazon.

Dicamba, regular formulation, gave us very poor weed control. We noted some yield reduction, however this reduction in yield was not statistically significant. The combination of dicamba and 2,4-D did give slightly better weed control. Somewhat better than the combination of dicamba and MCPA. The new formulation of dicamba (slow release) did not give us any additional weed control alone or in combination with the phenoxys.

RH2915 did not give a high degree of weed control, however we noticed as the rate increased the yield decreased.

R31401 gave fairly adequate weed control as rates were increased, but as the rates increased the yields also decreased.

Bromoxynil alsone did not provide the type of weed control we would expect, however there was 70% control.

Rhodia's product, 69-1299,did not provide very satisfactory weed control. The combination of bromoxynil and 69-1299 did increase control. Weed control was almost 100% with bromoxynil at .375 lbs/a plus 69-1299 at 4 lbs/a.

Terbutryn gave us 80% weed control which was the same as the combination of bromoxynil and MCPA. Table 2.

Experiment II - Spring Wheat

Weed control was not very effective with any product in this study. R31401 gave 80% weed control. Bentazon at 4 lbs/a provided 50% weed control. These rates of weed control are not satisfactory.

Yield differences were not found to be statistically different, but the 3 lb/a rate of bentazon did result in quite a low yield, seven bushel below the mean. The dicamba 2S, 1 lb/a, resulted in eight bushels below the mean. R31401, which gave the best weed control caused a seven bushel yield below the mean. It is interesting to note that this is the first year in our work with bentazon that we have seen any yield reduction of grain. Table 3.

Test weights were fairly consistant throughout the study, running from 56.6 to 58.9. However, no statistical measurements were made on the test weights.

Experiment III - Spring Barley - Ingrid

Bentazon provided us the best weed control in the spring barley experiment. About 90% weed control was obtained with bentazon at 4 lbs/a. R31401 provided up to 80% weed control at the higher rates of application. There did not seem to be a relationship between the weed score and yields. Using the Duncan Multiple Range Test we found that the yields did not vary too much. The lowest yielding plot was dicamba 2S at 2.5 lbs/a, with 70% weed control and a yield of 50.4 bu/a. Weed control of 20% gave a yield of 89.5 bu/a.

Results and Discussion (con't)

Significant differences in test weights were found. The low test weights occurred where we used bentazon. As the rate increased the test weight increases. The lowest test weight occurred where we used bentazon at 2 lbs/a, giving a test weight of 43.6 lbs/bu. Dicamba 2S at .25 and .5 lbs/a also resulted in somewhat lower test weights. The combination of bromoxynil and MCPA also caused some reduction in test weight. This is the first year that we have made this observation and it is something that should be watched very closely in the future. Table 4.

Table 1. Products used in these experiments.

Common Name	Trade Name or Other	Chemical Name	Company
bentazon	Basagran	3-isopropyl-1H-2,1,3-benzothiadiazin-(4)3H-one 2,2-dioxide	BASF
bifenox	Modown	methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate	Mobil
bromoxynil	Buctril Brominal	3,5-dibromo-4-hydroxybenzonitrile	Rhodia Amchem
dicamba	Banvel D	3,6-dichloro-o-anisic acid	Velsicol
MCPA		(4-chloro-o-tolyl)oxy acetic acid	
	RH2915	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-trifluoromethylbenzene	Rohmn-Hass
terbutryn	Igran	2-(tert-butylamino)-4-(ethylamino)-6-(methylthio)-s-triazine	CIBA-Geigy
2,4-D	2,4-D	(2,4-dichlorophenoxy)acetic acid	
	69-1299	chemical name not available	Rhodia

Table 2. Summary of weed control and yield data obtained from herbicide study on winter wheat located on the William Ambrose farm, Kalispell, MT, 1975.

Date seeded: September, 1974 Date harvested: August 14, 1975 Size of plot: 32 sq. ft.

Treatment		Weed Score	Yield	Test Wt	Remarks[1/]
Herbicide	Rate #/A	0-10	Bu/A	Lbs/Bu	
Bifenox	1.25	3 efg[2/]	52.6	58.1	gromwell,fanweed (no seeds in Rep.2)
Bifenox	1.50	5 cdef	50.1	58.7	fanweed,Silene,gromwell (stunted in Rep. 1)
Bentazon	3.00	10 a	50.9	59.0	no weeds
Bentazon	4.00	10 a	52.0	58.7	no weeds
Bentazon + MCP	4.00 + .25	9 ab	48.6	57.8	gromwell,fanweed (no seed development)
Bentazon + MCP	4.00 + .33	10 a	51.3	58.5	gromwell,fanweed (no apparent seeds in most of weed population
Dicamba	.12	3 efg	45.2	59.5	gromwell,fanweed (no seed in Rep. 3)
Dicamba	.25	3 efg	55.5	59.1	gromwell,fanweed (no seed in Rep. 3),slight tractor marks in Rep. 3
Dicamba + 2,4-D	.12 + .25	6 bcde	56.8	59.6	gromwell,fanweed,tractor marks in Rep. 3
Dicamba + MCP	.12 + .25	4 def	57.5	58.6	gromwell,fanweed
Dicamba 2S	.12	3 efg	51.5	59.5	gromwell,fanweed,(no seeds Rep.3),false flax, slight tractor marks in Rep. 2
Dicamba 2S	.25	5 cdef	48.2	59.4	gramwell(stunted in Rep.3)fanweed(no seed in Rep.3), tractor marks in Rep. 3
Dicamba 2S	.50	4 def	48.6	59.6	gromwell (stunted in Rep.3) tractor marks
Dicamba 2S + 2,4-D	.12 + .25	4 def	50.6	58.8	gromwell (stunted in Rep.3) fanweed,tractor marks in Rep. 3
Dicamba 2S + MCP	.12 + .25	3 efg	47.8	58.6	gromwell,fanweed,tractor marks in Rep. 3
RH 2915	.10	2 fg	55.4	57.8	fanweed, gromwell
RH 2915	.15	3 efg	49.6	58.4	gromwell,fanweed, false flax
RH 2915	.20	4 def	43.1	58.3	gromwell,fanweed,false flax
R 31401	1.00	7 abcd	51.2	57.4	gromwell,false flax,fanweed, Silene
R 31401	2.00	9 ab	43.8	58.2	gromwell,fanweed (stunted in Rep 2)
R 31401	4.00	9 ab	33.5	56.9	gromwell,fanweed,tractor marks,wheat heavily damaged in Rep. 3
Bromoxynil	.375	7 abcd	53.9	57.8	gromwell
Bromoxynil + 69-1299	.375 + 1.0	9 ab	52.7	57.2	gromwell, false flax
Bromoxynil + 69-1299	.375 + 2.0	10 a	49.0	57.6	fanweed in Rep. 2 with no seed set
Bromoxynil + 69-1299	.375 + 4.0	10 a	51.0	57.2	no weeds
69-1299	1.00	6 bcde	49.5	57.7	false flax,fanweed (no seed Rep.3) gromwell
69-1299	2.00	5 cdef	49.9	58.1	gromwell,fanweed(no seed in Rep.3) Silene
69-1299	4.00	6 bcde	41.3	58.9	gromwell, fanweed
Terbutryn	1.00	8 abc	47.0	57.8	gromwell, false flax

Table 2. (con't)

Treatment Herbicide	Rate #/A	Weed Score 0-10	Yield Bu/A	Test Wt Lbs/Bu	Remarks 1/
Bromoxynil + MCP	.375 + .375	8 abc	58.0	58.3	gromwell (stunted on Rep. 3)
Check	0.0	0 g	48.8	59.0	fanweed, gromwell, Silene
	$\bar{x}$	6.0	49.8	58.4	
	F 3/	17.14**	1.196	.0	
	S.E. $\bar{x}$	1.818	4.565	.0	
	C.V.%	14.06	9.16	.0	

1/ Weed species present following application of herbicide
2/ Items having common letter are not significantly different one from another .05 level (Duncan's Multiple Range Test)
3/ Value for treatment comparison
* Indicates statistical difference at the .05 level
** Indicates statistical difference at the .01 level

Application Data:

Date of application	5-13-75
Temperature	55 (F)
Humidity	65%
Wind velocity	3-7
Cloud Cover	clear
Volume	11.33 gpa
Soil type	silt loam
Stage of growth	4 to 7" tall
Weed species	field gromwell - fanweed

Table 3. Summary of weed control and yield data obtained from a herbicide study on spring wheat at the Northwestern Agricultural Research Center, Field R-13, Kalispell, MT, 1975.

Date seeded: May 12, 1975 Date harvested: September 25, 1975 Size of plot: 32 sq. ft.

Treatment		Weed Score	Yield	Test Wt	Remarks[1/]
Herbicide	Rate #/A	0-10	Bu/A	Lbs/Bu	
Bifenox (flowable 4#)	.50	4	49.9	56.6	lambsquarter, gromwell, chickweed, fanweed, plantain, henbit, tansy mustard, wild buckwheat. Slight mottling of wheat, henbit set back.
Bifenox	.75	3	52.8	58.0	lambsquarter, tansy mustard, chickweed, fanweed, plantain, wild buckwheat, henbit, gromwell. Henbit set back, some mottling of wheat.
Bifenox	1.00	3	44.2	59.1	gromwell, tansy mustard, chickweed, fanweed, plantain, wild buckwheat, henbit (set back), slight mottling of wheat.
Bifenox(WP 80%)	.50	2	47.7	57.8	lambsquarter, tumble mustard, gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit, slight mottling of wheat.
Bifenox(WP 80%)	.75	2	47.2	58.2	gromwell, tansy mustard, chickweed, fanweed, plantain, wild buckwheat, henbit, lambsquarter. Henbit severely set back.
Bifenox(WP 80%)	1.00	4	45.4	58.6	tumble mustard, chickweed, fanweed, plantain, wild buckwheat, henbit, lambsquarter, gromwell, few henbit set back, slight mottling of wheat.
Bentazon	2.00	4	38.2	58.0	fanweed, plantain, henbit, gromwell, wild buckwheat, lambsquarter good control, except henbit.
Bentazon	3.00	4	37.4	57.6	fanweed, plantain, wild buckwheat, henbit, lambsquarter, tumble mustard, good control except henbit.
Bentazon	4.00	5	50.2	58.4	fanweed, plantain, wild buckwheat, tumble mustard, gromwell, good control except henbit.
Dicamba	.12	1	44.6	58.5	tumble mustard, gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit, lambsquarter, false flax.
Dicamba	.25	1	50.6	58.0	tumble mustard, gromwell, tansy mustard, chickweed, fanweed, plantain, wild buckwheat, henbit.
Dicamba + 2,4-D	.12 + .25	2	40.2	57.3	tumble mustard, gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit, tansy mustard.
Dicamba + MCP	.12 + .25	2	40.5	58.9	gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit.
Dicamba 2S	.12	1	39.2	58.9	gromwell, tansy mustard, chickweed, fanweed, plantain, wild buckwheat, henbit.
Dicamba 2S	.25	2	53.7	58.1	Lambsquarter, gromwell, fanweed, wild buckwheat, henbit, chickweed plantain.
Dicamba 2S	.50	2	34.2	58.2	gromwell, tansy mustard, fanweed, plantain, wild buckwheat, henbit tumble mustard, chickweed.

Table 3. (con't)

Treatment Herbicide	Rate #/A	Weed Score 0-10	Yield Bu/A	Test Wt Lbs/Bu	Remarks 1/
Dicamba 2S + 2,4-D	.12 .25	1	46.4	57.9	gromwell, fanweed, plantain, wild buckwheat, henbit, tumble mustard, chickweed, tansy mustard.
Dicamba 2S + MCP	.25 + .25	2	41.5	58.0	gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit, tansy mustard.
2,4-D	.33	2	46.4	57.7	gromwell, tansy mustard, fanweed, plantain, wild buckwheat, henbit, chickweed, lambsquarter.
Bromoxynil + MCP	.375 + .375	2	43.1	57.5	gromwell, chickweed, fanweed, plantain, wild buckwheat, henbit, tansy mustard.
R-31401	1.00	6	41.3	56.2	gromwell, chickweed, fanweed, wild buckwheat, cockle, plantain, henbit, lambsquarter, most weeds sickly with burnt tips and slight yellowing.
R-31401	2.00	8	37.4	55.9	gromwell, wild buckwheat, henbit, fanweed, chickweed, plantain, burnt tips and yellowing.
Check	0.0	0	41.6	58.1	tumble mustard, gromwell, tansy mustard, fanweed, chickweed, plantain, wild buckwheat, henbit, lambsquareter
	$\bar{x}$ 2/	2.9	44.0	58.00	
	F 2/	17.55**	.87NS	.00	
	S.E.$\bar{x}$	.43	5.64	.00	
	CV %	14.83	12.81	.00	

1/ Weed species present following application of herbicide
2/ Value for treatment comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Application Data:

Date of application	6-12-75
Temperature	62 (F)
Humidity	39%
Wind velocity	0-10 mph
Cloud cover	P/C
Soil type	silt loam
Stage of growth	5-7 leaves (wheat)
Weed species	henbit, fanweed, buckwheat
Water volume	11.33 gpa

Table 4. Summary of weed control and yield data obtained from a herbicide study on spring barley at the Northwestern Agricultural Research Center, Field R-9, Kalispell, MT, 1975.

Date seeded: April 30, 1975 Date harvested: September 4, 1975 Size of plot: 32 sq. ft.

Treatment		Weed Score	Yield	Test Wt.	
Herbicide	Rate #/A	0-10	Bu/A[3/]	Lbs/Bu[3/]	Remarks[1/]
Bifenox (flable 4#)	.50	2	89.5 ab	47.4 abcd	fanweed, wild buckwheat, lambsquarter, henbit, tansy & tumble mustard
Bifenox	.75	3	72.7b	47.1 abcd	fanweed, lambsquarter, wild buckwheat, gromwell, tansy mustard
Bifenox	1.00	4	81.4 ab	47.0 abcd	fanweed, gromwell, lambsquarter, henbit, wild buckwheat, tansy & tumble mustard
Bifenox (W.P.80%)	.50	2	75.8 ab	46.3 cdef	fanweed, shepherdspurse, tansy & tumble mustard, gromwell, wild buckwheat, henbit
Bifenox (W.P.80%)	.75	3	83.7 ab	46.8 abcde	fanweed, shepherdspurse, lambsquarter, gromwell, wild buckwheat, tumble mustard, henbit
Bifenox (W.P.80%)	1.00	3	76.2 ab	47.0 abcde	fanweed, shepherdspurse, lambsquarter, tumble mustard, henbit, wild buckwheat
Bentazon	2.00	6	78.5 ab	43.6 f	fanweed, lambsquarter, wild buckwheat, henbit, gromwell, tansy & tumble mustard
Bentazon	3.00	8	75.9 ab	44.6 bcdef	fanweed, shepherdspurse, tansy & tumble mustard, lambsquarter, gromwell, wild buckwheat, henbit
Bentazon	4.00	9	78.4 ab	47.4 abcd	fanweed, lambsquarter, wild buckwheat, tansy & tumble mustard, tire tracks in Rep. 1
Dicamba	.12	3	78.8 ab	47.4 abcd	fanweed, shepherdspurse, tansy & tumble mustard, henbit, lambsquarter, wild buckwheat, gromwell
Dicamba	.25	3	87.7 ab	47.7 abcd	fanweed, shepherdspurse, tansy mustard, gromwell, wild buckwheat, henbit, lambsquarter
Dicamba + 2,4-D	.12 + .25	6	75.7 ab	46.5 cdef	fanweed, shepherdspurse, tansy mustard, wild buckwheat, henbit
Dicamba + MCP	.12 + .25	5	84.9 ab	46.7 abcde	fanweed, gromwell, wild buckwheat, tumble mustard, shepherdspurse, lambsquarter, henbit
Dicamba 2S	.12	2	79.4 ab	47.0 abcde	fanweed, shepherdspurse, lambsquarter, wild buckwheat, henbit, gromwell, tansy & tumble mustard
Dicamba 2S	.25	4	88.0 ab	47.3 abcd	fanweed, shepherdspurse, gromwell, wild buckwheat, henbit, lambsquarter
Dicamba 2S	.50	7	54.4 c	46.0 def	fanweed, shepherdspurse, gromwell, wild buckwheat, henbit, barley droopy in Reps. 2 & 3, stunted in #3
Dicamba 2S + 2,4-D	.12 + .25	6	80.1 ab	46.6 bcdef	fanweed, shepherdspurse, wild buckwheat, gromwell, henbit.

Table 4 . (con't)

Treatment Herbicide	Rate #/A	Weed Score 0-10	Yield Bu/A 3/	Test Wt. Lbs/Bu 3/	Remarks 1/
Dicamba 2S + MCP	.25 + .25	6	85.3ab	47.7abcd	fanweed, shepherdspurse, gromwell, wild buckwheat, henbit, lambsquarter, tansy mustard, barley stunted in Rep. 2
2,4-D	.33	6	89.8ab	46.9abcde	fanweed, wild buckwheat, henbit, tumble mustard
Bromoxynil + MCP	.375 + .375	7	82.8ab	46.1def	fanweed, gromwell, wild buckwheat, henbit
R 31401	1.00	6	82.6ab	49.0ab	fanweed, lambsquarter, wild buckwheat, tumble mustard henbit, gromwell, shepherdspurse
R 31401	2.00	8	87.0ab	49.1a	fanweed, shepherdspurse, wild buckwheat, henbit, tumble mustard
R 31401	3.00	8	88.8ab	48.9abc	fanweed, lambsquarter, wild buckwheat, henbit, gromwell barley slightly stunted in Rep. 2
Check	0	0	78.1ab	47.6abcde	fanweed, shepherdspurse, tansy & tumble mustard, henbit lambsquarter, wild buckwheat, gromwell
	$\bar{x}$	4.8	80.7	47.0	
	F 2/	19.12**	2.56**	2.85**	
	S.E.$\bar{x}$	.56	4.69	.72	
	CV %	15.29	5.82	1.53	

1/ Weed species present following application of herbicide
2/ Value for treatment comparison
3/ Items having common letters are not significantly different one from another .05 level (Duncan's Multiple Range Test)
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Application Data:

Date of application	5-9-75
Temperature	45-62 (F)
Humidity	44%
Wind velocity	calm
Cloud Cover	clear
Soil type	silt loam
Stage of growth	5-6 leaf
Weed species	wild buckwheat - henbit - fanweed

TITLE: Chemical Weed Control in Legumes

PROJECT: Weed Investigations MS 754

YEAR: 1975

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

LOCATION: Northwestern Agricultural Research Center, Field No. R-14

OBJECTIVES:

1. To determine the residual effect of pronamide (Kerb) on crops following alfalfa when applied to an established stand of alfalfa.
2. To find a herbicide that will effectively control weeds the entire season in new seedings of legumes.

SIGNIFICANT FINDINGS:

Experiment I - Pronamide did not adversely affect small grain yields when applied to an established legume crop in the fall, spring plowed and seeded.

Experiment II - USB3153 provided the most effective weed control of annual weeds in the establishment of a new seeding of alfalfa.

MATERIALS & METHODS:

Two experiments were evaluated in 1975. Experiment I was a continuation of a study began in 1973 on an established stand of alfalfa, then cropped with annual crops following the application of pronamide. Winter wheat and winter barley were seeded in the fall of 1974 on the area that had been treated with pronamide. This seeding was made at right angles to the treated area. Yields were obtained by harvesting 32 square feet from each plot. The entire area was sprayed with a combination of bromoxynil and MCP for annual broadleaf weed control.

Experiment II - The objective of this test was to find a product or products that would give season long weed control when establishing a new stand of alfalfa.

Weed species naturally occurring in this location were field pennycress (fanweed)(Thlaspi arvense (L.)); red root pigweed (Amaranthus retroflexus (L.)); lambsquarter (Chenopodium album (L.)); henbit (Lamium amplexicaule (L.)); shepherdspurse (Capella bursa-pastoris (L.)); tumble mustard (Sisymbrium altissimum (L.)); quackgrass (Agropyron repens (L.)).

Weed control measurements were made by counting weeds in a one square foot area. Eight counts were made in each plot. Alfalfa stands were measured on an occupancy basis. A quadrant containing 40 squares, 2 x 2 inches 3 feet long was the instrument used to determine alfalfa stands.

No yield data was obtained the seeding year, however yields will be secured in 1976.

Materials and Methods (con't)

Volume of liquid used, climatic data etc., are included in the tabulated data.

Herbicides used in these two experiments are found in Table 1.

RESULTS AND DISCUSSIONS:

Experiment I - The applications of pronamide were made to established stands of alfalfa and sainfoin in October 1973. Sainfoin yields in the 1974 season were not affected by pronamide application, however alfalfa yields were reduced significantly when .75 lb/a pronamide was used. It is interesting to note that the higher rate of pronamide did not reduce alfalfa yield. Thus, the reduction at .75 lb/a rate could be due to chance.

The legumes were plowed under in the early spring of 1974, seed bed prepared and seeded to spring wheat and spring barley. Yield data was obtained in the fall of 1974. Yields of wheat and barley were not found to be statistically significant, however plots treated with pronamide did show some yield reduction below the checks. Some visual differences were noted during the growing season at the 2 lb/a rate. Details of the 1974 data can be found in the Northwestern Agricultural Research Center Annual Report for 1974. Table 2 gives the 1974 data in this report.

The alfalfa-sainfoin harvested in 1974 was plowed down in the Fall of 1974, seed bed prepared and seeded to winter wheat and winter barley. These crops were harvested in the Fall of 1975.

Winter wheat yields were found to be statistically non-significant when analysed and no apparent pattern in yield was noted. Winter barley yields also show no significant differences. Table 3.

From these data we conclude that two pounds of pronamide applied in the Fall did not have any effect on subsequent crops one and two seasons later.

Experiment II - The natural weed population in this experiment was not uniform. This, in part, accounts for the very high C.V. Fanweed and pigweed were the predominate weed species.

Following is a summary of each product in this experiment:

EPTC - Overall weed control poor. Did reduce the Set ria sp population when compared to the check.

Vernolate - Slightly better than EPTC, but not a high degree of weed control. Pigweed control greater where vernolate was used alone.

Dinitramine - Fair fanweed control, good pigweed control. The .5 lbs/a rate gave 55% overall weed control, whereas the 1.0 lb/a rate gave 80%.

UB3153 - Provided season long control of pigweed. In fact, later in the season control of pigweed was over 95%. The .66 lb/a rate and the 1.0 lb/a rate were not too different in effectiveness.

Profluralin - Seventy percent control. Fair on both pigweed and fanweed.

2,4-DB - Late fall reading was rated as good weed control with a score of seven.

EPTC + 2,4-DB - This combination was not as effective in this test as we have observed in field applications.

Results and Discussion (con't)

Penoxalin - The 2 lb/a rate gave only 58% weed control. This was superior to the 3 lb/a rate. However, the late fall "ocular" reading gave this rate a slight edge over 2 lbs/a.

Fluchloralin - Reduced pigweed and fanweed numbers. Overall weed control 50%. Had one of the higher Fall "ocular" ratings.

Alfalfa stands were not found to be statistically different, however the dinitramine treatments had somewhat lower stands than the checks. Generally they were somewhat below the other products evaluated in the experiment. Table 4.

The evaluation of USB3153 should be continued. Yield data will be obtained from this experiment in 1976.

Table 1. Herbicides used in these experiments.

Common Name[1/]	Trade Name or Other	Chemical Name	Company
pronamide	Kerb	3,5-dichloro-N-(1,1-dimethyl-2-propynyl)benzamide	Rohm & Haas
EPTC	Eptam	S-ethyl dipropylthiocarbamate	Stauffer
vernolate	Vernam	S-propyldipropylthiocarbamate	Stauffer
dinitramine	Cobex	N^4,N^4-diethyl-α,α,α-trifluoro-3,5-dinitrotoluene-2,4-diamine	U.S. Borax
UB3153	UB3153	Chemistry not available	U.S. Borax
profluralin	Tolban	N-(cyclopropylmethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluidine	CIBA-Geigy
penoxalin	Prowl	N-(1-ethylpropyl-3,4-dimethyl-2,6-dinitrobenzenamine	American-Cyanamid
fluchloralin	Basalin	N-(2-chloroethyl)-2,6dinitro-N-propyl-4-(trifluoromethyl)aniline	BASF
2,4-DB	Butoxone	4-(2,4 dichlorophenoxy)butyric acid	Rhodia

1/ Designation used in this report.

Table 2. Effect of pronamide on yield of spring wheat and barley following its application on an established stand of sainfoin and alfalfa. Northwestern Agricultural Research Center. Field No. R-14

Treatment		Replications				
Herbicide	Rate #/A	I	II	III	Total	$\bar{x}$
		Sainfoin (Yield tons/a)				
Pronamide	.50	3.85	3.83	4.46	12.14	4.05
Pronamide	.75	4.78	4.01	5.69	14.48	4.83
Pronamide	1.00	4.65	4.02	3.96	12.63	4.21
Pronamide	2.00	4.25	4.33	4.26	12.84	4.28
Check	0.0	4.06	4.18	3.97	12.21	4.07
					$\bar{x}$	4.29
					F 1/	1.51NS
					S.E.$\bar{x}$	.25768
					C.V.%	6.01
		Alfalfa (Yield tons/a)				
Pronamide	.50	4.42	3.90	4.27	12.59	4.20a
Pronamide	.75	3.64	3.19	3.43	10.26	3.42b
Pronamide	1.00	5.26	4.83	4.46	14.55	4.85a
Pronamide	2.00	5.29	3.80	4.62	13.71	4.57a
Check	0.0	4.05	4.58	4.66	13.29	4.43a
					$\bar{x}$	4.30
					F 1/	5.26*
					S.E.$\bar{x}$	.2364
					C.V.%	5.51
		Spring Wheat (Plot yield in grams)				
Pronamide	.50	754	696	601	2051	34.2
Pronamide	.75	596	621	819	2036	33.9
Pronamide	1.00	513	744	864	2121	35.4
Pronamide	2.00	667	556	754	1977	33.0
Check	0.0	742	583	813	2138	35.6
					$\bar{x}$	34.4
					F 1/	NS
					S.E.$\bar{x}$	3.44
					C.V.%	9.99
		Spring Barley (Plot yield in grams)				
Pronamide	.50	289	455	505	1249	26.0
Pronamide	.75	424	428	415	1267	26.4
Pronamide	1.00	440	448	444	1332	27.8
Pronamide	2.00	342	412	467	1221	25.5
Check	0.0	471	382	581	1434	29.9
					$\bar{x}$	27.1
					F 1/	NS
					S.E.$\bar{x}$	2.318
					C.V.%	8.55

1/ Value for treatment comparison
a/ Value significantly greater than the check .05 level
b/ Value significantly less than the check .05 level
* Indicates statistical significance at the .05 level.

Table 2. (con't)

Size of Plot: 10 x 100 = 1000 square feet
Size of Plot harvested: Legume = 36 square feet
Small grains = 32 square feet

Application Data:

Date =	October 5, 1973
Temperature =	48 degrees Fahrenheit
Humidity =	55%
Wind =	4-6 mph
Cloud Cover =	Cloudy
Volume =	41.7 gpa

Seeding and Harvest Dates of Crops:

Crop	Date Seeded	Date Harvested
Sainfoin	July 3, 1973	July 8, 1974
Alfalfa	July 3, 1973	July 8, 1974
Spring wheat	May 22, 1974	Sept. 13, 1974
Spring barley	June 10, 1974	Sept. 13, 1974

Table 3. Effect of pronamide (Kerb) on subsequent crops when applied to an established stand of alfalfa and sainfoin.
Size of Plot: 16 square feet.

Treatment		Yield (grams/plot)				Yield	Test Wt.	%
Herbicide	Rate #/A	I	II	III	Total	Bu/A	Lbs/Bu.	Plump
				Winter Wheat (Nugaines)				
pronamide	.50	635	972	599	2566	85.6	57.0	-
pronamide	.75	750	877	729	2356	78.6	57.0	-
pronamide	1.00	785	872	780	2437	81.3	56.9	-
pronamide	2.00	729	881	895	2505	83.5	56.9	-
check	0.0	800	819	700	2319	77.3	57.0	-
	$\bar{x}$					81.2		
	F 1/					.43436		
	S.E.$\bar{x}$					5.16869		
	L.S.D.					N.S.		
	C.V. %					6.36		
				Winter Barley (Alpine)				
pronamide	.50	543	959	772	2274	94.8	48.6	76.7
pronamide	.75	464	795	952	2211	92.2	49.4	76.7
pronamide	1.00	721	938	836	2495	104.0	49.4	73.0
pronamide	2.00	613	853	893	2359	98.3	49.1	75.7
check	0.0	760	864	1042	2666	111.1	49.2	80.7
	$\bar{x}$					100.0		76.5
	F 1/					1.15267		1.20671
	S.E.$\bar{x}$					7.0804		2.50776
	L.S.D.					N.S.		N.S.
	C.V. %					7.08		3.28

1/ Value for treatment comparison.

Application Data:

Date applied =	October 5, 1973
Temperature =	48 degrees F
Humidity =	55%
Wind velocity =	4-6 mph
Cloud cover =	cloudy
Volume =	41.7 gpa
Soil type =	silt loam

Table 4. Effect of several herbicides on the control of weeds in the establishment of new seedings of legumes.

Treatment		% Stand[1]	Weed Species[2]							% Weed[3]	Weed Score	
Herbicide	Rate #/A	Alfalfa	Fanweed	Pigweed	Lambs-quarter	Setaria	Henbit	Shepherds-purse	Mustard	Control	4/	5/
					Preplant Incorporate							
Check weedy	0.0	28.79	56.0	73.7	3.0	6.0	8.3	.7	1.0	0	0.0	0.0
EPTC	3.0	23.71	106.7	68.7	1.7	.7	10.3	.3	.0	0	.7	2.7
EPTC	4.0	22.25	98.3	50.7	3.0	.3	2.3	.3	.3	0	2.0	4.0
Vernolate + [5]	3.0	23.09	63.3	58.3	5.0	1.0	1.3	.7	.0	13	1.7	2.7
Vernolate	3.0	21.63	87.3	35.7	6.3	1.3	0.0	.3	.7	11	2.0	6.3
Dinitramine	.5	23.13	45.0	17.0	.7	1.7	0.0	1.3	1.0	55	4.0	6.7
Dinitramine	.66	20.58	49.7	6.0	.7	.7	0.0	1.0	0.0	61	6.0	8.3
Dinitramine	1.0	21.29	23.7	4.0	.7	.7	.3	0.0	0.0	80	6.7	8.3
USB3153	.5	24.09	33.3	3.7	1.0	3.3	0.0	0.0	0.0	70	6.3	8.0
USB3153	.66	28.46	19.0	1.3	0.0	.7	0.0	1.3	.7	81	8.7	9.0
USB3153	1.0	28.43	15.7	2.0	0.0	.3	.3	1.0	0.0	87	8.3	8.3
Profluralin	.75	26.54	21.0	22.0	.3	0.0	0.0	0.0	1.0	70	4.3	6.0
2,4-DB[7]	1.0	26.63	17.0	34.0	.7	1.7	3.7	.3	0.0	61	7.0	7.0
Eptc + 2,4-DB[7]	3.0 + 1.0	27.04	25.3	37.3	2.0	1.0	4.7	1.0	0.0	52	5.0	6.3
Penoxalin	1.5	26.75	48.7	42.7	3.3	0.0	4.0	.7	.3	33	2.3	5.0
Penoxalin	2.0	27.50	35.3	23.3	1.3	.7	1.0	.7	0.0	58	3.3	5.3
Penoxalin	3.0	29.67	26.0	44.7	0.0	8.3	1.7	2.3	1.0	43	5.7	6.7
Fluchloralin	.75	23.71	38.7	19.3	4.7	3.0	1.0	.3	.3	54	4.7	7.7
Fluchloralin	1.0	24.67	39.0	10.3	2.3	1.0	1.0	1.7	1.3	62	4.7	7.0
Check hand weeded	0.0	26.92	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	10.0	10.0
	$\bar{x}$	25.25	42.5	27.7	1.8	1.6	2.0	.9	.4			6.4
	F[a]	1.1864	1.0	3.0*	1.4	.9	1.8	.7	1.0			6.83
	S.E.$\bar{x}$	2.528	27.9	13.4	1.6	2.2	2.2	.8	.5			.89
	C.V.%	10.02	65.7	48.3	85.8	135.9	108.5	89.9	120.6			13.98

a/ Value for treatment comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table 4. (con't)

1/ Based on occupancy using a quadrant 36" x 4" with squares 2" x 2".
2/ Average of No. weeds in eight square feet, eight counts made per plot.
3/ Calculated weed control from counts and compared with the non weeded check.
4/ Ocular weed score: August 26, 1975 - Scale 0-10; 0 = no control, 10 = complete control.
5/ Ocular weed score: November 4, 1975 - Scale 0-10; 0 = no control, 10 = complete control. (Reading relates mainly to redroot pigweed).
6/ Safner added to vernolate.
7/ Post emergence.

Application Data:

Dates:	June 13, 1975	July 15, 1975
Temperatures:	83 degrees F	74 degrees F
Humidity:	38 %	59 %
Cloud cover:	clear	clear
Wind velocity:	3 mph	calm
Soil type:	silt loam	silt loam
Volume	23.6 gpa	13.1 gpa
Pressure	40 psi	40 psi

TITLE: Chemical control of weeds in potatoes.

PROJECT: Weed Investigations MS 754

YEAR: 1975

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

LOCATION: Northwestern Agricultural Research Center, Field No. Y-2

OBJECTIVES:
1. To measure the effectiveness of several herbicides for the control of weeds in potatoes.
2. Determine the effects of herbicides on growth of the potato plant.
3. Determine the effect of herbicides on yield and grade of tubers.

SIGNIFICANT FINDINGS:

Potato yields were not affected by herbicides, at least not statistically. Metribuzin at .5 lbs/a applied post plant pre emergence gave effective weed control. The combination of dinitramine pre plant incorporate plus metribuzin post plant pre emergence was equal to or superior to metribuzin alone.

MATERIALS AND METHODS:

Seven herbicides were evaluated at different rates and in various combinations. Plots were 12 x 30 feet, replicated three times. Each plot consisted of four rows with the two center rows as yield rows. Herbicides were applied in an aqueous solution of 27.6 gallons per acre. Herbicides were applied per plant incorporate, post plant pre emergence and post emergence. The preplant materials were incorporated with a tandem disk. The post plant incorporate materials were incorporated with a Lilliston rolling cultivator after the potatoes were hilled.

Weed species found in this study were: Canada thistle (Cirsium arvense (L.)); quackgrass (Agropyron repens (L.)); field pennycress (Thlaspi arvense (L.)); red root pigweed (Amaranthus retroflexus (L.)); lambsquareter (Chenopodium album (L.)); green foxtail (Setaria viridis (L.)); knotweed (Polygonum aviculare (L.)); chickweed (Stellaria media (L.)); wild buckwheat (Polygonum convolvulus (L.)); mustard (Sisymbrium altissimum (L.)).

Data obtained included weed score, potato yields and grade of potatoes. Grading was based on commercial standards; seed, No. 1's, No. 2's and culls.

RESULTS AND DISCUSSION:

Yields were higher than average. We contribute this in part to our irrigation schedule. The potatoes were irrigated to maintain the moisture level at field capacity. No one irrigation exceeded 2.1 inches.

When analyzed statistically the yields were found to be non-significant, however there were some rather large yield differences varying up to 126.65 cwt/acre. The highest yielding treatment (428.74 cwt/a) was .66 lb/a of dinitramine applied preplant incorporate. The lowest yielding (301.69 cwt/a) was obtained with metribuzin at .25 lb/a, which also had the lowest weed score.

Yields by grade were not found to be significant, however the metribuzin treatment at .5 lb/a did result in a larger number of tubers grading for seed than most of the treatments. We also had an increase in seed grade weight where we had higher weed populations. This can be explained in part, by weeds competing for plant nutrients thus reducing tuber size. It is also my belief based on several years

Results and Discussion (con't)

data that metribuzin causes a stunting of the plant which results in a decrease in tuber size. Thus ending up with more tubers grading seed size.

Vernolate - Weed control ranged from 60 to 70% on the first reading. The delaying of incorporation did not seem to affect weed control materially. Vernolate Plus did not provide any better weed control than Vernolate 6E. Vernolate 4s gave less weed control than Vernolate 6E. Delaying the incorporation of Vernolate 4s did not increase or decrease weed control.

EPTC - EPTC with and without the safner did not give very effective weed control.

Dinitramine - As a preplant incorporate material dinitramine gave much better weed control when compared with a post plant pre emergence incorporated material. At the end of the growing season the preplant incorporated treatment was continuing to give superior weed control as compared to the post plant pre emergence treatment.

Penoxalin - Provided 60 to 70% weed control, but did not hold through the season. Green foxtail became a problem later in the season.

Profluralin - No effective weed control.

Trifluralin - Very limited weed control.

Dinitramine + metribuzin - Effective weed control obtained when dinitramine was applied preplant incorporate and metribuzin post plant pre emergence. At the end of the growing season the .33 lb/a of dinitramine plus .25 lb/a of metribuzin had a very high weed score. This combination, when the dinitramine was applied post plant pre emergence incorporated, resulted in very limited weed control.

Oxadiazon - Fair weed control early in the season, but did not hold. Green foxtail came on strong later in the season.

Metribuzin - The .25 lb/a rate did not give adequate weed control. At the end of the season there was a high population of pigweed and green foxtail. The .5 lb/a rate provided good weed control throughout the growing season.

See Tables 2 and 3 for complete details.

Table 1. Herbicides used in the experiments.

Common Name	Trade Name or Other	Chemical Name	Company
EPTC	Eptam	S-ethyl dipropylthiocarbamate	Stauffer
vernolate	Vernam	S-propyl dipropylthiocarbamate	Stauffer
trifluralin	Treflan	α,α,α-trifluror-2,6-dinitro-N,N-dipropyl-p-toluidine	Elli Lilly
profluralin	Tolban	N-(cyclopropylmethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluidine	CIBA-Geigy
metribuzin	Sencor	4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)one	Chemagro
dinitramine	Cobex	N^4,N^4-diethyl-α,α,α-trifluoro-3,5-dinitrotoluene-2,4-diamine	U. S. Borax
oxadiazon	Ronstar	2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-Δ^2-1,3,4-oxadiazolin-5-one	Rhodia
Bay NTN 6867		O-Methyl O-(4-methyl-2-nitrophenyl) (1-methylethyl) phosphoramidothioate	Chemagro
penoxalin	Prowl	N-(1-ethylpropyl-3,4-dimethyl-2,6-dinitrobenzenamine	American Cyanamid

Table 2. Weed control scores from herbicide study on potatoes. Northwestern Agricultural Research Center, Kalispell, Montana. Field No. X-3, 1975. Observations made July 9, 1975.

Treatment		Weed Score	
Herbicide	Rate #/A	0-10	Weed Species Present Following Treatment
		Preplant Incorporate	
Vernolate 6E	3.0	7	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, knotweed, mustard, Canada thistle, alfalfa.
Vernolate 6E	4.0	6	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, alfalfa, knotweed, mustard.
Vernolate 6E[1/]	4.0	7	pigweed, green foxtail, fanweed, wild buckwheat, quackgrass, knotweed, mustard, alfalfa, lambsquarter.
Vernolate Plus	3.0	6	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, knotweed, mustard, alfalfa, Canada thistle.
Vernolate Plus	4.0	7	pigweed, green foxtail, fanweed, wild buckwheat, knotweed, mustard, alfalfa, lambsquarter, quackgrass, Canada thistle.
Vernolate 4s	4.0	5	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, knotweed, mustard, alfalfa, Canada thistle.
Vernolate 4s[1/]	4.0	6	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, knotweed, mustard, quackgrass, Canada thistle, shepherdspurse, alfalfa.
EPTC	4.0	2	pigweed, green foxtail, lambsquarter, wild buckwheat, quackgrass, knotweed, mustard, Canada thistle, alfalfa, chickweed, fanweed.
EPTC + safner	4.0	3	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, knotweed, mustard, quackgrass, dandelions.
Dinitramine	.5	5	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, mustard, alfalfa.
Dinitramine	.66	6	green foxtail, fanweed, quackgrass, mustard, Canada thistle, alfalfa, pigweed.
		Post plant Pre emergence Incorporate	
Dinitramine	.5	4	green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, mustard, alfalfa, pigweed, knotweed, Canada thistle.
Dinitramine	.66	6	pigweed, green foxtail, fanweed, quackgrass, knotweed, mustard, alfalfa, lambsquarter, wild buckwheat, field chickweed.
Penoxalin	1.0	6	pigweed, fanweed, lambsquarter, mustard, alfalfa, green foxtail, wild buckwheat, quackgrass, Canada thistle.
Penoxalin	2.0	7	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, mustard, Canada thistle.

Table 2. (con't)

Treatment Herbicide	Rate #/A	Weed Score 0-10	Weed Species Present Following Treatment
Profluralin	.75	4	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, mustard, knotweed.
Trifluralin	1.0	2	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, mustard, quackgrass, knotweed, alfalfa, chickweed.
		Preplant Incorporate & Post plant Pre emergence	
Dinitramine 2/ + metribuzin 3/	.33 .25	7	fanweed, wild buckwheat, quackgrass, mustard, green foxtail, Canada thistle, pigweed, lambsquarter, knotweed, alfalfa.
Dinitramine 2/ + metribuzin 3/	.50 .25	7	green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, mustard, Canada thistle, pigweed, knotweed, alfalfa.
		Post plant Pre emergence Incorporated & Post plant Pre emergence	
Dinitramine 4/ + metribuzin 3/	.33 .25	6	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, knotweed, mustard, Canada thistle, alfalfa.
Dinitramine 4/ + metribuzin 3/	.50 .25	4	pigweed, green foxtail, fanweed, wild buckwheat (appeared burned), knotweed, mustard, alfalfa, lambsquarter, quackgrass, fanweed.
		Post plant Pre emergence	
Oxadiazon	1.0	6	green foxtail, fanweed, quackgrass, knotweed, mustard, alfalfa, wild buckwheat, Canada thistle, lambsquarter.
Oxadiazon	1.5	6	pigweed, green foxtail, fanweed, quackgrass, mustard, alfalfa, knotweed, wild buckwheat.
Oxadiazon	2.0	6	pigweed, green foxtail, wild buckwheat, quackgrass, knotweed, mustard, fanweed, Canada thistle, chickweed.
Metribuzin	.25	3	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, knotweed, mustard, Canada thistle, quackgrass.
Metribuzin	.50	7	pigweed, green foxtail, wild buckwheat, quackgrass, mustard, Canada thistle, knotweed, fanweed.
Check (weedy)	0.0	0	pigweed, green foxtail, fanweed, lambsquarter, wild buckwheat, quackgrass, knotweed, mustard, Canada thistle, alfalfa.
Check (handweeded)	0.0	10	

1/ Delayed 24 hours before incorporating.
2/ Pre plant incorporated.
3/ Post plant Pre emergence.
4/ Post plant Pre emergence incorporate.

Humidity =	46%-82%	54%
Wind velocity =	0-4 mph	3-10 mph
Cloud cover =	P/C	P/C
Soil type =	silt loam	silt loam
Volume =	27.6 gpa	27.6 gpa

Application Data:

Date =	5/22/75	6/4/75
Temperature =	40-58 F	62 F

Table 3. Summary of weed control, yield and grade data from various herbicides used on netted gem potatoes in 1975. Northwestern Agricultural Research Center, Kalispell, Montana. Field No. X-3.

Date seeded: May 23, 1975 Date harvested: October 14, 15, 1975

Treatment		Grade Cwt/Acre					Weed Score	
Herbicide	Rate #/A	#1	#2	Seed	Culls	Total	6/	7/
Preplant Incorporate								
Vernolate 6E	3.0	115.34	23.79	221.81	19.35	380.29	7ab[8/]	8ab[8/]
Vernolate 6E	4.0	106.08	28.64	237.56	12.91	385.18	6bc	5abcde
Vernolate 6E[1/]	4.0	102.45	27.83	194.81	19.76	344.85	7ab	8ab
Vernolate Plus	3.0	82.28	18.96	180.69	20.17	302.09	6bc	3bcde
Vernolate Plus	4.0	115.35	10.89	230.30	8.87	365.42	7ab	9a
Vernolate 4s	4.0	102.85	35.09	233.53	13.71	385.18	5bcd	7abc
Vernolate 4s[1/]	4.0	97.61	22.18	223.04	16.13	358.96	6bc	7abc
EPTC	4.0	101.64	18.15	253.69	18.55	392.04	2de	5abcde
EPTC + safner	4.0	68.16	29.04	204.89	12.50	314.60	3de	2cde
Dinitramine	.5	127.86	38.32	240.38	15.33	421.88	5bcd	9a
Dinitramine	.66	138.34	34.69	241.59	14.12	428.74	6bc	9a
Post plant Pre emergence Incorporate								
Dinitramine	.5	113.34	22.18	225.86	10.08	371.47	4bcd	7abc
Dinitramine	.66	139.15	50.82	205.70	15.73	411.40	6bc	4bcde
Penoxalin	1.0	98.82	28.23	241.19	6.45	374.69	6bc	4bcde
Penoxalin	2.0	123.02	30.25	210.94	18.15	382.36	7ab	3bcde
Profluralin	.75	85.91	25.41	214.57	10.49	336.38	4bcd	3bcde
Trifluralin	1.0	90.35	28.64	225.06	19.76	363.80	2de	3bcde
Preplant Incorporate & Post plant Pre emergence								
Dinitramine[2/] + metribuzin[3/]	.33 + .25	113.33	27.02	205.70	6.45	352.51	7ab	9a
Dinitramine[2/] + metribuzin[3/]	.50 + .25	137.13	30.65	213.80	12.50	394.05	7ab	7abc
Post plant Pre emergence Incorporated & Post plant Pre emergence								
Dinitramine[4/] + metribuzin[3/]	.33 + .25	92.36	24.20	218.20	8.47	343.23	6bc	4bcde
Dinitramine[4/] + metribuzin[3/]	.50 + .25	91.96	22.59	206.50	17.34	338.39	4bcd	1de
Post plant Pre emergence								
Check	0.0	145.20	25.81	217.80	17.34	406.15	10a	9a
Check	0.0	141.57	29.85	233.53	15.73	420.67	10a	9a

Table 3. (con't)

Treatment		Grade Cwt/Acre					Weed Score	
Herbicide	Rate #/A	#1	#2	Seed	Culls	Total	6/	7/
Oxadiazon	1.0	120.19	16.94	224.65	17.75	379.53	6bc	4bcde
Oxadiazon	1.5	115.76	20.57	228.28	16.13	380.74	6bc	6abcde
Oxadiazon	2.0	94.78	24.60	196.02	17.34	332.75	6bc	4bcde
Metribuzin	.25	65.74	20.57	203.28	12.10	301.69	3cde	1de
Metribuzin	.50	108.90	16.54	255.71	13.31	394.46	7ab	7abc
Check (weedy)	0.0	95.59	22.99	266.60	14.92	400.10	0e	0e
Check (hand weeded)	0.0	99.22	35.09	211.34	12.50	358.16	10a	9a
	$\bar{x}$	107.68	26.35	222.24	14.47	370.73	5.40	5.52
	F 5/	1.52	.92	1.09	1.07	1.31	4.61**	3.28**
	S.E.$\bar{x}$	16.71	8.01	18.48	3.76	29.49	.95	1.55
	L.S.D.	NS	NS	NS	NS	NS	2.7	4.41
	C.V.%	15.52	30.41	8.31	25.99	7.95	24.85	28.22

1/ Delayed 24 hours before incorporating.
2/ Preplant incorporated.
3/ Post plant pre emergence.
4/ Post plant pre emergence incorporated.
5/ Value for treatment comparison.
6/ Weed score 0-10 reading made July 9, 1975.
7/ Weed score 0-10 reading made August 26, 1975. This score was based on weeds above the canopy of potatoes on the date read. The predominate weeds were redroot pigweed and green foxtail.
8/ Items having common letters are not significantly different one from another, Duncan's Multiple Range Test.
9/ Pigweed
10/ Foxtail

Application Data:

Date =	5/22/75	6/4/75
Temperature =	40-50 F	62 F
Humidity =	46-82 %	54 %
Wind velocity =	0-4 mph	3-10 mph
Cloud cover =	P/C	P/C
Soil type =	silt loam	silt loam
Volume =	27.6 gpa	27.6 gpa

Table 3. Effect of glyphosate on leafy spurge (Euphorbia esula L.) after multiple applications from 1972 thru 1975. Northwestern Agricultural Research Center, Kalispell, Montana, Field R-8b.

	Mon 2139 1.0 lbs/a	
June	24, 1975[1/]	good ground cover-grasse, sainfoin, some salsify; leafy spurge fairly plentiful- some with seed, some dwarfed.
July	22, 1975	some tips burnt on grasses, sainfoin, salsify and leafy spurge.
August	29, 1975	grass stand poor, most leafy spurge looks healthy
	Mon 2139 1.5 lbs/a	
June	24, 1975[1/]	fair ground cover-grasses, sainfoin, salsify; leafy spruge - some with seed, some dwarfed.
July	22, 1975	very little grass, some tips burnt on sainfoin and salsify; leafy spurge stunted.
August	29, 1975	grass stand poor; leafy spurge stunted.
	Mon 2139 2.0 lbs/a	
June	24, 1975[1/]	fair ground cover - grasses, salsify, sainfoin; most leafy spurge dwarfed, some with seed.
July	22, 1975	grass, sainfoin, salsify injured; most leafy spurge stunted.
August	29, 1975	grass stand poor; leafy spurge stunted.
	Mon 2139 2.5 lbs/a	
June	24, 1975[1/]	fair to poor ground cover, grasses, salsify, sainfoin; a few leafy spurge dwarfed.
July	22, 1975	very little grass, very few salsify and sainfoin, most are burnt; leafy spurge stunted.
August	29, 1975	grass stand poor, some sainfoin regrowth; leafy spurge stunted.
	Check 0.0 lb/a	
June	24, 1975[1/]	good ground cover-grasses, some sainfoin and salsify, a few alfalfa; leafy spurge plentiful and with seed.
July	22, 1975	good ground cover-grasses, some sainfoin and salsify, a few alfalfa; leafy spurge plentiful.
August	29, 1975	good ground cover; leafy spurge plentiful.

1/ Read before herbicide application.

Application Data:	September 5, 1972	June 24, 1974	June 24, 1975
Temperature =	46 degree F	72 degree F	45 degree F
Cloud cover =	partly/cloudy	clear	cloudy
Wind velocity =	calm	calm	calm
Humidity =	80%	52%	72%

TITLE: Glyphosate Evaluations

PROJECT: Weed Investigations MS 754

YEAR: 1975

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

OBJECTIVES:

1. To determine the effectiveness of glyphosate on several perennial weeds and rate necessary to provide effective control.
2. To determine the effectiveness of glyphosate for chemical vegetation control in crop land.
3. To measure the long term effect of glyphosate on perennial weeds.

SIGNIFICANT FINDINGS:

Experiment I - Continuous cropping using tillage for weed control resulted in higher yield over a two year period. Winter wheat followed by a spring crop also resulted in higher yields in both tillage and non-tilled treatments.

Experiment II - Repeated application of glyphosate at 2.5 lbs/a reduced the leafy spurge population, but did not adequately control this weed.

Experiment III - Glyphosate at both 1 and 2.5 lbs/a rate gave excellent control of quackgrass and an increase in yield of winter wheat resulted.

MATERIALS AND METHODS:

Three studies using glyphosate were conducted in 1975. Two were studies which were initiated in 1972 and 1973, and the third in the fall of 1974 on winter wheat.

Experiment I - The "small grain culture with and without tillage and with herbicide" is in its second year. This study will continue for a total of four years. Details of procedures are in the Northwestern Agricultural Research Center Research Report No. 80. Additional information is found in the project outline, thus this information is not made a part of this report.

Experiment II - Leafy spurge (Euphorbia esula (L.)).

This study is in its fourth year in which repeated applications of glyphosate have been made to the same plots at the same rates. The first applications were made in September 1972 when the plants were somewhat dormant. Since that time they have been made in June and after the spurge was in bloom.

Experiment II - Field applications of glyphosate.

Two large scale tests were conducted in 1974-75. One test was on the Paul Boss farm and contained seven acres of treated area. The field was plowed in May of 1974, leveled and allowed to remain that way until late August when weeds were sprayed with glyphosate. Weeds present at time of spraying were: Canada thistle (Cirsium arvense (L.)); fanweed (Thlapsi arvense (L)); quackgrass (Agropyron repens (L.)); wild oats (Avena fatur (L.)); and volunteer grain. Glyphosate was applied at the rate of .5 lb/a. Yields were determined by harvesting an area in the field 897 x 11.5 or 10315.5 square feet from each of the treated and untreated areas of the field.

The test located on the research center was in fields R-15 treated, and R-16 untreated. Quackgrass was the primary weed in this field. Approximately the same procedure was used in this location as discribed for the Boss farm. The area harvested was 800 x 13.5 or 10800 square feet from both fields. These were placed in a truck and weighed. From this we calculated the yield.

Materials and Methods (con't)

Both locations were sprayed with a combination of bromoxynil and MCP for weed control.

The common name, trade name and chemistry for this product developed by Monsanto Chemical Company is;glyphosate, Roundup, and N-(phosphonomethyl)glycine respectively.

RESULTS AND DISCUSSION:

Experiment I - Two years data has been obtained from this experiment. We have noted some rather high C.V.'s which indicate that we need to refine some of our techniques. At present, we are using an International Harvester Hoe type drill, 10" spacing, for seeding the non-till crop areas, and a double disk press drill, 7" spacing, for seeding the tilled areas. The hoe drill does not always cover the seed because of crop residue on the soil surface.

Two years of this test have shown us the .5 lb/a of glyphosate does not effectively control quackgrass, thus in 1975-76 the rate has been increased to 1 lb/a. The need for additional selective herbicides is apparent because of the increasing wild oat population. To date we have only used herbicides for selective broadleaf weeds. In 1976 a post emergence type wild oat herbicide will be used on all plots.

In this location we would expect 4500 to 7000 pounds of grain per acre. The yields are much below this level. This can be attributed mainly to the rather high quackgrass population, with additional competition from wild oats.

For the two year period rotation E (winter wheat and spring barley in continuous rotation with tillage for soil preparation and weed control and no preplant herbicides, but herbicides for broad leaf weed control) has the highest production, 6613 lbs/a. Rotation F which is an alternate sequence of rotation E (spring barley followed by winter wheat) was second in yield at 5303.2 lbs/a for the two year period. Rotation E and H have lower populations of wild oats and quackgrass than we find in any of the other rotations. The sequence to H is rotation G in which yields were much lower and a higher population of quackgrass and wild oats was found.

Rotation J (winter wheat and chemical fallow continuous with selective herbicides) was the lowest yielding. However, wild oat populations were not too high, but quackgrass was very high. We have also found it necessary to repeat glyphosate applications two to three times to get control of all weeds. Henbit seems to be the most difficult of the annual weeds to control.

A sequence of winter wheat followed by spring grain produced more grain than where winter wheat follows either spring barley or spring wheat. Rotations A and B (Table 1) illustrate this. Rotation A, two year yield, 3106 lbs/a. Note rotation B is an alternate of rotation A. This condition is also seen in rotations C and D, with high yields being in rotation D where winter wheat is followed by spring wheat. Tables 1 and 2.

Experiment II - The application of glyphosate to a natural stand of leafy spurge was made September 5, 1972. The leafy spurge was almost dormant and soil conditions were very dry. In June 1973, we evaluated this study with a camera. The slides are on file. At the 1 lb/a rate there was a reduction in the height of the spurge. At the 1.5 lb/a rate the reduction was somewhat greater than the 1 lb/a rate. Spurge was severely stunted and caused some rosetting at the crown of the plant at 2.5 lbs/a. It should be noted that at the June evaluation all growing spurge was in bloom.

Results and Discussion (con't)

In 1974 another evaluation was made of this experiment. This showed some control but no real high degree of control. Thus on June 24 1974, an additional application of glyphosate was made at the same rate as the original. Reading of these results were made in 1975. The 1974 data are found in Research Report #80 of the Northwestern Agricultural Research Center.

In June 1975, this experiment was observed. It appeared that the June 1974 application did not give us much better control than the 1972 application. Thus, a decision was made to make one more application per the original plan. On June 24, 1975 these applications were made. Two readings were made following the applications, the first on July 22, 1975 and the second August 29, 1975. We seem to be getting our best control at the 2.5 lb/a rate, but it does not appear adequate to control spurge in this location, even after repeated applications. Thus, we would conclude that to control leafy spurge the glyphosate rates must be in excess of 2.5 lb/a. Table 3.

Experiment III - Control of quackgrass and other annuals in the experiment on the Paul Boss farm was almost 100%. Little or no quackgrass was seen in the field at harvest time. Yields obtained were as follows: Check = 72.2 bu/a; glyphosate at 1.0 lb/a = 84.5 bu/a.

Quackgrass was effectively controlled at 1.0 lb/a in the experiment on the Northwestern Agricultural Research Center. This was most notable where a "skip" occurred while spraying. Quackgrass in this missed area was 60" to 72" tall. Yield differences were not as great as found on the Boss farm. They follow: Check = 61 bu/a; glyphosate at 1.5 lb/a = 64 bu/a.

Table 1. Results from the small grain culture with tillage and chemical vegetation control at Northwestern Agricultural Research Center, Kalispell, Montana, Field R-13, 1974 and 1975.

Reps.	Pounds per Acre 1974	Pounds per Acre 1975	2 yr. Total Lbs/A	Comments 1974	Comments 1975
A. Winter wheat and barley continuous rotation planted on stubble with herbicides and no tillage.					
	W Wheat	Barley			
I	2096.8	3144.0		clean	heavy wild oats
II	1290.3	969.6		heavy quackgrass	light wild oats, heavy quackgrass
III	3387.1	2016.0		light quackgrass	medium quackgrass
IV	1612.9	1291.2		heavy quackgrass	some wild oats & quackgrass
$\bar{x}$	2096.8	1855.2	3952.0		
B. Spring barley and winter wheat in continuous rotation planted on stubble with herbicides and no tillage (the alternate crop sequence of treatment A).					
	Barley	W Wheat			
I	1854.8	888.0		heavy wild oats	very heavy wild oats
II	2258.1	1374.0		w/o quackgrass where missed	heavy quackgrass
III	1371.0	1050.0		quackgrass where sprayer missed	heavy quackgrass
IV	1854.8	1776.0		medium wild oats	medium quackgrass
$\bar{x}$	1834.7	1272.0	3106.7		
C. Spring wheat and winter wheat in continuous rotation planted on stubble with herbicide and no tillage.					
	S Wheat	W Wheat			
I	1774.2	1614.0		high wild oats	very heavy wild oats, some quackgrass
II	1371.0	1374.0		heavy wild oats	heavy wild oats
III	1129.0	648.0		heavy quackgrass, light wild oats	heavy quackgrass
IV	1612.9	1374.0		heavy wild oats	some wild oats, heavy quackgrass
$\bar{x}$	1471.8	1252.5	2724.3		
D. Winter wheat and spring wheat in continuous rotation planted on stubble with herbicide and no tillage (the alternate crop sequence of treatment C).					
	W Wheat	S Wheat			
I	3709.7	2580.0		very light quackgrass	light wild oats, medium quackgrass
II	1451.6	162.0		heavy quackgrass	heavy quackgrass
III	3306.5	1374.0		light quackgrass	heavy wild oats
IV	3032.3	402.0			heavy quackgrass
$\bar{x}$	2875.0	1129.5	4004.5		

Table 1. (con't)

Reps.	Pounds per Acre 1974	Pounds per Acre 1975	2 yr. Total Lbs/A	Comments 1974	Comments 1975
E. Winter wheat and spring barley in continuous rotation with tillage for soil preparation and weed control - no preplant herbicides.					
	W Wheat	S Barley			
I	5322.6	2985.6		clean	medium wild oats on south side of strip
II	3548.4	2904.0		medium quackgrass	some quackgrass
III	2661.3	2822.4		medium quackgrass	medium quackgrass
IV	2983.9	3225.6		light quackgrass	medium quackgrass & wild oats
$\bar{x}$	3629.1	2984.4	6613.5		
F. Spring barley and winter wheat in continuous rotation with tillage for soil preparation and weed control - no preplant herbicides (the alternate crop sequence of treatment E).					
	S Barley	W Wheat			
I	3629.0	2826.0		medium wild oats	heavy wild oats, some quackgrass
II	3871.0	2340.0		heavy wild oats	heavy wild oats
III	2258.1	1452.0		medium quackgrass	heavy quackgrass
IV	2580.6	2256.0		light wild oats	medium quackgrass
$\bar{x}$	3084.7	2218.5	5303.2		
G. Tillage fallow and winter wheat continuous with selective herbicides.					
	Fallow	W Wheat			
I	"	4116.0			some quackgrass
II	"	4278.0			light quackgrass
III	"	3228.0			very heavy quackgrass
IV	"	3552.0			very heavy quackgrass
$\bar{x}$		3793.5	3793.5		
H. Winter wheat and tillage fallow continuous with selective herbicides (the alternate crop sequence of treatment G).					
	W Wheat	Fallow			
I	5080.6	"		very light quackgrass	
II	3483.9	"		light quackgrass	
III	3548.4	"		very light quackgrass	
IV	8225.8	"		clean	
$\bar{x}$	5084.7		5084.7		
I. Chemical fallow and winter wheat continuous rotation with selective herbicides.					
	Fallow	W Wheat			
I	"	3468.0			moderately clean, mustard & wild oats on south side
II	"	3792.0			medium wild oats & quackgrass
III	"	2418.0			medium wild oats & quackgrass
IV	"	2178.0			very light wild oats & quackgrass
$\bar{x}$		2964.0	2964.0		

Table 1. (con't)

Reps.	Pounds per Acre 1974	Pounds per Acre 1975	2 yr. Total Lbs/A	Comments 1974	Comments 1975
J. Winter wheat and chemical fallow continuous rotation with selective herbicides (the alternate crop sequence of treatment I).					
	W Wheat	Fallow			
I	3306.5	"		heavy quackgrass	
II	1371.0	"		heavy quackgrass	
III	1371.0	"		heavy quackgrass	
IV	1209.7	"		heavy quackgrass	
$\bar{x}$	1814.6		1814.6		
$\bar{x}$	2737.12	2183.03			
F 1/	4.97**	10.31**			
S.E.$\bar{x}$	539.82	306.14			
L.S.D.	1587.92	900.54			
C.V.%	19.72	14.02			

1/ Value for variety conparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Planting Dates: Winter wheat = September 27, 1973; September 19, 1974
Spring barley and wheat = May 7, 1974; May 10, 1975

Harvest Dates: Winter wheat = August 22, 1974
Spring barley = September 6, 1974
Spring wheat + September 17, 1974

Harvest Dates: Winter wheat = September 9, 1975
Spring barley = September 11, 1975
Spring wheat = September 25, 1975

Chemical applications: Roundup (.5 lb/a) = October 2, 1973
= May 4, 1974
= August 1, 1974
= May 15, 1975

Table 2. Summary of data from small grain culture study with tillage and chemical vegetation control at the Northwestern Agricultural Research Center, Kalispell, Montana, 1974 and 1975.

Rotation	Year	Crop	Yield lbs/a	Value[1]	Weed Population[2] quackgrass	Weed Population[2] wild oats
A[3]	1974	winter wheat	2096.8	155.86	M	-
	1975	spring barley	1855.2	76.06	M	M
	Total		3952.0	231.92		
B	1974	spring barley	1834.7	117.42	-	H
	1975	winter wheat	1272.0	75.26	H	M
	Total		3106.7	192.68		
C	1974	spring wheat	1471.8	110.39	M	H
	1975	winter wheat	1252.5	74.11	H	H
	Total		2724.3	184.49		
D	1974	winter wheat	2875.0	213.71	M	-
	1975	spring wheat	1129.5	79.25	H	M
	Total		4004.5	292.96		
E	1974	winter wheat	3629.1	269.76	M	-
	1975	spring barley	2984.4	122.36	M	M
	Total		6613.6	392.12		
F	1974	spring barley	3084.7	197.42	M	M
	1975	winter wheat	2218.5	123.81	M	H
	Total		5303.2	321.23		
G	1974	fallow[4]	0.0	.00	-	-
	1975	winter wheat	3793.5	244.45	M	-
	Total		3793.5	244.45		
H	1974	winter wheat	5084.7	377.96	L	-
	1975	fallow	0.0	.00	-	-
	Total		5084.7	377.96		
I	1974	chemical fallow	0.0	.00	-	-
	1975	winter wheat	2964.0	175.37	M	M
	Total		2964.0	175.37		
J	1974	winter wheat	1814.6	107.36	H	H
	1975	chemical fallow	0.0	.00	-	-
	Total		1814.6	107.36		

1/ Barley value, December 1974 = 6.40/cwt
December 1975 = 4.10/cwt
Winter wheat value, December 1974 = 4.46/bu
December 1975 = 3.55/bu
Spring wheat value, December 1974 = 4.50/bu
December 1975 = 3.55/bu

2/ Observation made at harvest time: L = thin population; M = intermediate population; H = very high population

3/ Discription of the rotation:

A. Winter wheat and barley continuous roation on stuble with herbicides and no tillage.

B. Spring barley and winter wheat in continuous rotation planted on stubble with herbicides and no tillage (the alternate crop sequence of treatment A).

Table 2.

3/ Discription of the rotation (con't)

C. Spring wheat and winter wheat in continuous rotation planted on stubble with herbicides and no tillage.
D. Winter wheat and spring wheat in continuous rotations planted on stubble with herbicides and no tillage (the alternate crop sequence of treatment C).
E. Winter wheat and spring barley in continuous rotation with tillage for soil preparation and weed control and no preplant herbicides.
F. Spring barley and winter wheat in continuous rotation with tillage for weed control, soil preparation, and no preplant herbicides (the alternate crop sequence of treatment E).
G. Tillage fallow and winter wheat continuous rotation with selective herbicides.
H. Winter wheat and tillage fallow continuous with selective herbicides (the alternate crop sequence of treatment G).
I. Chemical fallow and winter wheat continuous rotation with selective herbicides.
J. Winter wheat and chemical fallow continuous rotation with selective herbicides (the alternate crop sequence of treatment I).

SUMMARY OF SIGNIFICANT FINDINGS

Irrigated Pasture Study: Gain (pounds per acre), A.D.G. (pounds) and number of steers per acre for the Melrose sainfoin-Empire birdsfoot trefoil-Manchar smooth bromegrass were 741.3, 1.68, and 3.19 respectively; for the Ladino clover-Chinook orchardgrass were 852.3, 1.74, and 3.27 respectively; for the Thor alfalfa were 886.6, 1.82 and 3.31 respectively; and for the Thor alfalfa-Potomac orchardgrass-Troy bluegrass were 1042.9, 1.67, and 3.69 respectively.

Small Grains and Wintergraze 90-90 for Irrigated Pastures as Influenced by Three Fall Planting Dates: Wintergraze, Crest winter wheat, Nugaines winter wheat and Schuyler winter barley yielded 3.71, 3.49, 2.94 and 2.58 tons per acre respectively when averaged over all planting dates. A variety x planting date interaction was evident.

Irrigated Alfalfa Nursery: Mean yields declined in 1975. Highest yielding varieties over a four year period were Thor, Dupuits, Grimm and NK-919 in that order. Two red clover varieties yielded less than the mean of all alfalfa varieties.

Dryland Alfalfa Nursery: Yields made a sharp decline in 1975. Vernal, Haymor, Ladak and NK-919 were the highest yielding varieties in that order over a four year period.

Irrigated Alfalfa Commercial Nursery: Yields were 0.95 tons per acre lower in 1975 than in 1974. Two experimental lines; A-73-6 and A-73-5 were comparable to Haymor over a three year period.

Irrigated Sainfoin Commercial Nursery: Yields were 0.32 tons per acre lower in 1975 than in 1974. No regrowth type variety yielded more than Remont over a three year period, although S-73-3 yields were comparable to Remont. Eski and Melrose yielded about 0.3 tons per acre less than Remont over a three year period.

Irriaged Trefoil Nursery: Mean yields were 0.35 tons per acre lower in 1975 than in 1974. P-15456 and Leo yielded more than the check variety, Empire, over the three year period with Leo being the highest yielding variety.

Effect of Seeding Rates on Yield and Protein Level of Thor Alfalfa and Eski Sainfoin: Greatest yields in 1975 for the alfalfa occurred at the 10 pound per acre rate and for the sainfoin at 40 pounds per acre seeding rate. No real differences in protein content were observed for either legume regardless of seeding rate. In the seeding year higher seeding rates resulted in significantly more forage for both legumes.

Simulated Irrigated Pasture Trial: Regar bromegrass yielded more than Manchar smooth bromegrass in most mixtures. Yields were the highest when Thor alfalfa and Ladino clover were included in the mixture. Regar recovered more rapidly after cutting than did Manchar.

Dryland Agropyron Hybrid Nursery: Cristatum x Desertorum hybrid and Repens x Desertorum hybrid yielded more than the standard crested check variety over a four year period. Rhizomatous growth after four years was greatest for the Repens x Cristatum hybrid. There was a negative correlation between spreading and yield.

Summary (con't)

Orchardgrass Row Spacing Study: Pennlate seed yields were about 50 percent higher than Potomac seed yields. Seed yields at the 24 and 36 inch spacing for both varieties were about twice as high as seed yields for the 6 and 12 inch spacing. A row spacing x year interaction was evident.

Irrigated Orchardgrass Nursery: 1975 forage yields were only half those of 1974. All early maturing varieties yielded more than the check, Potomac, over a four year period. Also, all late maturing varieties yielded more than the check, Pennlate, over four years. NK-1 was the highest yielding variety at Kalispell. No variety consistently produced the most hay at all locations. The four highest yielding varieties throughout the state were NK-1, NK-4, NK-2 and Napier. The three NK varieties did well at most locations. Napier yielded exceptionally high at Bridger.

TITLE: Irrigated and Dryland Alfalfa Yield Trials

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: 1972-1975 - Completed

OBJECTIVE: Evaluate alfalfa varieties under dryland and irrigated conditions for forage production in northwestern Montana.

PROCEDURES:

The nurseries were planted in Fields Y-8 (irrigated) and F-2 (dryland) on May 15, 1972 and May 12, 1972, respectively, in a randomized complete block design with four replications. Plot size was 4 feet by 20 feet with 1 foot between rows. The irrigated nursery was seeded at a rate of eight pounds per acre and the dryland nursery at a rate of seven pounds per acre on a pure live seed basis. Harvest area was 32 square feet. Four hundred pounds of 0-45-0 were applied in the spring of 1972. The variety, DuPuits, was eliminated from the dryland analysis because of an error in planting. Two cuttings within each nursery were made on an uniform date in 1975.

RESULTS:

Irrigated alfalfa yields ranged from 3.11 to 3.97 tons per acre in 1975 (Table 1). Grimm, Thor and Vernal were the highest yielding entries in that order. Hot One red clover yielded significantly more than Mammoth red clover which was the result of regrowth in the second harvest.

Over a four year period Thor was the highest yielding variety under irrigation followed by DuPuits and Grimm (Table 2). Red clover yields were lower than most alfalfa yields. Hot One yielded 20 percent more than Mammoth over the four year period.

Dryland yields ranged from 2.07 to 3.34 tons per acre in 1975 (Table 3). Ladak, Vernal and Orca were the highest yielding entries in that order. Hot One red clover yielded more than Mammoth red clover but not to the same extent as it did under irrigation. Regrowth for both red clover varieties was poor under dryland conditions.

Over the four year period Vernal yielded the most followed by Haymor and Ladak (Table 4). Over the period Mammoth yielded more than Hot One. Both red clover varieties yielded less than the alfalfa varieties.

Stand reductions from 1972 to 1975 were more severe under dryland than irrigated conditions. BH-22, 502, Grimm and Mesilla survived the least of all the varieties. Both red clover varieties had high stand reductions although Hot One survived better than Mammoth.

Under irrigation stand reductions were the most severe for Mesilla, 502 and BH-22. Other alfalfa varieties were consistently persistent. Stand losses were more severe for Mammoth than for Hot One red clover. Both red clover varieties did not persist as well as did most of the alfalfa varieties.

Table 1. Yields obtained from an irrigated alfalfa nursery grown at Kalispell in 1975.

Variety	Harvest	Tons per acre at 12 percent moisture, Replications I	II	III	IV	Mean
Ranger	First	2.57	2.46	2.18	2.27	2.37
	Second	1.46	1.47	1.24	1.24	1.35
	Total	4.03	3.93	3.42	3.51	3.72
Ladak 65	First	2.95	2.39	2.31	2.85	2.63
	Second	1.20	1.08	0.93	1.12	1.08
	Total	4.15	3.47	3.24	3.97	3.71
Vernal	First	3.33	2.43	2.42	2.30	2.62
	Second	1.47	1.28	1.18	1.28	1.30
	Total	4.80	3.71	3.60	3.58	3.92
Thor	First	2.92	2.44	2.13	2.55	2.51
	Second	1.55	1.52	1.26	1.35	1.42
	Total	4.47	3.96	3.39	3.90	3.93
Grimm	First	2.23	2.61	2.59	2.50	2.48
	Second	1.33	1.56	1.47	1.58	1.49
	Total	3.56	4.17	4.06	4.08	3.97
NK 919	First	2.70	2.37	2.26	2.21	2.39
	Second	1.56	1.46	1.50	1.45	1.49
	Total	4.26	3.83	3.76	3.66	3.88
Orca	First	2.03	2.20	2.09	1.75	2.02
	Second	1.35	1.36	1.28	1.24	1.31
	Total	3.38	3.56	3.37	2.99	3.33
Mesilla	First	1.99	1.88	1.88	2.22	1.99
	Second	1.28	1.08	1.19	1.21	1.19
	Total	3.27	2.96	3.07	3.43	3.18
Ladak	First	2.59	2.54	2.63	2.44	2.55
	Second	1.21	1.15	1.09	1.11	1.14
	Total	3.80	3.69	3.72	3.55	3.69
DuPuits	First	2.21	2.16	2.22	1.99	2.15
	Second	1.47	1.59	1.41	1.42	1.47
	Total	3.68	3.75	3.63	3.41	3.62
502	First	2.03	1.80	1.55	2.07	1.86
	Second	1.28	1.25	1.15	1.31	1.25
	Total	3.31	3.05	2.70	3.38	3.11
German	First	1.93	2.02	2.25	2.18 [1/]	2.10
	Second	1.32	1.45	1.47	1.52 [1/]	1.44
	Total	3.25	3.47	3.72	3.70 [1/]	3.54
Haymor	First	2.26	2.06	2.25	2.35	2.23
	Second	1.37	1.53	1.40	1.55	1.46
	Total	3.63	3.59	3.65	3.90	3.69

Table 1 . (con't)

Variety	Harvest	Tons per acre at 12 percent moisture Replications I	II	III	IV	Mean
BH 22	First	2.37	2.44	2.12	2.34	2.32
	Second	1.43	1.57	1.22	1.46	1.42
	Total	3.80	4.01	3.34	3.80	3.74
Hot One red clover	First	2.56	2.41	2.63	2.33	2.48
	Second	1.00	0.78	1.18	1.14	1.03
	Total	3.56	3.19	3.81	3.47	3.51
Mammoth red clover	First	2.21	2.00	1.60	2.09	1.98
	Second	0.05	0.03	0.03	0.10	0.05
	Total	2.26	2.03	1.63	2.19	2.03

	First Harvest	Second Harvest	Total
Harvest date	7-8	8-13	
Mean yields (T/A)	2.29	1.24	3.53
F-value for variety yield comparison	5.44**	47.82**	10.99**
S.E.$\bar{x}$ (T/A)	0.107	0.051	0.144
S.E.$\bar{d}$ (T/A)	0.151	0.072	0.203
C.V. = $\frac{100s}{\bar{x}}$ (%)	9.3	8.2	8.1
L.S.D. at 0.05 (T/A)	0.306	0.146	0.410
L.S.D. at 0.01 (T/A)	0.409	0.195	0.549

1/ Yield calculated by missing plot formula.
NOTE: Vernal is considered to be the check variety for this nursery.

Table 2. Summary of yield data from an irrigated alfalfa nursery grown at Kalispell in 1972, 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture				
	1972	1973	1974	1975	Mean
Ranger	3.11	5.04	5.29	3.72	4.29
Ladak-65	3.90	4.80	4.89	3.71	4.33
Vernal	3.37	5.30	5.21	3.92	4.45
Thor	4.20	5.75	5.40	3.93	4.82
Grimm	3.54	5.20	5.74	3.97	4.61
NK 919	3.76	4.97	5.29	3.88	4.48
Orca	3.33	5.10	4.79	3.33	4.14
Mesilla	2.80	3.77	4.88	3.18	3.66
Ladak	3.32	4.83	5.23	3.69	4.27
DuPuits	4.19	5.44	5.35	3.62	4.65
502	3.68	4.37	4.71	3.11	3.97
German	3.50	5.15	5.53	3.54	4.43
Haymor	3.48	5.15	5.27	3.69	4.40
BH 22	3.79	4.62	5.27	3.74	4.36
Hot One red clover	2.54	4.88	4.80	3.51	3.93
Mammoth red clover	2.05	4.71	4.38	2.03	3.29
Mean yields (T/A)	3.41	4.94	5.12	3.53	
F-value for variety yield comparison	6.18**	4.99**	1.89NS	10.99**	
S.E.$\bar{x}$ (T/A)	0.231	0.204	0.255	0.144	
S.E.$\bar{d}$ (T/A)	0.326	0.288	0.361	0.203	
C.V.= $\frac{100s}{\bar{x}}$ (%)	13.6	8.2	10.0	8.1	
L.S.D. at 0.05 (T/A)	0.657	0.580	0.727	0.410	
L.S.D. at 0.01 (T/A)	0.878	0.775	0.972	0.549	

NOTE: Vernal is considered to be the check variety for this nursery.

Table 3. Yields obtained from a dryland alfalfa nursery grown at Kalispell in 1975.

Variety	Harvest	Tons per acre at 12 percent moisture				
		Replications				
		I	II	III	IV	Mean
Ranger	First	2.11	1.63	1.07	1.48	1.57
	Second	0.74	0.39	0.40	0.45	0.50
	Total	2.85	2.02	1.47	1.93	2.07
Ladak-65	First	3.30	2.29	1.79	2.35	2.43
	Second	0.80	0.51	0.33	0.53	0.54
	Total	4.10	2.80	2.12	2.88	2.97
Vernal	First	2.70	2.49	2.36	2.23	2.45
	Second	0.91	0.50	0.74	0.56	0.68
	Total	3.61	2.99	3.10	2.79	3.13
Thor	First	2.52	2.22	2.26	1.49	2.12
	Second	0.96	0.71	0.74	0.40	0.70
	Total	3.48	2.93	3.00	1.89	2.82
Grimm	First	2.03	2.10	1.70	1.06	1.72
	Second	0.88	0.89	0.66	0.40	0.71
	Total	2.91	2.99	2.36	1.46	2.43
NK 919	First	2.12	2.63	2.25	1.83	2.21
	Second	0.63	0.61	0.68	0.59	0.63
	Total	2.75	3.24	2.93	2.42	2.84
Orca	First	1.95	2.47	2.80	1.46	2.17
	Second	0.67	0.97	1.11	0.60	0.84
	Total	2.62	3.44	3.91	2.06	3.01
Mesilla	First	1.96	1.63	1.93	1.77	1.82
	Second	0.87	0.64	0.58	0.41	0.63
	Total	2.83	2.27	2.51	2.18	2.45
Ladak	First	2.62	2.29	2.98	2.92	2.70
	Second	0.62	0.63	0.78	0.51	0.64
	Total	3.24	2.92	3.76	3.43	3.34
502	First	1.26	1.50	2.42	2.17	1.83
	Second	0.49	0.46	0.60	0.67	0.56
	Total	1.75	1.96	3.02	2.84	2.39
German	First	2.04	1.81	2.06	2.42	2.08
	Second	0.59	0.50	0.83	0.81	0.68
	Total	2.63	2.31	2.89	3.23	2.76
Haymor	First	2.06	1.90	2.72	1.71	2.10
	Second	0.90	0.65	1.04	0.70	0.82
	Total	2.96	2.55	3.76	2.41	2.92
BH 22	First	1.90	1.96	1.68	1.90	1.86
	Second	0.67	0.69	0.46	0.56	0.60
	Total	2.57	2.65	2.14	2.46	2.46

Table 3 . (con't)

Variety	Harvest	Tons per acre at 12 percent moisture — Replications I	II	III	IV	Mean
Hot One red clover	First	1.13	1.33	1.32	1.66	1.36
	Second	0.00	0.00	0.00	0.00	0.00
	Total	1.13	1.33	1.32	1.66	1.36
Mammoth red clover	First	1.14	1.17	0.68	1.17	1.04
	Second	0.00	0.00	0.00	0.00	0.00
	Total	1.14	1.17	0.68	1.17	1.04

	First Harvest	Second Harvest	Total
Harvest date	7-7	8-6	
Mean yields (T/A)	1.97	0.57	2.54
F-value for variety yield comparison	4.84**	10.96**	6.02**
S.E.$\bar{x}$ (T/A)	0.197	0.075	0.259
S.E.$\bar{d}$ (T/A)	0.279	0.106	0.367
C.V. = $\frac{100s}{\bar{x}}$ (%)	20.1	26.5	20.5
L.S.D. at 0.05 (T/A)	0.563	0.215	0.741
L.S.D. at 0.01 (T/A)	0.754	0.287	0.991

NOTE: Ladak-65 is considered to be the check variety for this nursery.

TITLE: Irrigated Commercial Alfalfa Yield Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Ray Ditterline

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVE: Evaluate four commercial alfalfa varieties for forage production in northwestern Montana.

PROCEDURES:

Four commercial varieties were seeded with two check varieties in Field Y-1 on May 11, 1973, utilizing a randomized complete block design with four replications. Plots were 4 by 20 feet and consisted of four rows spaced one foot apart. Thirty-two square feet were harvested from each plot. All varieties were harvested on a common date for all cuttings. Four hundred pounds of 0-45-0 were applied in the spring of 1973.

RESULTS:

There were no real yield differences among any of the commercial varieties and the check, Haymor (Table 1). A-73-4 yielded significantly less then Haymor for the first harvest as did A-73-7 for the third harvest. Ladak-65 produced significantly less forage than Haymor for the second and third harvests as well as total season yields.

Haymor produced the most forage over a three year period followed by A-75-5 and A-73-6, although this difference was not significant (Table 2). Ladak-65 produced the least amount of forage over the three year period.

Table 1. Yields obtained from an irrigated alfalfa nursery at Kalispell, 1975.

Variety	Harvest	Tons per acre at 12 percent moisture Replications I	II	III	IV	Mean
A-73-4	First	2.24	2.10	2.03	2.10	2.12a
	Second	2.20	1.83	1.78	1.84	1.91
	Third	1.24	1.09	1.04	1.06	1.11
	Total	5.68	5.02	4.85	5.00	5.14
Haymor	First	2.36	2.48	2.42	2.09	2.34
	Second	2.22	1.61	1.81	1.70	1.84
	Third	1.18	1.07	1.15	0.98	1.10
	Total	5.76	5.16	5.38	4.77	5.28
A-73-6	First	2.53	2.40	2.45	2.09	2.37
	Second	1.65	1.53	1.95	1.54	1.67
	Third	1.11	0.97	1.10	1.00	1.05
	Total	5.29	4.90	5.50	4.63	5.09
A-73-7	First	2.65	2.42	2.12	2.27	2.37
	Second	1.86	1.65	1.52	1.42	1.62
	Third	1.13	0.96	0.94	0.88	0.98a
	Total	5.64	5.03	4.58	4.57	4.97
A-73-5	First	2.62	2.33	2.31	2.32	2.40
	Second	2.03	1.52	1.84	1.68	1.77
	Third	1.05	1.06	1.06	0.96	1.03
	Total	5.70	4.91	5.21	4.96	5.20
Ladak-65	First	2.41	2.45	2.33	2.53	2.43
	Second	1.25	1.18	1.24	1.45	1.28aa
	Third	0.68	0.58	0.61	0.71	0.65aa
	Total	4.34	4.21	4.18	4.69	4.36aa

	First Harvest	Second Harvest	Third Harvest	Total
Harvest date	7-2	8-5	9-23	
Mean yields (T/A)	2.34	1.68	0.98	5.00
F-value for variety yield comparison	2.74NS	7.62**	32.14**	5.11**
S.E.$\bar{x}$ (T/A)	0.067	0.081	0.030	0.147
S.E.$\bar{d}$ (T/A)	0.095	0.115	0.044	0.208
C.V. = $\frac{100s}{\bar{x}}$ (%)	5.8	9.7	6.2	5.9
L.S.D. at 0.05 (T/A)	0.202	0.245	0.093	0.443
L.S.D. at 0.01 (T/A)	0.280	0.338	0.130	0.613

NOTE: Haymor is considered to be the check variety for this nursery.

a Indicates a significantly lower yield than the check at the 0.05 probability level for that cutting or for the season total.

aa Indicates a significantly lower yield than the check at the 0.01 probability level for that cutting or for the season total.

Table 2. Summary of yield data from an irrigated alfalfa nursery grown at Kalispell in 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture			
	1973	1974	1975	Mean
A-73-4	3.50	5.88	5.14	4.84
Haymor	3.74	6.33	5.28	5.12
A-73-6	3.83	6.16	5.09	5.03
A-73-7	3.85	5.78	4.97	4.87
A-73-5	3.62	6.39	5.20	5.07
Ladak-65	3.59	5.19	4.36	4.38

	1973	1974	1975
Mean yields (T/A)	3.69	5.95	5.00
F-value for variety yield comparison	0.77NS	3.44*	5.11**
S.E.$\bar{x}$ (T/A)	0.161	0.239	0.147
S.E.$\bar{d}$ (T/A)	0.228	0.339	0.208
C.V. = $\frac{100s}{\bar{x}}$ (%)	8.8	8.0	5.9
L.S.D. at 0.05 (T/A)	0.486	0.721	0.443
L.S.D. at 0.01 (T/A)	0.672	0.998	0.613

NOTE: Haymor is considered to be the check variety for this nusrery.

Table 4. Summary of yield data obtained from a dryland alfalfa nursery grown at Kalispell in 1972, 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture				
	1972	1973	1974	1975	Mean
Ranger	2.58	4.85	4.68	2.07	3.55
Ladak-65	2.64	4.33	4.65	2.97	3.65
Vernal	2.62	4.93	5.35	3.13	4.01
Thor	3.15	4.57	4.73	2.82	3.82
Grimm	2.63	4.42	4.55	2.43	3.51
NK 919	2.97	4.73	4.90	2.84	3.86
Orca	2.43	3.76	4.29	3.01	3.37
Mesilla	2.43	4.30	4.60	2.45	3.45
Ladak	2.84	4.66	4.95	3.34	3.95
502	1.23	4.89	4.53	2.39	3.26
German	3.06	4.58	4.99	2.76	3.85
Haymor	3.30	4.43	5.26	2.92	3.98
BH 22	2.81	4.56	4.96	2.46	3.70
Hot One red clover	1.97	2.43	2.60	1.36	2.09
Mammoth red clover	2.51	3.27	2.53	1.04	2.34
Mean yields (T/A)	2.61	4.31	4.50	2.54	
F-value for variety yield comparison	3.53**	9.68**	11.86**	6.02**	
S.E.$\bar{x}$ (T/A)	0.270	0.218	0.242	0.259	
S.E.$\bar{d}$ (T/A)	0.381	0.308	0.342	0.367	
C.V. = $\frac{100s}{\bar{x}}$ (%)	20.6	10.2	10.8	20.5	
L.S.D. at 0.05 (T/A)	0.769	0.622	0.691	0.741	
L.S.D. at 0.01 (T/A)	1.025	0.828	0.925	0.991	

NOTE: Ladak-65 is considered to be the check variety for this nursery.

TITLE: Effect of Seeding Rate on Forage Yields and Protein Content of Two Perennial Forage Crops

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVES: Determine if forage yields and protein content of perennial legumes can be increased by increasing seeding rates.

PROCEDURES:

Thor alfalfa and Eski sainfoin were seeded at four rates in a randomized block design with four replications on May 2, 1974. Seeding rates for the alfalfa were 2, 10, 20 and 40 pounds per acre; and for the sainfoin were 20, 40, 80 and 100 pounds per acre. Each plot consisted of 4 rows, 20 feet in length, spaced one foot apart. Four hundred pounds of 0-45-0 per acre were applied prior to seeding. Forage yield and protein data were obtained.

RESULTS:

Thor alfalfa when seeded at 40 pounds per acre produced 12 percent less forage in the year after seeding when compared to the 10 pound per acre seeding rate (Table 1). This difference was very close to being significant at the 0.05 probability level. The optimum seeding rate for second year yields was the 10 pound per acre rate. Protein level for the 10 pound per acre rate was one percent lower than any of the other treatments. However, I doubt whether this difference was real.

Eski sainfoin responded similarly to seeding rates (Table 2). The greatest yields were obtained at the 40 pound per acre rate. Also, protein levels were the lowest for this treatment.

Yields were the greatest for the 20 pound per acre rate over a two year period for Thor alfalfa (Table 3). This was due to the yield increase at the higher rates in the seeding year. Protein levels for the two year period were the greatest for the two pound per acre rate.

Yields were the greatest for the 80 pound per acre rate over two years for Eski sainfoin (Table 3). Again, this was due to the yield increase at the higher rate in the seeding year. Like the alfalfa, protein levels of the sainfoin were the greatest at the lowest seeding rate (20 pounds per acre) for the two year period.

Mean yields for the alfalfa over all seeding rates were 25 percent greater than for the sainfoin. There was essentially no difference in protein levels between the two legumes.

Table 1. The effect of seeding rate on forage yield and protein content of Thor alfalfa.

Seeding Rate (lbs/a)	Harvest	Tons per acre at 12 percent moisture: Replication I	II	III	IV	Total	Mean	Protein %
2	First	2.39	2.97	2.31	2.65	10.32	2.58	14.7
	Second	1.35	2.01	1.34	1.78	6.48	1.62	19.5
	Third	0.77	0.70	0.71	0.73	2.91	0.73	22.4
	Total	4.51	5.68	4.36	5.16	19.71	4.93	$\bar{x}$ = 18.9
10 1/	First	2.43	2.91	2.95	2.47	10.76	2.69	12.6
	Second	2.12	1.69	1.65	1.46	6.92	1.73	18.9
	Third	0.75	0.72	0.67	0.88	3.02	0.76	22.3
	Total	5.30	5.32	5.27	4.81	20.70	5.18	$\bar{x}$ = 17.9
20	First	2.61	2.15	2.67	2.12	9.55	2.39	15.5
	Second	1.68	1.92	1.81	1.42	6.83	1.71	17.5
	Third	0.81	0.66	0.75	0.62	2.84	0.71	23.3
	Total	5.10	4.73	5.23	4.16	19.22	4.81	$\bar{x}$ = 18.8
40	First	2.28	1.89	2.21	2.12	8.50	2.13	16.1
	Second	1.74	1.54	1.44	1.88	6.60	1.65	17.7
	Third	0.78	0.73	0.85	0.63	2.99	0.75	23.0
	Total	4.80	4.16	4.50	4.63	18.09	4.53	$\bar{x}$ = 18.9

	First Harvest	Second Harvest	Third Harvest	Total
Harvest dates:	7-1	8-5	9-24	
Mean yields (T/A)	2.45	1.68	0.74	4.86
F-value for treatment yield comparison	2.91NS	0.13NS	0.25NS	1.31NS
S.E.$\bar{x}$ (T/A)	0.145	0.139	0.041	0.237
S.E.$\bar{d}$ (T/A)	0.205	0.197	0.058	0.335
C.V. = 100s/$\bar{x}$ (%)	11.9	16.6	11.2	9.8
L.S.D. at 0.05 (T/A)	0.465	0.445	0.132	0.758
L.S.D. at 0.01 (T/A)	0.668	0.640	0.190	1.089

1/ Check treatment

Table 2. The effect of seeding rate on forage yield and protein content of Eski sainfoin.

Seeding rate (lbs/a)	Harvest	Tons per acre at 12 percent moisture: Replication I	II	III	IV	Total	Mean	Protein %
20	First	3.75	2.68	2.43	2.98	11.84	2.96	16.3
	Second	0.72	0.70	0.72	0.63	2.77	0.69	22.8
	Total	4.47	3.38	3.15	3.61	14.61	3.65	
								$\bar{x}$ = 19.6
40 1/	First	3.21	2.59	4.05	4.10	13.95	3.49	14.3
	Second	0.58	0.72	0.89	0.74	2.93	0.73	22.0
	Total	3.79	3.31	4.94	4.84	16.88	4.22	
								$\bar{x}$ = 18.2
80	First	3.69	3.01	3.27	2.72	12.69	3.17	15.5
	Second	0.73	0.72	1.11	0.62	3.18	0.80	22.7
	Total	4.42	3.73	4.38	3.34	15.87	3.97	
								$\bar{x}$ = 19.1
100	First	3.10	3.14	3.38	2.88	12.50	3.13	15.1
	Second	0.81	0.78	0.60	0.62	2.81	0.70	22.0
	Total	3.91	3.92	3.98	3.50	15.31	3.83	
								$\bar{x}$ = 18.6

	First Harvest	Second Harvest	Total
Harvest dates:	7-1	8-5	
Mean yields (T/A)	3.19	0.73	3.92
F-value for treatment yield comparison	0.71NS	0.47NS	0.68NS
S.E.$\bar{x}$ (T/A)	0.262	0.067	0.291
S.E.$\bar{d}$ (T/A)	0.370	0.095	0.411
C.V. = 100s/$\bar{x}$ (%)	16.4	18.4	14.8
L.S.D. at 0.05 (T/A)	0.837	0.216	0.930
L.S.D. at 0.01 (T/A)	1.203	0.310	1.336

1/ Check treatment

Table 3. Effect of seeding rate on forage yields and protein content of two perennial forage crops in 1974 and 1975.

Variety	Seeding Rate (lbs/a)	Yield (Tons/a at 12% moisture) 1974	1975	Mean	Protein (%) 1974	1975	Mean
Thor alfalfa	2	2.25	4.93	3.59	16.8	18.9	17.9
Thor alfalfa	10[1/]	2.92	5.18	4.05	16.6	17.9	17.3
Thor alfalfa	20	3.40	4.81	4.11	15.5	18.8	17.2
Thor alfalfa	40	3.45	4.53	3.99	16.3	18.9	17.6
	Mean	3.01	4.86	3.94	16.3	18.6	17.5
Eski sainfoin	20	1.89	3.65	2.77	17.2	19.6	18.4
Eski sainfoin	40[1/]	2.17	4.22	3.20	15.8	18.2	17.0
Eski sainfoin	80	2.79	3.97	3.38	16.5	19.1	17.8
Eski sainfoin	100	2.66	3.83	3.25	16.9	18.6	17.8
	Mean	2.38	3.92	3.15	16.6	18.9	17.8

1/ Check treatments

TITLE: Irrigated Commercial Sainfoin Yield Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Ray Ditterline

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVE: Evaluate two commercial sainfoin varieties for forage production in northwestern Montana.

PROCEDURES:

Five sainfoin varieties were planted on May 11, 1973 in Field Y-1, utilizing a randomized complete block design with four replications. Plot size was 4 by 20 feet with one foot between rows and two feet between plots. Four hundred pounds of 0-45-0 were applied in the spring of 1973. Thirty-two square feet were harvested from all varieties as they matured.

RESULTS:

Remont yielded significantly more forage than Melrose and Eski for total season yields. Yields of the two experimental regrowth types were similar to Remont for total season yields, although S-73-2 second and third harvest yields were significantly lower than Remont. Yields for Eski and Melrose were very similar for all cuttings.

All regrowth types yielded more than Eski and Melrose over a three year period with Remont and S-73-3 being the highest. Melrose and Eski yielded more than the regrowth types in the year of seeding only.

Table 1. Yields obtained from an irrigated sainfoin nursery at Kalispell in 1975.

Variety	Harvest	Harvest Date	Tons per acre at 12 percent moisture — Replications I	II	III	IV	Mean
Remont	First	6-24	2.84	2.29	2.33	1.92	2.35
	Second	7-27	1.29	1.18	1.20	1.11	1.20
	Third	9-24	1.10	1.01	1.00	1.04	1.04
	Total		5.23	4.48	4.53	4.07	4.59
S-73-2	First	6-24	2.98	2.71	2.34	2.32	2.59
	Second	7-27	0.92	0.91	0.83	0.85	0.88aa
	Third	9-24	0.93	0.77	0.83	0.93	0.87aa
	Total		4.83	4.39	4.00	4.10	4.34
S-73-3	First	6-24	2.33	2.50	2.37	2.20	2.35
	Second	7-27	1.15	1.31	1.23	0.98	1.17
	Third	9-24	1.09	1.03	1.06	1.08	1.07
	Total		4.57	4.84	4.66	4.26	4.59
Eski	First	6-24	3.10	2.69	2.46	2.82	2.77**
	Second	8- 5	0.84	0.86	0.77	0.87	0.84aa
	Total		3.94	3.55	3.23	3.69	3.61aa
Melrose	First	6-24	3.19	3.07	2.78	2.88	2.98**
	Second	8- 5	0.53	0.72	0.75	0.76	0.69aa
	Total		3.72	3.79	3.53	3.64	3.67aa

	First Harvest	Second Harvest	Third Harvest	Total
Mean yields (T/A)	2.61	0.95	0.99	4.15
F-value for variety yield comparison	8.70**	21.98**	42.73**	14.50**
S.E.$\bar{x}$ (T/A)	0.093	0.047	0.017	0.127
S.E.$\bar{d}$ (T/A)	0.132	0.066	0.024	0.179
C.V. = $\frac{100s}{\bar{x}}$ (%)	7.1	9.8	3.4	6.1
L.S.D. at 0.05 (T/A)	0.287	0.145	0.060	0.391
L.S.D. at 0.01 (T/A)	0.402	0.203	0.091	0.548

NOTE: Remont is considered to be the check variety for this nursery.

aa Indicates a significantly lower yield than the check at 0.01 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at 0.01 for that cutting or for the season total.

Table 2. Summary of yield data from an irrigated sainfoin nursery grown at Kalispell in 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture			
	1973	1974	1975	Mean
Remont	2.38	4.78	4.59	3.92
S-73-2	2.23	4.47	4.34	3.68
S-73-3	2.23	4.81	4.59	3.88
Eski	2.99	4.19	3.61	3.60
Melrose	3.00	4.10	3.67	3.59

	1973	1974	1975
Mean yields (T/A)	2.57	4.47	4.15
F-value for variety yield comparison	12.47**	2.22NS	14.50**
S.E.$\bar{x}$ (T/A)	0.112	0.220	0.127
S.E.$\bar{d}$ (T/A)	0.159	0.311	0.179
C.V. = $\frac{100s}{\bar{x}}$ (%)	8.8	9.8	6.1
L.S.D. at 0.05 (T/A)	0.346	0.679	0.391
L.S.D. at 0.01 (T/A)	0.486	0.951	0.548

NOTE: Remont is considered to be the check variety for this nursery.

TITLE: Irrigated Trefoil Yield Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Ray Ditterline

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVE: Evaluate several trefoil varieties for forage production in northwestern Montana.

PROCEDURES:

Five trefoil varieties were planted with the check variety, Empire, on May 11, 1973 in Field Y-1. Plot size was 4 by 20 feet with one foot between plots. A randomized complete block design with four replications was utilized. Thirty-two square feet were harvested from each variety as it matured. Four hundred pounds of 0-45-0 were applied in the spring of 1973.

RESULTS:

Leo (which was the highest yielding entry) yielded significantly more forage than Empire for the first, second and total season yields in 1975 (Table 1). Two regrowth types, Granger and Mansfield, significantly outyielded Empire for total season yields.

Over a three year period Leo was the best forage producer followed by P-15456 (Table 2). Over that same period, Tana and Mansfield were slightly lower in yield than the check, Empire. A year x variety interaction was evident. Leo ranked in the middle for yields in the seeding year, however it ranked number one in 1974 and 1975. Granger did well the year of seeding then slacked off the second and third years.

Table 1. Yields obtained from an irrigated trefoil nursery at Kalispell in 1975.

Variety	Harvest	Harvest Date	Tons per acre at 12 percent moisture Replications I	II	III	IV	Mean
P-15456	First	7- 2	2.02	2.16	2.19	2.32	2.17
	Second	8-13	1.18	0.90	1.10	1.15	1.08
	Total		3.20	3.06	3.29	3.47	3.25
Leo	First	7- 2	2.25	2.04	2.58	2.47	2.34**
	Second	8-13	1.16	1.19	1.29	1.49	1.28**
	Total		3.41	3.23	3.87	3.96	3.62**
Empire	First	7- 2	1.97	1.95	2.22	2.28	2.11
	Second	8-13	1.02	0.98	0.97	1.18	1.04
	Total		2.99	2.93	3.19	3.46	3.15
Mansfield	First	6-23	1.93	2.00	2.04	2.10	2.02
	Second	7-29	0.77	0.74	0.98	1.12	0.90a
	Third	9-24	0.52	0.57	0.61	0.54	0.56**
	Total		3.22	3.31	3.63	3.76	3.48**
Granger	First	6-23	1.92	1.82	1.85	1.88	1.87aa
	Second	7-29	0.81	0.81	0.77	1.08	0.87a
	Third	9-24	0.51	0.55	0.74	0.50	0.58**
	Total		3.24	3.18	3.36	3.46	3.32*
Tana	First	6-23	1.74	1.88	1.86	1.84	1.83aa
	Second	7-29	0.75	0.77	0.80	0.84	0.79aa
	Third	9-24	0.45	0.40	0.49	0.50	0.46**
	Total		2.94	3.05	3.15	3.18	3.08

	First Harvest	Second Harvest	Third Harvest	Total
Mean yields (T/A)	2.06	0.99	0.53	3.31
F-value for variety yield comparison	12.44**	18.44**	4.49NS	13.60**
S.E.$\bar{x}$ (T/A)	0.054	0.041	0.030	0.056
S.E.$\bar{d}$ (T/A)	0.077	0.059	0.042	0.078
C.V. $\frac{100s}{\bar{x}}$ (%)	5.3	8.4	11.1	3.3
L.S.D. at 0.05 (T/A)	0.164	0.126	0.104	0.166
L.S.D. at 0.01 (T/A)	0.226	0.174	0.156	0.230

NOTE: Empire is considered to be the check variety for this nursery.

a Indicates a significantly lower yield than the check at 0.05 for that cutting or for the season total.

aa Indicates a significantly lower yield than the check at 0.01 for that cutting or for the season total.

* Indicates a significantly higher yield than the check at 0.05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at 0.01 for that cutting or for the season total.

Table 2. Summary of yield data from an irrigated trefoil nursery grown at Kalispell in 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture			
	1973	1974	1975	Mean
P-15456	2.65	3.99	3.25	3.30
Leo	2.49	4.29	3.62	3.47
Empire	2.30	3.92	3.15	3.12
Mansfield	2.62	2.97	3.48	3.02
Granger	2.70	3.36	3.32	3.13
Tana	2.20	3.46	3.08	2.91

	1973	1974	1975
Mean yields (T/A)	2.50	3.66	3.31
F-value for variety yield comparison	4.82**	14.23**	13.60**
S.E.$\bar{x}$ (T/A)	0.093	0.129	0.056
S.E.$\bar{d}$ (T/A)	0.131	0.182	0.078
C.V. = $\frac{100s}{\bar{x}}$ (%)	7.4	7.0	3.3
L.S.D. at 0.05 (T/A)	0.279	0.388	0.166
L.S.D. at 0.01 (T/A)	0.386	0.537	0.230

NOTE: Empire is considered to be the check variety for this nursery.

TITLE: Simulated Pasture Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Scott Cooper

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1977

OBJECTIVES: Compare yield and regrowth pattern of Regar bromegrass to Manchar smooth bromegrass in pure stands and in mixtures with four perennial legume species.

PROCEDURES:

The nursery was planted in Y-10 on May 2, 1974, utilizing a randomized complete block design with four replications. Regar and Manchar were seeded in a pure stand at a rate of nine pounds per acre and in mixtures at 4.5 pounds per acre. Seeding rates for Thor alfalfa, Ladino clover, Cicer milkvetch and Empire birdsfoot trefoil when seeded with the grasses were 4,2,3.4 and 10 pounds per acre respectively. The legume plots were seeded first in one foot rows and the grasses were then seeded between the legume rows. Excellent stands were obtained for Manchar, however stands of Regar were consistently spotty. Plots were 4 feet wide, and 20 feet in length. Thirty-two pounds of P_2O_5 and forty pounds of nitrogen were applied to the nursery in 1974 and 1975. Thirty-two square feet were harvested from each plot four times in 1975. All treatments were cut on the same date for each harvest. The first replication was eliminated from the analyses because the legumes were hoed out in several of the plots. Some alfalfa weevil damage was noticed in 1975.

RESULTS:

Pure stands of Regar outyielded Manchar by 18 percent. Regar-legume mixture yields exceeded Manchar-legume yields except for the Ladino clover mixture. Regar recovered more rapidly after cutting than Manchar. Manchar became dormant earlier in the fall than did Regar.

Yields were increased in all cases when a legume was planted with either grass. Ladino clover increased yields the most followed by the alfalfa. The highest forage producing mixture in the nursery was the Thor alfalfa - Regar bromegrass treatment.

Table 1. Yields of two bromegrass varieties when grown in mixtures with four legume varieties at Kalispell, 1975.

Mixture	Harvest	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean[1/]
Cicer-Manchar	First	1.85	2.66	2.51	2.34
	Second	0.70	0.76	0.83	0.76
	Third	0.59	0.57	0.46	0.54
	Fourth	0.61	0.65	0.61	0.62
	Total	3.75	4.64	4.41	4.26de
Cicer-Regar	First	2.04	2.52	2.18	2.25
	Second	0.92	0.97	0.94	0.94
	Third	0.85	0.79	0.69	0.78
	Fourth	0.82	0.89	0.70	0.80
	Total	4.63	5.17	4.51	4.77bcd
Trefoil-Manchar	First	2.66	`.59	2.58	2.61
	Second	0.87	0.95	0.95	0.92
	Third	0.64	0.68	0.61	0.64
	Fourth	0.52	0.73	0.53	0.59
	Total	4.69	4.95	4.67	4.76bcd
Trefoil-Regar	First	1.88	2.42	2.11	2.14
	Second	0.94	1.22	1.00	1.05
	Third	0.92	0.94	0.73	0.86
	Fourth	0.72	0.89	0.78	0.80
	Total	4.46	5.47	4.62	4.85bcd
Ladino-Manchar	First	2.12	2.58	2.48	2.39
	Second	1.01	0.83	1.08	0.97
	Third	0.93	0.98	0.90	0.94
	Fourth	0.96	1.12	0.92	1.00
	Total	5.02	5.51	5.38	5.30ab
Ladino-Regar	First	1.99	2.13	2.23	2.12
	Second	1.22	1.00	0.99	1.07
	Third	0.92	0.85	0.78	0.85
	Fourth	1.06	1.05	0.96	1.02
	Total	5.19	5.03	4.96	5.06abc
Thor-Manchar	First	2.43	2.25	2.17	2.28
	Second	0.95	0.84	0.81	0.87
	Third	0.94	0.79	0.70	0.81
	Fourth	0.67	0.54	0.53	0.58
	Total	4.99	4.42	4.21	4.54cd
Thor-Regar	First	2.65	2.83	2.58	2.69
	Second	1.07	0.90	0.99	0.99
	Third	0.94	0.93	0.90	0.92
	Fourth	0.83	0.91	0.80	0.85
	Total	5.49	5.57	5.27	5.45a

Table 1. (con't)

Mixture	Harvest	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean 1/
Manchar	First	2.04	2.04	2.10	2.06
	Second	0.69	0.67	0.70	0.69
	Third	0.54	0.50	0.39	0.48
	Fourth	0.57	0.72	0.64	0.64
	Total	3.84	3.93	3.83	3.87e
Regar	First	1.82	2.39	2.34	2.18
	Second	0.68	0.88	0.96	0.84
	Third	0.73	0.76	0.89	0.79
	Fourth	0.73	0.71	0.79	0.74
	Total	3.96	4.74	4.98	4.55cd

	First Harvest	Second Harvest	Third Harvest	Fourth Harvest	Total
Harvest date	6-11	7-16	8-22	9-29	
Mean yields (T/A)	2.31	0.91	0.76	0.77	4.74
F-value for treatment yield comparison	3.75**	4.31**	18.58**	18.26**	6.69**
S.E.$\bar{x}$ (T/A)	0.108	0.059	0.036	0.037	0.182
S.E.$\bar{d}$ (T/A)	0.152	0.084	0.052	0.053	0.257
C.V. = $\frac{100s}{\bar{x}}$ (%)	8.1	11.2	8.3	8.5	6.6
L.S.D. at .05 (T/A)	0.320	0.176	0.109	0.111	0.540
L.S.D. at .01 (T/A)	0.438	0.241	0.149	0.152	0.740

1/ Treatment total means not followed by the same letter are significantly different at the 0.05 probability level according to Duncan's Multiple Range test.

TITLE: Irrigated Intrastate Orchardgrass Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperators - C. S. Cooper, Scott Laudert and J. G. Sheetz

LOCATIONS: Northwestern Agricultural Research Center, Kalispell, Montana
Montana Agricultural Experiment Station, Bozeman, Montana
Southern Agricultural Research Center, Huntley, Montana
Plant Materials Center, Bridger, Montana

DURATION: 1972-1975 - Completed

OBJECTIVES: Evaluate eleven orchardgrass varieties for forage production throughout Montana.

PROCEDURES:

Eleven orchardgrass varieties were established at the above locations in the spring of 1972. The nursery at Kalispell was seeded at a rate of eight pounds per acre in Field Y-8 on May 12, utilizing a randomized complete block design with four replications. Plots consisted of four rows spaced one foot apart and were 20 feet in length. Harvest area was 32 square feet. All varieties were harvested as they matured for the first harvest and were harvested on a common date for the second cutting in 1975. Four hundred pounds of 0-45-0 per acre were applied in the year of seeding. One-hundred pounds of nitrogen per acre were applied in the spring of 1975 to the entire nursery.

RESULTS:

The highest producing orchardgrass variety in the nursery at Kalispell over a four year period was NK-1, followed by NK-4 and Chinook (Table 2). Chinook yields were much higher than the other varieties in the seeding year and decreased substantially in subsequent years. Yields of NK-1 and NK-4 were much more stable over the same period.

Mean yield differences among varieties at Bozeman from 1973 through 1975 were slight (Table 3). NK-2, NK-1 and Napier were the highest yielding varieties at this location.

Over the same three year period, NK-4 produced the most hay at Huntley followed by the early maturing check variety, Potomac (Table 4).

At Bridger from 1973 through 1975 Napier was the best producing variety followed by NK-2 (Table 5). Chinook, Kay and NK-3 were the lowest yielding varieties in the nursery.

No variety consistently produced the most hay at all locations (Table 6). The four highest yielding varieties throughout the state were NK-1, NK-4, NK-2 and Napier. The three NK varieties did well at most locations. Napier did exceedingly well at Bridger and not so well at the other three locations.

Table 1. Yields obtained from an irrigated orchardgrass nursery at Kalispell in 1975.

Variety	Harvest	Harvest Date	Tons per acre at 12 percent moisture				
			Replications				
			I	II	III	IV	Mean
Chinook	First	6-12	1.53	1.05	1.37	0.93	1.22
	Second	8-15	0.70	0.50	0.60	0.42	0.56
	Total		2.23	1.55	1.97	1.35	1.78
Napier	First	6-12	1.28	1.15	1.43	1.08	1.24
	Second	8-15	1.16	1.11	1.08	0.92	1.07
	Total		2.44	2.26	2.51	2.00	2.31
Dayton	First	6-12	1.10	1.10	1.06	0.95	1.05
	Second	8-15	1.02	0.87	0.75	0.84	0.87
	Total		2.12	1.97	1.81	1.79	1.92
NK-2	First	6-12	1.37	1.05	1.23	1.15	1.20
	Second	8-15	0.99	0.71	0.69	0.80	0.80
	Total		2.36	1.76	1.92	1.95	2.00
Potomac	First	6-12	1.01	1.27	1.11	1.12	1.13
	Second	8-15	0.90	0.95	0.73	0.94	0.88
	Total		1.91	2.22	1.84	2.06	2.01
NK-1	First	6-18	1.61	1.30	1.18	1.38	1.37
	Second	8-15	0.91	0.75	0.56	0.68	0.73
	Total		2.52	2.05	1.74	2.06	2.10
NK-4	First	6-18	1.44	1.09	1.32	1.16	1.25
	Second	8-15	0.96	0.58	0.61	0.61	0.69
	Total		2.40	1.67	1.93	1.77	1.94
Kay	First	6-18	1.34	1.21	1.25	1.02	1.21
	Second	8-15	0.80	0.69	0.48	0.53	0.63
	Total		2.14	1.90	1.73	1.55	1.84
Latar	First	6-18	1.18	0.92	1.11	1.20	1.10
	Second	8-15	0.95	0.71	0.72	0.76	0.79
	Total		2.13	1.63	1.83	1.96	1.89
NK-3	First	6-18	1.34	1.18	1.22	0.92	1.17
	Second	8-15	0.70	0.85	0.72	0.45	0.68
	Total		2.04	2.03	1.94	1.37	1.85
Pennlate	First	6-18	1.38	1.27	1.06	1.06	1.19
	Second	8-15	0.72	0.98	0.49	0.66	0.71
	Total		2.10	2.25	1.55	1.72	1.90

	First Harvest	Second Harvest	Total
Mean yields (T/A)	1.19	0.76	1.96
F-value for variety yield comparison	1.64NS	6.95**	1.82NS
S.E.$\bar{x}$ (T/A)	0.066	0.054	0.108
S.E.$\bar{d}$ (T/A)	0.092	0.075	0.153
C.V. = $\frac{100s}{\bar{x}}$ (%)	10.9	14.0	11.1
L.S.D. at 0.05 (T/A)	0.188	0.154	0.313
L.S.D. at 0.01 (T/A)	0.253	0.207	0.421

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

Table 2. Summary of yield data from an irrigated orchardgrass nursery grown at Kalispell in 1972, 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture				
	1972	1973	1974	1975	Mean
Chinook 1/	2.68	4.37	3.81	1.78	3.16
Napier 1/	1.71	4.21	4.03	2.31	3.07
Dayton 1/	1.73	4.55	4.22	1.92	3.11
NK-2 1/	1.48	4.52	4.50	2.00	3.13
Potomac 1/	1.53	4.17	3.66	2.01	2.84
NK-1 2/	2.23	4.96	4.35	2.10	3.41
NK-4 2/	1.61	4.89	4.25	1.94	3.17
Kay 2/	1.72	4.63	3.43	1.84	2.91
Latar 2/	1.91	4.70	3.61	1.89	3.03
NK-3 2/	1.61	4.69	4.05	1.85	3.05
Pennlate 2/	1.75	4.26	3.46	1.90	2.84
Mean yields (T/A)	1.82	4.54	3.94	1.96	
F-value for variety yield comparison	2.93*	1.98NS	2.48*	1.82NS	
S.E.$\bar{x}$ (T/A)	0.206	0.189	0.237	0.108	
S.E.$\bar{d}$ (T/A)	0.291	0.268	0.335	0.153	
C.V. = $\frac{100s}{\bar{x}}$ (%)	22.6	8.4	12.0	11.1	
L.S.D. at 0.05(T/A)	0.593	0.547	0.684	0.313	
L.S.D. at 0.01(T/A)	0.800	0.736	0.921	0.421	

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

1/ Early maturing varieties
2/ Late maturing varieties

Table 3. Summary of yield data from an irrigated orchardgrass nursery grown at Bozeman in 1973, 1974 and 1975.

Variety	Tons per acre at 12% moisture			
	1973	1974	1975	Mean
Chinook 1/	3.11	1.62	1.76	2.16
Napier 1/	3.08	2.01	2.00	2.36
Dayton 1/	2.93	1.69	2.14	2.25
NK-2 1/	3.07	2.09	2.16	2.44
Potomac 1/	3.13	1.69	2.23	2.35
NK-1 2/	3.26	1.88	1.96	2.37
NK-4 2/	3.01	1.85	2.01	2.29
Kay 2/	2.93	1.80	2.21	2.31
Latar 2/	2.98	2.05	1.88	2.30
NK-3 2/	2.70	1.86	1.95	2.17
Pennlate 2/	3.01	1.72	1.98	2.24
Mean yields (T/A)	3.02	1.84	2.02	
F-value for variety yield comparison	1.06NS	2.05NS	1.37NS	
S.E.$\bar{x}$ (T/A)	0.141	0.110	0.126	
S.E.$\bar{d}$ (T/A)	0.199	0.156	0.178	
C.V. - $\frac{100s}{\bar{x}}$ (%)	9.2	12.0	12.5	
L.S.D. at 0.05 (T/A)	0.406	0.318	0.364	
L.S.D. at 0.01 (T/A)	0.547	0.429	0.490	

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

1/ Early maturing varieties
2/ Late maturing varieties

Table 4. Summary of yield data from an irrigated orchardgrass nursery grown at Huntley in 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture			
	1973	1974	1975	Mean
Chinook 1/	3.52	6.53	3.22	4.42
Napier 1/	3.47	5.90	3.25	4.21
Dayton 1/	4.06	5.83	3.38	4.42
NK-2 1/	3.64	6.30	3.17	4.37
Potomac 1/	3.66	6.48	3.50	4.55
NK-1 2/	3.47	5.95	3.44	4.29
NK-4 2/	3.20	7.31	3.92	4.81
Kay 2/	4.03	5.65	3.41	4.36
Latar 2/	3.02	6.54	2.99	4.18
NK-3 2/	3.25	6.11	3.57	4.31
Pennlate 2/	3.62	5.98	3.18	4.26
Mean yields (T/A)	3.54	6.23	3.36	
F-value for variety yield comparison	1.94NS	1.42NS	0.99NS	
S.E.$\bar{x}$ (T/A)	0.229	0.389	0.252	
S.E.$\bar{d}$ (T/A)	0.324	0.550	0.356	
C.V. = $\frac{100s}{\bar{x}}$ (%)	13.0	12.6	15.0	
L.S.D. at 0.05 (T/A)	0.661	1.126	0.727	
L.S.D. at 0.01 (T/A)	0.891	1.517	0.979	

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

1/ Early maturing varieties
2/ Late maturing varieties

Table 5. Summary of yield data from an irrigated orchardgrass nursery grown at Bridger in 1973, 1974 and 1975.

Variety	Tons per acre at 12 percent moisture			
	1973	1974	1975	Mean
Chinook 1/	1.38	3.45	1.97	2.27
Napier 1/	2.55	5.60	2.60	3.58
Dayton 1/	2.23	4.49	2.33	3.02
NK-2 1/	2.37	5.08	2.19	3.21
Potomac 1/	1.89	4.46	2.09	2.81
NK-1 2/	1.91	4.53	1.92	2.79
NK-4 2/	1.59	4.14	2.28	2.67
Kay 2/	1.67	3.28	1.83	2.26
Latar 2/	2.12	4.46	1.89	2.82
NK-3 2/	1.51	3.14	1.95	2.20
Pennlate 2/	1.90	4.05	1.59	2.51
Nordstern 2/	1.29	3.49	1.88	2.22
Mean yields (T/A)	1.87	4.18	2.05	
F-value for variety yield comparison	4.81**	15.18**	1.57 NS	
S.E.$\bar{x}$ (T/A)	0.180	0.191	0.215	
S.E.$\bar{d}$ (T/A)	0.255	0.270	0.304	
C.V. = $\frac{100s}{\bar{x}}$ (%)	19.4	9.2	18.2	
L.S.D. at 0.05(T/A)	0.539	0.561	0.631	
L.S.D. at 0.01(T/A)	0.719	0.762	0.858	

1/ Early maturing varieties
2/ Late maturing varieties

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

Table 6. Summary of irrigated orchardgrass yield data at four locations throughout Montana. 1/

Variety	Kalispell 2/		Bozeman 3/		Huntley 3/		Bridger 3/		Mean	
	Yield	% of Check	Yield	% of Check	Yield	% of Check	Yield	% of Check	Yield	% of Check
Chinook 4/	3.16	111	2.16	92	4.42	97	2.27	81	3.00	96
Napier 4/	3.07	108	2.36	100	4.21	93	3.58	127	3.31	105
Dayton 4/	3.11	110	2.25	96	4.42	97	3.02	108	3.20	102
NK-2 4/	3.13	110	2.44	104	4.37	96	3.21	114	3.29	105
Potomac 4/	2.84	100	2.35	100	4.55	100	2.81	100	3.14	100
NK-1 5/	3.41	120	2.37	106	4.29	101	2.79	111	3.22	109
NK-4 5/	3.17	112	2.29	102	4.81	113	2.67	106	3.24	110
Kay 5/	2.91	103	2.31	103	4.36	102	2.26	90	2.96	100
Latar 5/	3.03	107	2.30	103	4.18	98	2.82	112	3.08	104
NK-3 5/	3.05	107	2.17	97	4.31	101	2.20	88	2.93	99
Pennlate 5/	2.84	100	2.24	100	4.26	100	2.51	100	2.96	100

1/ Yields reported in tons per acre at 12 percent moisture.
2/ Mean yields from 1972, 1973, 1974 and 1975.
3/ Mean yields from 1973, 1974 and 1975.
4/ Early maturing varieties.
5/ Late maturing varieties.

NOTE: Potomac is considered to be the early maturing check variety and Pennlate the late maturing check variety.

TITLE: Effect of row spacing on the seed production of two orchardgrass varieties.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Loren Wiesner

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVE: Determine the correct cultural practices to achieve maximum seed yields of two orchardgrass varieties.

PROCEDURES:

Pennlate and Potomac orchardgrass were seeded in 6, 12, 24 and 36 inch rows in the northeast corner of Field Y-10 on May 17, 1972. A randomized complete block design with four replications was utilized. Plot size for all row spacings was 9 by 20 feet. Seventy pounds of nitrogen and 35 pounds of P_2O_5 were applied in the spring of 1975. Seed yield data were not obtained in 1974 due to mouse damage of the stored samples.

RESULTS:

Seed yields in 1975 ranged from 170.6 pounds per acre for Potomac at the six inch row spacing to 658.1 pounds per acre for Pennlate at the 36 inch row spacing (Table 1). Pennlate seed yields exceeded Potomac seed yields at every row spacing so the variety x row spacing interaction was not significant. The 24 and 36 inch row spacing yields exceeded the 6 and 12 inch row spacing yields for both varieties with essentially no difference occurring between each group.

A row spacing x year interaction was evident (Table 2). Maximum yields the year after seeding for both varieties occurred at the 12 inch row spacing; whereas in 1975 (three years after seeding) maximum yields for both varieties were achieved at the wider row spacings.

Table 1. Effect of row spacing and variety on orchardgrass seed production (pounds per acre) at Kalispell in 1975.

Variety	Replication	Row Spacing (inches) 6	12	24	36	Mean[1/]
Pennlate	I	324.3	448.1	747.7	922.3	
	II	285.6	128.5	756.1	811.7	
	III	330.7	272.3	463.3	554.9	
	IV	308.1	378.1	525.7	343.3	
	Mean	312.2	306.8	623.2	658.1	475.1a
Potomac	I	271.1	101.4	521.2	184.6	
	II	105.3	237.8	470.2	568.5	
	III	138.4	202.5	400.2	252.1	
	IV	167.7	265.5	415.2	755.7	
	Mean	170.6	201.8	451.7	440.2	316.1b
	Mean[2/]	241.4a	254.3a	537.5b	549.1b	

Mean yield: 395.57 lbs/a
s^2 = 25175.71 lbs/a
s = 158.67 lbs/a
Harvest date: Pennlate = July 21 and Potomac July 18
Harvest area: 6" and 12" row spacing = 28 square feet, 24" row spacing = 56 square feet, and 36" row spacing = 42 square feet.
F-value, S.E.$\bar{x}$, C.V.($S_{\bar{x}}/\bar{x}$) for variety yield comparison: 8.03**, 39.67 lbs/a, 10.0%
F-value, S.E.$\bar{x}$, C.V.($S_{\bar{x}}/\bar{x}$) for row spacing yield comparison: 9.26**, 56.10 lbs/a, 14.2%
F-value, S.E.$\bar{x}$, C.V.($S_{\bar{x}}/\bar{x}$) for row spacing X variety interaction: 0.18NS, 79.34 lbs/a, 20.1%

1/ Variety means followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.
2/ Row spacing means followed by the same letter are not significantly different at the .05 level of probability according to Duncan's Multiple Range Test.

Table 2. Effect of row spacing and variety on orchardgrass seed production (pounds per acre) at Kalispell in 1973 and 1975.

Row Spacing (inches)	Variety: Pennlate 1973	Pennlate 1975	Pennlate Mean	Potomac 1973	Potomac 1975	Potomac Mean	Mean
6	578.1	312.2	445.2	419.8	170.6	295.2	370.2
12	756.8	306.8	531.8	508.5	201.8	355.2	443.5
24	706.4	623.2	664.8	361.6	451.7	406.7	535.8
36	562.1	658.1	610.1	275.9	440.2	358.1	484.1
Mean	650.9	475.1	563.0	391.5	316.1	353.8	458.4

TITLE: Dryland Agropyron Hybrid Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Art Dubbs

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: 1972-1975 - Completed

OBJECTIVE: Compare forage production and degree of rhizomatous growth of three Agropyron hybrids to that of the standard crested variety.

PROCEDURES:

All entries were planted in 4 by 20 feet plots in a randomized complete block design with four replications. The wheatgrasses were seeded at a rate of five pounds per acre on May 11, 1972 in Field F-3. Thirty-two square feet were harvested from each plot on a common date. Sixty pounds of nitrogen per acre and 30 pounds of P_2O_5 per acre were applied to the nursery in the spring of 1975.

RESULTS:

The Cristatum x Desertorum hybrid produced the most forage of the crested type grasses in 1975 (Table 1). Oahe intermediate wheatgrass produced more forage than any of the other wheatgrasses. Ladak-65 alfalfa produced over two tons per acre more forage than any of the grass varieties.

Mean yields over a four year period were greatest for the Cristatum x Desertorum hybrid followed by the Repens x Desertorum hybrid when considering only the crested types (Table 2). Oahe yielded more than any of the crested types and Ladak-65 yielded more than any of the grasses.

The Repens x Cristatum hybrid had the greatest degree of rhizomatous growth after four years followed by Oahe and the Repens x Desertorum hybrid (Table 2). When considering only the crested types, there was a negative relationship between rhizomatous growth and yield.

Table 1. Yields obtained from an Agropyron hybrid nursery at Kalispell, 1975.

Entry	Tons per acre at 12 percent moisture				
	Replications				
	I	II	III	IV	Mean
Cristatum x Desertorum	2.82	1.70	1.71	1.37	1.90
Repens x Cristatum	1.97	1.53	0.83	1.06	1.35
Repens x Desertorum	1.73	1.64	2.06	1.27	1.68
Standard Crested	2.25	1.52	1.27 1/	1.08	1.53
Oahe intermediate wheatgrass	2.75	1.74	2.06	2.55	2.28*
Ladak-65 alfalfa	4.58	5.12	3.48	3.79	4.24**

Harvest date	7-9
Mean yield (T/A)	2.16
F-value for variety yield comparison	23.15**
S.E.$\bar{x}$ (T/A)	0.222
S.E.$\bar{d}$ (T/A)	0.314
C.V. = $\frac{100s}{\bar{x}}$ (%)	20.5
L.S.D. at 0.05 (T/A)	0.674
L.S.D. at 0.01 (T/A)	0.935

1/ Yield calculated by missing plot formula.

NOTE: Standard crested is considered to be the check variety for this nursery.

* Indicates a significantly higher yield than the check at the 0.05 probability level according to Duncan's Multiple Range Test.

** Indicates a significantly higher yield than the check at the 0.01 probability level according to Duncan's Multiple Range Test.

Table 2. Yields obtained from an Agropyron hybrid nursery grown at Kalispell in 1972, 1973, 1974 and 1975.

Entry	Tons per acre at 12 percent moisture					Degree of spread in 1975 1/
	1972	1973	1974	1975	Mean	
Cristatum x Desertorum	1.39	2.90	2.33	1.90	2.13	0.0
Repens x Cristatum	0.42	2.94	2.07	1.35	1.70	8.5
Repens x Desertorum	0.89	3.29	2.39	1.68	2.06	5.0
Standard Crested	0.71	2.50	2.14	1.53	1.72	0.0
Oahe intermediate wheatgrass	0.38	5.29	2.88	2.28	2.71	7.5
Ladak-65 alfalfa	2.48	3.62	5.16	4.24	3.88	0.0
Mean	1.05	3.42	2.83	2.16	2.37	

	1972	1973	1974	1975
Mean yields (T/A)	1.05	3.42	2.83	2.16
F-value for variety yield comparison	16.85**	22.24**	11.80**	23.15**
S.E.$\bar{x}$ (T/A)	0.194	0.210	0.343	0.222
S.E.$\bar{d}$ (T/A)	0.274	0.296	0.485	0.314
C.V. = $\frac{100s}{\bar{x}}$ (%)	37.0	12.2	24.2	20.5
L.S.D. at 0.05 (T/A)	0.588	0.636	1.040	0.674
L.S.D. at 0.01 (T/A)	0.816	0.882	1.444	0.935

NOTE: Standard crested is considered to be the check variety for this nursery.

1/ Range of spreading from 0 to 10 with 0 equal to no spreading and 10 equal to solid stand.

TITLE: Effect of planting date on the forage yields of four fall-planted small grains.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Determine the influence of three fall planting dates on the forage yields of Wintergraze 90-90, Crest winter wheat, Nugaines winter wheat and Schuyler winter barley.

PROCEDURES:

Wintergraze, Crest, Nugaines and Schuyler were seeded in the fall of 1974 on August 19, September 3 and September 17 in Field Y-5. Each variety was seeded at 100 pounds per acre. Thirty-two pounds of nitrogen per acre and 40 pounds of P_2O_5 per acre were applied at the time of seeding. Seventy pounds of nitrogen per acre were applied to the entire nursery in the spring of 1975. The nursery was irrigated three times in 1975 with two inches being applied at each irrigation. A split plot design (planting dates as whole plots) with three replications was utilized. Plots consisted of four rows spaced one foot apart and were 20 feet in length. Thirty-two square feet were harvested from each plot. Yield, plant protein and plant nitrate data were obtained.

RESULTS:

Total season yields for Schuyler winter barley were greatest when seeded on September 3, 1974 (Table 1). When planted on August 19, 0.55 tons per acre of forage were harvested on November 11, 1974. Regrowth in early summer after the spring harvest was good across all planting dates. Third harvest yields were low for Schuyler. Much of the Schuyler was lost to snow mold, especially those plots seeded at the early planting date.

Maximum yields for Nugaines winter wheat were obtained at the August 19, 1974 planting date (Table 2). Yields decreased as the fall planting date was delayed. Third harvest yields were better than Schuyler, but were still low (approximately 0.50 tons per acre).

Crest winter wheat produced the most forage when planted on August 19 (Table 3). First and third summer harvest yields were greater for Crest than for Schuyler or Nugaines. However, second summer harvest yields were lower for Crest than the latter two varieties.

Forage yields increased for Wintergraze 90-90 as fall planting dates were delayed (Table 4). Yield distribution was better for Wintergraze than for the other three varieties.

The August 19, 1974 planting date produced significantly more hay than the two later planting dates with no difference occurring between the latter two (Table 5). Across all planting dates Wintergraze 90-90 and Crest produced significantly more hay than Nugaines and Schuyler. Nugaines yielded significantly more than Schuyler when averaging all planting dates.

Results (con't)

A graph of the variety x planting date interaction is presented in Figure 1. Varieties did not respond the same for all planting dates.

Crude protein levels were highest for Nugaines followed by Wintergraze. Protein levels decreased in each succeeding harvest.

Nitrate levels were highest for Schuyler and lowest for Wintergraze. Nitrate levels increased in each succeeding harvest.

Table 1. Effect of planting date on the forage yield of fall planted Schuyler winter barley.

Planting Date	Harvest Date	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean
8-19-74	11-26-74	0.51	0.61	0.54	0.55
	5-29-75	0.64	0.42	0.42	0.49
	6-25-75	1.10	1.08	1.22	1.13
	7-15-75	0.22	0.19	0.24	0.22
	Total	2.47	2.30	2.42	2.39
9- 3-74	5-29-75	0.93	1.07	0.81	0.94
	6-25-75	1.44	1.11	1.22	1.26
	7-15-75	0.46	0.60	0.55	0.54
	Total	2.83	2.78	2.58	2.74
9-17-74	5-29-75	0.67	0.50	0.51	0.56
	6-25-75	1.41	1.72	1.61	1.58
	7-15-75	0.42	0.45	0.52	0.46
	Total	2.50	2.67	2.64	2.60

Table 2. Effect of planting date on the forage yield of fall planted Nugaines winter wheat.

Planting Date	Harvest Date	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean
8-19-74	11-26-74	0.18	0.31	0.52	0.34
	5-29-75	1.71	1.40	1.07	1.39
	6-25-75	0.80	1.08	1.18	1.02
	7-15-75	0.61	0.54	0.62	0.59
	Total	3.30	3.33	3.39	3.34
9- 3-74	5-29-75	1.21	0.72	0.86	0.93
	6-25-75	1.08	1.53	1.31	1.31
	7-15-75	0.63	0.36	0.64	0.54
	Total	2.92	2.61	2.81	2.78
9-17-74	5-29-75	0.95	1.00	0.68	0.88
	6-25-75	1.20	1.31	1.42	1.31
	7-15-75	0.54	0.43	0.56	0.51
	Total	2.69	2.74	2.66	2.70

Table 3. Effect of planting date on the forage yield of fall planted Crest winter wheat.

Planting Date	Harvest Date	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean
8-19-74	11-26-74	0.33	0.34	0.52	0.40
	5-29-75	2.42	2.37	1.65	2.15
	6-25-75	0.49	0.64	0.82	0.65
	7-15-75	1.08	0.52	0.59	0.73
	Total	4.32	3.87	3.58	3.93
9- 3-74	5-29-75	1.66	1.49	1.77	1.64
	6-25-75	0.72	0.76	0.74	0.74
	7-15-75	1.00	0.78	0.81	0.86
	Total	3.38	3.03	3.32	3.24
9-17-74	5-29-75	2.21	1.22	1.34	1.59
	6-25-75	0.74	1.03	1.10	0.96
	7-15-75	0.77	0.73	0.77	0.76
	Total	3.72	2.98	3.21	3.31

Table 4. Effect of planting date on the forage yield of fall planted Winter-graze 90-90.

Planting Date	Harvest Date	Tons per acre at 12 percent moisture			
		Replication			
		I	II	III	Mean
8-19-74	11-26-74	0.17	0.18	0.57	0.31
	5-29-75	1.17	1.12	1.11	1.13
	6-25-75	1.29	1.25	1.48	1.34
	7-15-75	0.73	0.83	0.96	0.84
	Total	3.36	3.38	4.12	3.62
9- 3-74	5-29-75	0.96	1.03	1.18	1.06
	6-25-75	1.58	1.69	1.67	1.65
	7-15-75	1.00	0.98	0.86	0.95
	Total	3.54	3.70	3.71	3.66
9-17-74	5-29-75	0.77	0.86	0.77	0.80
	6-25-75	1.82	1.92	1.80	1.85
	7-15-75	1.34	1.17	1.08	1.20
	Total	3.93	3.95	3.65	3.85

Table 5. Effect of planting date and variety on the forage yields of four fall planted small grains.

Planting Date	Harvest Date	Tons per acre at 12 percent moisture Variety Schuyler	Nugaines	Crest	Wintergraze	Mean 1/
8-19-74	11-26-74	0.55	0.34	0.40	0.31	0.40
	5-29-75	0.49	1.39	2.15	1.13	1.29
	6-25-75	1.13	1.02	0.65	1.34	1.04
	7-15-75	0.22	0.59	0.73	0.84	0.60
	Total	2.39	3.34	3.93	3.62	3.33a
9- 3-74	5-29-75	0.94	0.93	1.64	1.06	1.14
	6-25-75	1.26	1.31	0.74	1.65	1.24
	7-15-75	0.54	0.54	0.86	0.95	0.72
	Total	2.74	2.78	3.24	3.66	3.10b
9-17-74	5-29-75	0.56	0.88	1.59	0.80	0.96
	6-25-75	1.58	1.31	0.96	1.85	1.43
	7-15-75	0.46	0.51	0.76	1.20	0.73
	Total	2.60	2.70	3.31	3.85	3.12b
	Variety Mean 2/	2.58c	2.94b	3.49a	3.71a	3.18

Mean yield: 3.18 T/A
Harvest area: 32 square feet
F-values: Planting date = 14.42*; Varieties 40.89**; Varieties x Planting dates = 4.23**
$S_{\bar{d}}$'s: Two planting date means = 0.046 T/A; Two variety means = 0.114 T/A; Two variety means at one planting date = 0.197 T/A; Two planting date means at same variety or different varieties (any two treatment means) = 0.177 T/A

1/ Planting date means followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

2/ Variety means followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

Figure 1. Effect of planting date and variety on the forage yield of four fall planted small grains.

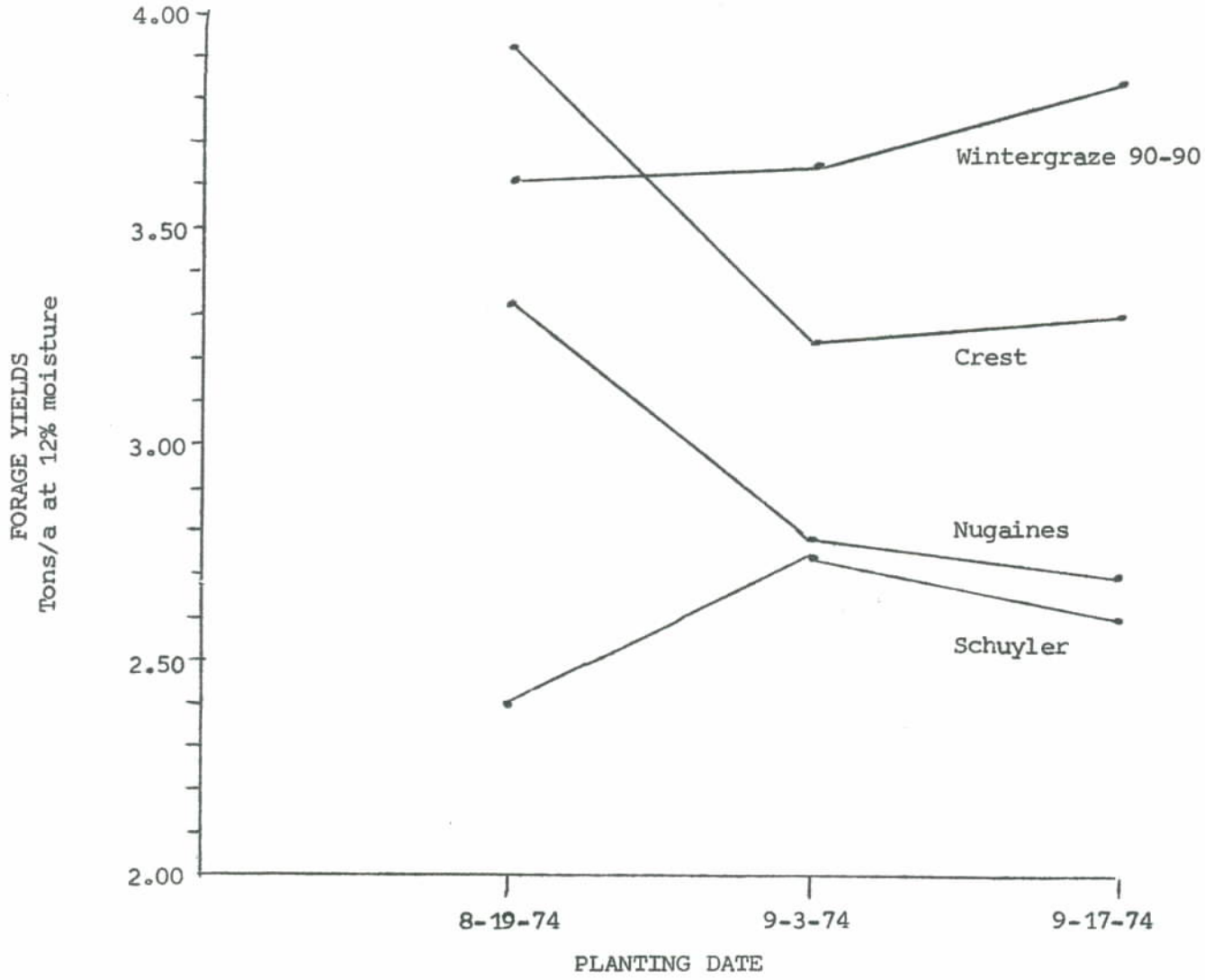

Table 6. Effect of variety on the protein content of four fall planted small grains.

Variety	Protein (%) Fall Harvest 1974	First Harvest 1975	Second Harvest 1975	Third Harvest 1975	Mean
Schuyler winter barley	18.4	21.1	17.6	13.9	17.8
Nugaines winter wheat	23.7	20.8	21.8	9.8	19.0
Crest winter wheat	21.7	15.8	21.1	9.0	16.9
Wintergraze 90-90	20.6	21.0	17.9	12.9	18.1
Mean	21.1	19.7	19.6	11.4	18.0

Table 7. Effect of variety on the nitrate content of four fall planted small grains.

Variety	Nitrate (%) Fall Harvest 1974	First Harvest 1975	Second Harvest 1975	Third Harvest 1975	Mean 1/
Schuyler winter barley	<0.10	<0.10	0.42	0.28	0.23
Nugaines winter wheat	<0.10	0.13	0.21	0.37	0.20
Crest winter wheat	<0.10	<0.10	0.24	0.27	0.18
Wintergraze 90-90	<0.10	<0.10	0.16	0.12	0.12
Mean 1/	<0.10	0.11	0.26	0.26	0.18

1/ When means were calculated <0.1 values were treated as 0.1.

NOTE: PERCENT NITRATE ON DRY MATTER BASIS	CLASSIFICATION AS FEED FOR LIVESTOCK
0.00 - 0.30	Generally safe
0.30 - 1.20	Controlled feeding plan suggested
1.20 and above	Do not recommend feeding

TITLE: Effect of Seeding Rate on Second Year Forage Yields of Spring Planted Wintergraze 90-90.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Completed

OBJECTIVES: Determine the effect of seeding rates on second year forage yields of spring planted Wintergraze 90-90.

PROCEDURES:

Wintergraze 90-90, Crest winter wheat and Nugaines winter wheat were seeded on April 15, 1974 (soil temperature was 46 degrees) in Field Y-9. Each variety was seeded at 40, 60, 80 and 100 pounds per acre. Each variety was subjected to four nitrogen treatments (0, 50, 100 and 150 pounds nitrogen per acre) soon after emergence. Forty pounds of P_2O_5 were broadcast over the entire nursery before seeding. A split plot design with three replications was utilized. Plot size was 4 by 20 feet with one foot between rows. Thirty-two square feet were harvested from each variety as it matured. The nursery was irrigated four times with two inches being applied at each irrigation. Yield, plant protein and plant nitrate data were obtained in 1974. This data is presented in the 1974 annual Forage Crops Report.

As expected, Wintergraze 90-90 was the only variety that survived the winter. The plots were harvested in 1975 in the same manner as 1974. Thirty-two pounds of nitrogen per acre and 40 pounds of P_2O_5 per acre were applied to the Wintergraze in the fall of 1974. In spring of 1975, 70 pounds of nitrogen per acre were applied to the Wintergraze plots. The nursery was irrigated three times in 1975 with two inches being applied at each irrigation. Yield, plant protein and plant nitrate data were obtained in 1975.

RESULTS: The mean yield in 1975 (second year of production) for the entire nursery was 1.54 tons per acre (Table 1). It would not be economically feasible to take the second year's production as had been advertised. Surprisingly, yields were higher in the second year at the lower seeding rates.

Total yields for two years for all seeding rates are presented in Table 2. Seeding rates had no affect on yield the first year, but did the second year. The mean yield for the entire nursery for the two year period was 4.03 tons per acre. On the basis of our research, if Wintergraze 90-90 is to be used as pasture forage it should be planted in the fall (see preceding study in this report).

Mean crude protein levels were 16.5 percent in 1974 and 15.5 percent in 1975 (Table 3). Nitrate levels were also lower in 1975.

Table 1. Effect of seeding rate on second year forage production of spring planted Wintergraze 90-90

Seeding Rate (lbs/acre)	Harvest	Tons per acre at 12 percent moisture Replication I	II	III	Mean
40	First	0.72	0.59	0.62	0.64
	Second	0.86	0.77	0.70	0.78
	Third	0.25	0.28	0.20	0.24
	Total	1.83	1.64	1.52	1.66
60	First	0.73	0.38	0.65	0.59
	Second	0.92	0.85	0.68	0.82
	Third	0.24	0.23	0.22	0.23
	Total	1.89	1.46	1.55	1.64
80	First	0.58	0.47	0.38	0.48
	Second	0.86	0.73	0.65	0.75
	Third	0.26	0.24	0.23	0.24
	Total	1.70	1.44	1.26	1.47
100	First	0.43	0.29	0.52	0.41
	Second	0.79	0.75	0.66	0.73
	Third	0.23	0.24	0.24	0.24
	Total	1.45	1.28	1.42	1.38

Analysis for total season yields

Mean yield = 1.54 tons/a
F-value for seeding rate yield comparison = 4.68*
S.E.$\bar{x}$ = 0.062 tons/a
S.E.$\bar{d}$ = 0.088 tons/a
C.V. = 100s/$\bar{x}$ = 7.0%
L.S.D. at 0.05 = 0.215 tons/a
L.S.D. at 0.01 = 0.325 tons/a

Table 2. Effect of seeding rates on first and second year forage yields of spring planted Wintergraze 90-90

Seeding Rate (lbs/acre)	1974	1975	Total
40	2.49	1.66	4.15
60	2.48	1.64	4.12
80	2.49	1.47	3.96
100	2.50	1.38	3.88
Mean	2.49	1.54	4.03

Table 11. Performance of yearling steers when grazing four irrigated pasture treatments in 1975

	Sainfoin trefoil bromegrass	Clover orchardgrass	Alfalfa bluegrass orchardgrass	Alfalfa	Mean
Grazing season (days)	135	147	148	143	143
Gain/acre (lbs)	741.3	852.3	1042.9	886.6	880.8
ADG - testers (lbs)	1.68	1.74	1.67	1.82	1.73
No. of steers/acre	3.19	3.27	3.69	3.31	3.37
No. of AUM's	9.6	10.7	12.2	10.6	10.8
12% hay intake/steer/day (lbs)	13.0	11.5	15.6	16.6	14.2
12% hay/lb of beef (lbs)	9.2	6.7	9.6	10.1	8.9

Table 12. Performance of yearling steers when grazing a sainfoin-trefoil-grass mixture in 1973, 1974 and 1975[1/]

	1973	1974	1975	Mean
Grazing season (days)	146	136	135	139
Gain/acre (lbs)	855.5	751.4	741.3	782.7
ADG - testers (lbs)	1.99	1.96	1.68	1.88
No. of steers/acre	3.10	2.94	3.19	3.08
No. of AUM's	9.9	8.9	9.6	9.5
12% hay intake/steer/day (lbs)	14.0	13.0	13.0	13.3
12% hay/lb of beef (lbs)	7.0	7.0	9.2	7.7

1/ 1973 - Eski sainfoin-Empire birdsfoot trefoil-bluegrass (natural invasion)
1974 - Melrose sainfoin-Empire birdsfoot trefoil- Manchar smooth bromegrass
1975 - Melrose sainfoin-Empire birdsfoot trefoil- Manchar smooth bromegrass

13. Performance of yearling steers when grazing a clover-orchardgrass mixture in 1973, 1974 and 1975[1/]

	1973	1974	1975	Mean
Grazing season (days)	146	150	147	148
Gain/acre (lbs)	977.0	991.5	852.3	940.3
ADG - testers (lbs)	1.81	1.97	1.74	1.84
No. of steers/acre	3.69	3.17	3.27	3.38
No. of AUM's	11.8	10.6	10.7	11.0
12% hay intake/steer/day (lbs)	14.2	14.3	11.5	13.3
12% hay/lb of beef (lbs)	8.1	7.2	6.7	7.3

1/ 1973 - Ladino clover-Potomac orchardgrass
1974 - Ladino clover-Chinook orchardgrass
1975 - Ladino clover-Chinook orchardgrass

Table 3. Crude protein and nitrate content of Wintergraze 90-90 in 1974 and 1975

Harvest	Protein(%)			Nitrate(%)		
	1974	1975	Mean	1974	1975	Mean
First	18.4	16.8	17.6	0.25	<0.1	0.18
Second	14.5	14.0	14.3	<0.1	<0.1	<0.1
Third	-	15.8	-	-	<0.1	-
Mean	16.5	15.5	16.0 1/	0.18	<0.1	0.14 1/

1/ Based on first and second harvest only

NOTE: PERCENT NITRATE ON DRY MATER BASIS	CLASSIFICATION AS FEED FOR LIVESTOCK
0.00 - 0.30	Generally safe
0.30 - 1.2	Controlled feeding plan suggested
1.2 and above	Do not recommend feeding

TITLE: Evaluation of Four Irrigated Pastures When Grazed by Yearling Steers.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

OBJECTIVES: Determine forage yields and utilization, carrying capacity and beef gain per acre on four irrigated pastures when grazed by yearling steers.

DURATION: Indefinite

PROCEDURES:

Three potential bloating pastures (Ladino clover - Chinook orchardgrass, Thor alfalfa - Potomac orchardgrass - Troy bluegrass, and Thor alfalfa alone) and one non bloating pasture (Melrose sainfoin - Empire birdsfood trefoil - Manchar smooth bromegrass) were grazed in 1975. The clover - orchardgrass and sainfoin - trefoil-bromegrass pastures were established in the spring of 1973. The alfalfa pastures were established in mid-August of 1974. All pasture treatments consisted of two acres plus a one-half acre (approximately) holding pasture. The two acres for each treatment were divided into four sub-pastures (paddocks) for the clover-orchardgrass and the sainfoin-trefoil-bromegrass pastures, and into five paddocks for the alfalfa pastures to allow rotational grazing.

One hundred and eighty pounds of P_2O_5 per acre was applied to all pastures prior to seeding. Fifty pounds of nitrogen per acre was applied to the clover-orchardgrass and sainfoin-trefoil-bromegrass pastures in the fall of 1974. An additional sixty pounds of nitrogen was applied to the sainfoin-trefoil-bromegrass pasture in mid-July of 1975. There was no nitrogen fertilizer applied to the alfalfa-grass pasture.

After each paddock was grazed it was dragged to disperse cattle droppings. All pastures were irrigated six times in 1975 with two inches being applied per irrigation.

Three samples of 3 x 10 feet were taken from each paddock before and after grazing for the first three rotations to evaluate each species mixture for forage yield and forage consumption. In at least one paddock per rotation for each pasture three samples were hand separated to determine the species composition by weight. No forage data was obtained in the fourth rotation, which essentially was a fall grazing rotation.

Hereford yearling steers were used to graze the pastures in 1975. Each steer was implanted with 36 milligrams of Ralgro. The steers were received in early May of 1975 and weighed prior to assignment to the pastures. Three steers that weighed 490 $\pm$ 28 pounds were assigned to each pasture treatment as "tester" steers. These steers remained on the study throughout the season to evaluate the quality of the forage. In addition, steers with similar initial weights were assigned at random to each pasture treatment. These steers were "put and take" steers and were added to or taken off the study as the forage demanded to determine total production per acre and carrying capacity. The "put and take" steers were shrunk overnight (off feed and water for 16 hours) each time they were removed or added to any pasture. The tester steers were weighed at the end of each rotation in the same manner. No concentrates were fed to either group of steers throughout the grazing season. A mineral supplement (block form) was provided for the sainfoin-trefoil-bromegrass steers and Bloat Guard (block form) which contained the antibloat compound, poloxalene, was provided for those

Procedures (con't)

steers grazing the alfalfa and clover. The latter steers were fed Bloat Guard for three days prior to putting them on the bloating pasture. There were no signs of bloat in those steers grazing the alfalfa and clover in 1975.

RESULTS :

The alfalfa-orchardgrass-bluegrass pasture provided the most forage in 1975 followed by the pure alfalfa pasture (Table 1). These two pastures also had the best yield distribution throughout the grazing season.

More forage was produced in 1974 than in 1975 for the clover-orchardgrass pasture, however the reverse was true for the sainfoin-trefoil-bromegrass pasture (Table 2). Generally, the yield distribution throughout the season was better for the clover-orchardgrass pasture.

Sainfoin and trefoil contributed very little to the total yield of the mixture in 1975 (Table 3). Orchardgrass contributed twice as much forage to the total yield of the mixture than did the Ladino clover. Orchardgrass and bluegrass comprised 61 percent of the alfalfa-grass mixture. When alfalfa was seeded in a pure stand, weeds became a more serious problem.

Stands of sainfoin and trefoil were reduced in 1975 probably due to the competitiveness of the bromegrass (Table 4). Disease factors contributed to the loss of sainfoin.

The alfalfa-grass pasture was utilized the best of all the pastures and the sainfoin-trefoil-grass pasture the least (Table 5).

Percent consumption by the steers was reduced in 1975 (Table 6). This reduction was greater for the clover-grass mixture than it was for the sainfoin-trefoil-grass mixture.

Detailed performance data on each rotation for each pasture in 1975 are presented in Tables 7 - 10. Generally, total gains per acre and carrying capacity decreased from the first rotation through the fourth rotation.

A comparison of steer performance for all pastures is presented in Table 11. The alfalfa-grass pasture produced the greatest amount of beef per acre, had the longest grazing period, had the greatest carrying capacity, and the lowest average daily gain (ADG). The sainfoin-trefoil-grass pasture had the shortest grazing season and produced the least amount of pounds per acre. The steers on the alfalfa pastures consumed more forage than the other two pastures. Also, it took more alfalfa to produce a pound of beef than it did for the other pastures.

Length of grazing season, and total pounds of beef per acre decreased from 1973 to 1975 for the sainfoin-trefoil-grass pasture (Table 12). ADG's were low in 1975, however the carrying capacity was higher than the two previous years. This is a good example of the negative relationship between ADG and carrying capacity.

Total beef production and ADG were down in 1975 for the clover-orchardgrass (Table 13). Since this was the third year of production I would expect forage yields to begin declining. I would guess that this decline will even be more severe in 1976.

A comparison of two Thor alfalfa pastures when planted in a pure stand in two different years is presented in Table 14. Length of grazing season, total pounds of beef per acre and carrying capacity were increased in 1975. Greater forage yields and better utilization of the alfalfa forage can account for this increase. In 1975 the alfalfa pastures contained five paddocks and in 1974 only four paddocks. This, in part, would account for the increase in utilization.

Results (con't)

Net income per acre for all pastures is presented in Table 15. Even though the steers on the alfalfa and clover pastures were provided with the costly Bloat Guard they all netted more dollars per acre than the sainfoin-trefoil-grass pasture. This is partially due to the increased production from the more productive legumes. Also, the cost of the Bloat Guard is somewhat offset by the decreased cost of nitrogen fertilizer for the legume pastures.

An economic analysis of irrigated pastures from 1973 to 1975 is presented in Table 16. In 1973 and 1975 excellent returns were realized with irrigated pastures. However, in 1974 when the difference between buying in spring and selling in fall was 11.5¢, over $100 per acre was lost on irrigated pastures. In 1974 the good operator who carried the most animals per acre also lost the most money per acre.

Table 1. Forage yields in tons/acre at 12% moisture of four irrigated pasture treatments in 1975.

	First Rotation	Second Rotation	Third Rotation	Total
Sainfoin-trefoil-bromegrass	1.28	1.27	0.70	3.25
Clover orchardgrass	1.11	1.16	0.76	3.03
Alfalfa-grass[1/]	1.73	1.71	1.08	4.52
Alfalfa	1.62	1.26	1.37	4.25

1/ Predominately orchardgrass and some bluegrass

Table 2. A comparison of forage yields between 1974 and 1975 in tons/acre at 12% moisture of two irrigated pasture treatments.

	First Rotation	Second Rotation	Third Rotation	Total
Sainfoin-trefoil-bromegrass				
1974	1.34	1.00	0.73	3.07
1975	1.28	1.27	0.70	3.25
Clover-orchardgrass				
1974	1.04	1.23	1.21	3.48
1975	1.11	1.16	0.76	3.03

Table 3. Percent species composition by weight of four irrigated pasture treatments throughout the grazing season in 1975.

	First Rotation	Second Rotation	Third Rotation	Mean
Sainfoin-trefoil-bromegrass				
sainfoin	4	6	1	4
trefoil	2	12	1	5
bromegrass	92	73	95	86
weeds	2	9	3	5
Clover-orchardgrass				
clover	24	62	14	33
orchardgrass	74	30	85	63
weeds	2	8	1	4
Alfalfa-grass				
alfalfa	32	23	37	31
grass[1/]	66	68	50	61
weeds	2	9	13	8
Alfalfa				
alfalfa	82	80	82	81
weeds	18	20	18	19

1/ Predominately orchardgrass and some bluegrass

Table 4. Percent species composition by weight in 1974 and 1975 of two irrigated pasture treatments throughout the grazing season.

	First Rotation		Second Rotation		Third Rotation		Mean	
	1974	1975	1974	1975	1974	1975	1974	1975
Sainfoin-trefoil-bromegrass								
sainfoin	32	4	6	6	6	1	15	4
trefoil	4	2	18	12	10	1	11	5
bromegrass	56	92	75	73	80	95	70	86
weeds	8	2	1	9	4	3	4	5
Clover-orchard-grass								
clover	36	24	70	62	76	14	61	33
orchardgrass	60	74	29	30	23	85	37	63
weeds	4	2	1	8	1	1	2	4

Table 5. Percent consumption of four irrigated pasture treatments by yearling steers in 1975

	First Rotation	Second Rotation	Third Rotation	Mean
Sainfoin-trefoil-bromegrass	81	85	65	77
Clover-orchardgrass	80	79	79	79
Alfalfa-grass	87	87	84	86
Alfalfa	86	79	78	81

Table 6. Percent consumption by yearling steers of two irrigated pasture treatments in 1974 and 1975

	First Rotation	Second Rotation	Third Rotation	Mean
Sainfoin-trefoil-bromegrass				
1974	84	80	72	79
1975	81	85	65	77
Clover-orchardgrass				
1974	89	83	87	86
1975	80	79	79	79

Table 7. Performance of yearling steers by rotation when grazing a mixture of Melrose sainfoin, Manchar smooth bromegrass and Empire birdsfoot trefoil in 1975.

	First Rotation 5/22-6/30	Second Rotation 7/1/-8/9	Third Rotation 8/10-9/11	Fourth Rotation 9/12-10/4	Total	Mean
No. of days/rotation	40	40	33	22	135	-
Gain/acre (lbs)	432.9	174.1	87.1	47.2	741.3	-
ADG - testers (lbs)	2.66	0.91	1.58	1.47	-	1.68 1/
No. of steers/acre	4.33	3.90	2.08	1.46	-	3.19 1/
No. of AUM's 2/	3.9	3.5	1.5	0.7	9.6	-
12% hay intake/steer/day (lbs)	12.0	13.8	13.3	-	-	13.0
12% hay/lb of beef (lbs)	4.8	12.4	10.5	-	-	9.2

1/ Weighted mean
2/ Calculated on the basis that one animal unit equals 1½ steers

Table 8. Performance of yearling steers by rotation when grazing a mixture of Ladino clover and Chinook orchardgrass in 1975

	First Rotation 5/22-7/1	Second Rotation 7/2-8/10	Third Rotation 8/11-9/18	Fourth Rotation 9/19-10/15	Total	Mean
No. of days/rotation	41	40	39	27	147	-
Gain/acre (lbs)	395.7	231.0	156.7	68.9	852.3	-
ADG - testers (lbs)	2.46	1.68	1.53	1.01	-	1.74[1/]
No. of steers/acre	4.41	3.72	2.48	2.00	-	3.27[1/]
No. of AUM's[2/]	4.0	3.3	2.2	1.2	10.7	-
12% hay intake/steer/day (lbs)	9.8	12.3	12.4	-	-	11.5
12% hay/lb of beef (lbs)	4.5	7.9	7.7	-	-	6.7

1/ Weighted mean
2/ Calculated on the basis that one animal unit equals 1½ steers

Table 9. Performance of yearling steers by rotation when grazing a pure stand of Thor alfalfa in 1975

	First Rotation 5/21-6/28	Second Rotation 6/29-8/6	Third Rotation 8/7-9/12	Fourth Rotation 9/13-10/10	Total	Mean
No. of days/rotation	39	39	37	28	143	-
Gain/acre (lbs)	446.5	172.0	172.5	95.6	886.6	-
ADG-testers (lbs)	2.74	1.13	1.45	1.98	-	1.82[1/]
No. of steers/acre	4.36	3.66	2.97	1.78	-	3.31[1/]
No. of AUM's[2/]	3.8	3.2	2.5	1.1	10.6	-
12% hay intake/steer/day (lbs)	16.4	13.9	19.5	-	-	16.6
12% hay/lb of beef (lbs)	6.2	11.6	12.4	-	-	10.1

1/ Weighted mean
2/ Calculated on the basis that one animal unit equals 1½ steers

Table 10. Performance of yearling steers by rotation when grazing a mixture of Thor alfalfa, Potomac orchardgrass and Troy bluegrass in 1975

	First Rotation 5/21-7/2	Second Rotation 7/3-8/14	Third Rotation 8/15-9/23	Fourth Rotation 9/24-10/15	Total	Mean
No. of days/rotation	43	43	40	22	148	-
Gain/acre (lbs)	490.4	344.0	130.6	77.9	1042.9	-
ADG - testers (lbs)	2.47	1.65	0.72	1.86	-	1.67[1/]
No. of steers/acre	4.86	4.16	2.86	1.97	-	3.69[1/]
No. of AUM's[2/]	4.7	4.0	2.6	0.9	12.2	-
12% hay intake/steer/day (lbs)	14.4	16.6	15.9	-	-	15.6
12% hay/lb of beef (lbs)	6.1	8.7	13.9	-	-	9.6

1/ Weighted mean
2/ Calculated on the basis that one animal unit equals 1½ steers

Table 14. Performance of yearling steers when grazing a pure stand of alfalfa in 1974 and 1975[1/]

	1974	1975	Mean
Grazing season (days)	137	143	140
Gain/acre (lbs)	777.7	886.6	832.2
ADG - testers (lbs)	2.03	1.82	1.93
No. of steers/ acre	2.55	3.31	2.93
No. of AUM's	7.8	10.6	9.2
12% hay intake/steer/day (lbs)	16.8	16.6	16.7
12% hay/lb of beef (lbs)	7.7	10.1	8.9

1/ 1974 - Thor alfalfa - four paddocks per rotation
1975 - Thor alfalfa (replanted because of loss of alfalfa due to excessive spring precipitation - five paddocks per rotation)

Table 15. Economic analysis of 1975 irrigated pasture data

	Sainfoin-trefoil bromegrass	Clover orchardgrass	Alfalfa grass	Alfalfa
Total lbs/acre	741.3	852.3	1042.9	886.6
Gross income/acre[1/]	$317.39	$357.62	$ 433.08	$373.63
Minus interest on cattle/acre[2/]	$ 18.34	$ 20.27	$ 23.30	$ 21.09
Minus supplement costs/acre[3/]	$ 6.00	$ 34.00	$ 38.00	$ 33.00
Minus production costs/acre[4/]	$185.00	$175.00	$ 175.00	$175.00
Net income/acre	$108.05	$128.35	$ 196.78	$144.54

1/ Buy in May at 32¢/lb and sell in October at 35.5¢/lb.
2/ Calculated at 10% for number of days steers were on respective pasture.
3/ Bloat Guard for potential bloating pastures and mineral block for non-bloating pasture.
4/ Assume $175.00/acre production, real estate and tax costs for all pastures except sainfoin-trefoil-bromegrass at $185.00/acre due to an extra increment of nitrogen in mid-July.

Table 16. Economic analysis of irrigated pastures from 1973 through 1975

	1973	1974	1975	Mean
Total lbs/acre[1/]	916.3	840.2	880.8	879.1
Gross income/acre[2/]	$349.10	$ 80.87	$370.43	$266.80
Minus interest on cattle/acre[3/]	$ 37.88	$ 25.39	$ 20.75	$ 28.01
Minus supplement costs/acre[4/]	$ 16.05	$ 21.79	$ 27.75	$ 21.86
Minus production costs/acre	$125.00	$ 150.00	$177.50	$150.83
Net income/acre	$170.17	$-116.31	$144.43	$ 66.10

1/ Mean of all research pastures for each given year.
2/ Buy in May at 59.5¢/lb and sell in October at 52¢/lb - 1973.
Buy in May at 41.5¢/lb and sell in October at 30¢/lb - 1974.
Buy in May at 32¢/lb and sell in October at 35.5¢/lb - 1975.
3/ Interest computed at 9% for 1973, 10% for 1974 and 10% for 1975.
4/ Includes cost of Bloat Guard and mineral block.

TITLE: Spring Barley

PROJECT: Small Grains Investigations MS 756

YEAR: 1975

PERSONNEL: Leader - Vern R. Stewart
Research Technician - Nancy Campbell
Cooperating Agencies - Montana Agricultural Experiment Station
Field Crops Branch A.R.S., U.S.D.A.

OBJECTIVES:

1. To determine the adaptation of new and introduced barley varieties in western Montana.
2. To assist in the state breeding program for development of varieties with stiff straw and disease resistance.

1975 EXPERIMENTS:

1. Dryland Intrastate Yield Nursery
2. Irrigated Intrastate Yield Nursery
3. Dryland 2-6 Row Vantage Yield Nursery
4. Irrigated 2-6 Row Vantage Yield Nursery

SUMMARY OF 1975 RESULTS:

Dryland Intrastate Yield Nursery - Yields and test weights tend to be low this year. The mean yield was 52.65 bu/a and the mean test weight was 41.68 bu/a. The high CV and low yields, test weights, and plumpness can be accounted for in part because the nursery was extensively rained on after being cut and bundled. By the time the bundles were dried enough to thrash, a large number of heads had germinated. No variety had yields significantly greater than the check, Piroline. Fifteen varieties had yields significantly less than Piroline. There was an increase in lodging severity, from a .43 mean last year to a 3.97 mean this year. Five varieties had lodging severities significantly greater than Piroline. Table 1.

In a summary over several years Piroline is used as a check. Five varieties show yields greater than Piroline. Table 2.

Irrigated Intrastate Yield Nursery - The unfavorable harvesting weather in August resulted in severe lodging and extensive germination. Yields, test weights, and plumpness were therefore unobtainable from this nursery. However, heading dates, plant height, lodging prevalence and severity, and powdery mildew readings were obtained. Table 3.

Experiments listed as Number 3 and 4 above are not made a part of this report, however they are included in the Feed Crops Report. A copy is on file at the Northwestern Agricultural Research Center.

SPRING BARLEY VARIETIES

SPRING BARLEY VARIETIES RECOMMENDED FOR WESTERN MONTANA

Six-row Type

1. Unitan - dryland and irrigated
2. Steptoe - dryland and irriagted

Two-row Type

1. Piroline - dryland and irrigated
2. Centennial - yield levels above 60 bu/acre
3. Ingrid - irrigated
4. Georgie - irrigated
5. Vireo - irrigated

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Unitan
   a. Six-row
   b. High yielding ability
   c. Moderate lodging resistance
   d. Early maturity
   e. Dryland or irrigated
   f. Medium kernel size
   g. Good test weight
2. Steptoe
   a. Six-row
   b. High yielding ability
   c. Good lodging resistance
   d. Early maturity
   e. Dryland or irrigated
   f. Large Kernel size
   g. Low test weight
3. Piroline
   a. Two-row
   b. High yielding ability
   c. Good lodging resistance
   d. Mid-season maturity
   e. Dryland or irrigated
   f. Large kernel size
   g. Good test weight
4. Centennial
   a. Two-row
   b. High yielding ability
   c. Good lodging resistance
   d. Late maturity
   e. Dryland (where yield levels exceed 60 bu/a) or irrigated
   f. Large kernel size
   g. Good test weight

Recommended Barley (con't)

5. Ingrid
   a. Two-row
   b. High yielding ability
   c. Good lodging resistance
   d. Late maturity
   e. Irrigated
   f. Large kernel size
   g. Good test weight

VARIETY BEING CONSIDERED FOR RECOMMENDATION IN 1976

1. Purcell
   a. Two-row
   b. High yielding ability
   c. Good lodging resistance
   d. Mid-season maturity
   e. Dryland
   f. Large kernel size
   g. Good test weight

Table 1. Agronomic data from the intrastate barley yield grown at Kalispell, MT. in 1975. Random block design, four replications. Field A-3. (Dryland)

Date seeded: April 21, 1975 Date harvested: August 15, 1975 Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging		Powdery Mildew	% Plump
						Prev.	Sev.		
CI 15229	Steptoe	69.02	42.30	181.00b	31.75	13.75	3.50	1.00	86.00
MT 486124	Bomi	68.05	41.70	189.75a	29.00	40.00	2.00b	1.00	82.75
CI 10421	Unitan	62.86	42.20	182.25	33.00	58.75	5.00	2.25	74.25b
CI 9558	Piroline 1/	61.21	42.90	183.50	30.50	47.50	4.50	1.00	85.00
MT 751		61.11	43.40	186.00a	26.25b	99.00a	1.00b	1.25	90.00
MT 125265	Hypana/Unitan,F8	60.96	46.60	183.25	34.25a	18.75	3.25	1.00	99.00a
MT 754		60.86	38.60	186.50a	25.75b	99.00a	1.00b	1.00	64.00b
ID 711180	Mentor/Vance Smyrna	60.52	42.50	186.50a	27.75	71.25	6.75a	1.00	82.25
MT 756		60.49	43.20	190.00a	27.25b	76.75	1.25b	1.00	76.00b
CI 13625	Centennial	59.93	43.10	188.75a	25.75b	13.75	2.50b	1.00	93.00
ID 143413	Piroline/Vance Smyrna	59.24	43.80	185.50a	26.50b	58.75	6.00	2.25	72.50b
MT 7510		58.21	43.00	184.00	33.50	13.75	3.50	1.50	94.00a
MT 742		57.52	45.90	188.25a	25.00b	15.00	2.75	1.00	76.00b
MT 753		57.05	43.80	186.25a	32.25	10.00	2.25b	2.00	82.00
MT 726	RPB 82,69	56.33	44.60	187.00a	25.25b	34.75	2.00b	1.00	89.50
MT 759		55.83	40.60	182.50	35.25a	17.50	3.75	1.75	84.75
MT 741		55.71	42.60	188.25a	25.25b	10.00	2.00b	1.00	61.25b
MT 125235	Hypana/Unitan, F8	53.74	45.00	183.00	32.75	13.75	3.25	1.50	97.75a
MT 758		52.30	41.60	190.25a	25.00b	54.50	1.50b	1.00	78.00
CI 3351	Dekap	52.27	43.20	183.00	28.25	82.50	7.75a	1.50	71.25b
PI 384988	Riso 1508	52.24	41.20	191.50a	27.00b	34.75	2.00b	1.00	73.25b
CI 10114	Carlsberg II	52.24	39.40	190.00a	28.25	16.25	4.00	1.50	81.00
CI 15514	Hector	52.14	45.40	186.00a	29.00	43.50	3.50	1.00	87.00
MT 723	RPB 38,69 Georgie	52.02	41.60	189.75a	22.75b	34.75	2.25b	1.00	81.00
MT 752		51.83	37.60	186.75a	28.00	40.00	3.75	1.50	72.00b
CI 15487	Karl	51.77	40.60	183.00	29.50	21.25	4.25	4.75a	67.50b
CI 15478	Klages	50.99	37.80	188.75a	28.50	20.00	3.50	1.00	78.75
MT 13455	B/4/P/2*B/3/M/4*H//J	50.45	44.50	191.00a	25.50b	74.50	1.25b	1.00	67.00b
PI 384987	Riso 86	50.08	38.50	191.00a	29.25	36.00	3.50	1.25	67.00b
CI 5438	Compana	49.70	40.40	184.50	27.25b	93.75a	8.25a	3.25a	88.75
PI 384985	Riso 29	47.95	37.60	189.50a	29.00	39.75	3.50	1.75	71.50b
MT 9503	Ingrid Awnless	47.95	39.00	188.50a	25.75b	32.25	1.75b	1.00	67.25b
CI 1775	Horsford	47.20b	41.00	181.25b	31.00	36.00	4.50	5.00a	70.50b
MT 14313	Compana Awnless	47.20b	35.50	183.25	28.25	60.00	6.50a	1.00	87.50

Table 1. (con't)

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.	Lodging Sev.	Powdery Mildew	% Plump
CI 13826	Erbet	47.08b	39.80	175.25	28.25	73.75	6.25	3.50a	84.75
MT 267100	Betzes Hooded Brachytic	46.83b	42.40	184.75	24.50b	10.00	2.00b	3.50a	82.25
MT 7214		46.83b	42.50	188.75a	24.50b	99.00a	1.00b	1.00	91.00
MT 148366	Domen/Ingrid	46.73b	41.40	187.75a	25.50b	13.75	2.00b	1.00	88.75
MT 267105	Betzes Awned Brachytic	46.61b	42.90	187.00a	26.25b	33.50	2.00b	1.50	86.00
CI 6398	Betzes	46.61b	39.30	187.75a	30.50	53.75	5.50	1.00	68.00b
MT 755		45.73b	44.10	187.75a	23.50b	10.00	2.00b	1.00	95.25
CI 10083	Ingrid	45.39b	40.20	188.75a	26.75b	25.00	3.25	1.00	74.75b
MT 729		44.64b	42.40	188.50a	24.50b	54.50	1.50b	1.00	86.50
CI 13827	Shabet	43.73b	39.10	187.00a	30.75	45.00	6.00	2.75a	73.00b
MT 4061	Betzes Hooded	43.20b	36.30	185.50a	30.25	30.00	4.00	1.00	62.50b
MT 73331	Washonupana	42.64b	45.10	182.75	28.50	92.50a	8.25a	4.50a	39.50b
MT 757		41.45b	42.90	188.25a	25.50b	55.75	1.50b	1.00	81.25
	$\bar{x}$	52.65	41.68	186.38	28.05	43.15	3.47	1.61	78.99
	F 2/	1.85**	.00	34.26**	7.15**	3.88**	9.73**	3.72**	12.23**
	S.E.$\bar{x}$	4.98	.00	.56	1.11	13.93	.63	.55	3.24
	L.S.D. .05	13.80	.00	1.55	3.08	38.62	1.75	1.53	8.99
	C.V. %	9.46	.00	.30	3.96	32.28	18.21	34.26	4.10

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

Table 2. Ten year summary of yields for the spring dryland intrastate barley nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT, 1966-1975.

C.I. or State No.	Variety	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Piroline
CI 10421	Unitan	72.6	60.7	90.1	64.5	86.2	78.5	88.9	62.1	75.2	62.9	74.2	10	108
CI 6398	Betzes	69.9	56.5	90.4	76.4	72.0	72.5	83.8	60.6	88.1	46.6	71.7	10	104
CI 9558	Piroline	69.1	58.3	96.5	50.4	78.7	67.7	57.1	61.8	87.1	61.2	68.8	10	100
CI 3551	Dekap	56.5	52.4	86.7	53.8	74.8	73.4	68.6	63.9	73.4	52.3	65.6	10	95
CI 5438	Compana	62.9	58.2	89.1	44.9	66.2	58.6	44.2	50.3	76.8	49.7	60.1	10	87
CI 5914	Centennial			101.4	64.3	94.9	83.7	57.1	58.9	74.3	59.9	81.3	8	105
CI 13827	Shabet				57.8	73.4	68.4	62.6	61.4	84.2	43.7	70.5	7	98
MT 72132	Hector				43.1	74.0	77.5	68.1	59.4	80.8	52.1	71.0	7	98
CI 15229	Steptoe						97.9	75.9	69.1	83.2	69.0	83.0	5	117
MT 729								70.0	62.9	77.8	44.6	66.8	4	96
MT 723	RPB 38,69							63.1	58.1	72.9	52.0	64.5	4	92
ID 18101	Klages								62.1	82.2	51.0	61.1	3	85
MT 726	RPB 82,69								55.3	80.9	56.3	66.2	3	92
CI 10083	Ingrid								53.6	82.0	45.4	62.3	3	87
MT 7214									52.2	79.2	46.8	61.4	3	85
MT 267105	Betzes awned brachytic									85.4	46.6	67.0	2	89
MT 741										81.5	55.7	69.6	2	93
MT 148366	Domen/Ingrid									80.7	46.7	64.7	2	86
MT 13455	B/4/P/2*B/3/M/4*H//J									80.5	50.5	66.5	2	88
MT 742										78.1	57.5	68.8	2	91
MT 267100	Betzes hooded brachytic									73.2	46.8	61.0	2	81
MT 125265	Hypana/Unitan, F8									72.6	61.0	67.8	2	90
MT 486124	Bomi										68.1	68.1	1	111
MT 751											61.1	61.1	1	100
MT 754											60.9	60.9	1	99
ID 711180	Mentor/Vance Smyrna										60.5	60.5	1	99
MT 756											60.5	60.5	1	99
ID 143413	Piroline/Vance Smyrna										59.2	59.2	1	97
MT 7510											58.2	58.2	1	95
MT 753											57.1	57.1	1	93
MT 759											55.8	55.8	1	91
MT 125235	Hypana/Unitan, F8										53.7	53.7	1	88
MT 758											52.3	52.3	1	85
PI 384988	Riso 1508										52.2	52.2	1	85
CI 10114	Carlsburg II										52.2	52.2	1	85
MT 752											51.8	51.8	1	85

Table 2 . (con't)

C.I. or State No.	Variety	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Piroline
CI 15487	Karl										51.8	51.8	1	85
PI 384987	Riso 86										50.1	50.1	1	82
PI 384985	Riso 29										48.0	48.0	1	78
MT 9503	Ingrid Awnless										48.0	48.0	1	78
CI 1775	Horsford										47.2	47.2	1	77
MT 14313	Compana Awnless										47.2	47.2	1	77
CI 13826	Erbet										47.1	47.1	1	77
MT 755											45.7	45.7	1	75
MT 4061	Betzes hooded										43.2	43.2	1	71
MT 73331	Washonupana										42.6	42.6	1	70
MT 757											41.5	41.5	1	68

Table 3. Agronomic data from the intrastate barley yield nursery grown at Kalispell, MT in 1975. Random block design, five replications. Field Y-5. (Irrigated)

Date seeded: May 2, 1975 Size of plot: 16 sq. ft.

C. I. or State No.	Variety	Heading Date	Plant Height	Lodging		Powdery Mildew
				Prev.	Sev.	
PI 384987	Riso 86	192.40a	35.80	80.00	8.60	5.80
CI 10114	Carlsberg II	192.00a	36.00	78.00	9.00	6.20
PI 384985	Riso 29	191.20a	35.60	79.00	8.40	5.00
MT 13455	B/4/P/2*B/3/M/4*H//J	190.80a	32.60	83.00	8.60	6.80
PI 384988	Riso 1508	190.40a	35.60	80.00	8.40	4.60
MT 486124	Bomi	189.80a	36.20	78.00	8.00	1.20b
MT 756		188.80	34.80	91.60	8.40	1.00b
MT 758		188.20	34.80	79.00	8.60	1.00b
MT 7214		188.20	33.40	85.80	8.00	1.00b
CI 10083	Ingrid[1/]	188.00	32.80	91.00	8.40	5.60
MT 757		187.60	36.20	75.80	8.40	1.00b
MT 742		187.60	35.60	71.00	9.00	1.40b
MT 754		187.40	32.80	78.00	8.40	5.80
MT 741		187.40	34.80	76.00	8.60	1.00b
MT 755		187.20	35.40	89.60	8.00	1.00b
MT 148366	Domen/Ingrid	187.20	37.40	78.00	8.00	5.60
MT 9503	Ingrid Awnless	187.00b	34.60	79.00	8.40	6.40
CI 13625	Centennial	187.00b	33.80	83.00	8.60	1.60b
MT 729		186.80b	34.60	79.00	8.20	1.00b
MT 723	RPB 38,69	186.80b	33.60	89.00	8.60	1.00b
CI 15478	Klages	186.80b	34.80	89.00	8.20	3.40b
MT 726	RPB 82,69	186.40b	35.60	79.00	8.60	1.00b
CI 13827	Shabet	186.40b	38.80	79.00	8.40	5.20
MT 753		186.00b	37.60	86.00	8.00	6.80
CI 6398	Betzes	186.00b	36.80	83.00	8.80	2.00b
MT 267105	Betzes Awned Brachytic	185.60b	32.20	83.00	8.20	1.00b
ID 711180	Mentor/Vance Smyrna	185.20b	33.00	88.00	8.80	1.00b
MT 751		185.20b	36.80	79.00	8.40	6.20
CI 15514	Hector	185.00b	36.20	73.00	8.40	3.40b
MT 267100	Betzes Hooded Brachytic	184.80b	34.40	94.60	8.40	7.20a
CI 9558	Piroline	184.80b	36.40	87.00	7.60b	1.00b
MT 752		184.60b	34.80	91.00	8.80	1.00b
MT 4061	Betzes Hooded	184.40b	40.80	88.00	8.00	3.60b
MT 7510		184.20b	40.20	79.00	7.80	1.80b
ID 143413	Piroline/Vance Smyrna	184.00b	35.00	78.00	8.80	4.80
CI 3351	Dekap	183.60b	31.40	88.60	8.60	5.00
MT 759		183.40b	41.00	84.00	8.20	4.80
MT 73331	Washonupana	183.20b	35.40	87.60	8.20	4.80
CI 1775	Horsford	183.20b	37.80	79.80	8.40	7.00a
MT 14313	Compana Awnless	183.20b	35.20	67.00	8.00	4.60
CI 15487	Karl	182.60b	36.60	89.60	7.80	7.20a
CI 5438	Compana	182.60b	30.80	87.00	8.40	3.40b
MT 125265	Hypana/Unitan, F8	182.40b	40.40	72.00	7.20b	3.60b
MT 125235	Hypana/Unitan, F8	182.40b	40.20	63.00	8.20	2.20b
CI 10421	Unitan	182.00b	38.20	67.00	7.20b	2.20b
CI 15229	Steptoe	179.80b	35.40	76.00	8.60	1.00b
CI 13826	Erbet	175.20b	32.40	92.00	8.40	3.00b

Table 3 . (con't)

	Heading Date	Plant Height	Prev.	Sev.	Powdery Mildew
$\bar{x}$ 2/	185.85	35.63	81.57	8.32	3.45
F 2/	79.84**	4.34**	1.46NS	2.06**	21.24**
S.E.$\bar{x}$	.36	1.16	5.91	.27	.48
L.S.D. (.05)	.99	3.22	16.38	.75	1.34
C.V. %	.19	3.26	7.25	3.27	14.00

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

TITLE: Winter Barley

PROJECT: Small Grain Investigations MS 756

YEAR: 1975

PERSONNEL: Leader - Vern R. Stewart
Research Technician - Nancy Campbell
Cooperators - Feed Crops Committee, Montana State University

LOCATION: Northwestern Agricultural Research Center

DURATION: Indefinite

OBJECTIVES:

1. To determine the adaptability of new and introduced barley lines and varieties for western Montana.
2. To select from the World Population new promising lines for use in western Montana.

1975 EXPERIMENTS:

1. Uniform Winter Barley Nursery of Hardy Varieties
2. Western Winter Barley Nursery
3. Barley Winterhardiness Nursery

SUMMARY OF 1975 RESULTS:

Uniform Winter Barley Nursery - Though the percent winter survival has an effect on the yield, more important seems to be the ability of the variety to tiller. Varieties with the higher percent of survival were not necessarily the high yielders; eg. Schuyler with a low percent survival of 37.5 had a yield of 70.3 bu/a. The nursery's mean yield was 60.8 bu/a. No entry was significantly greater than the check, Schuyler. Table 1.

In a summary of the yields Schuyler was used as a check. Only one variety, Okla. S-682344, outyielded Schuyler. Over a two year period Okla. S-6872344's yield was 26 percent higher than Schuyler. Table 2.

Western Winter Barley Nursery - Yields were higher this year with a mean of 60.87 bu/a. There was a 59.90 bu/a difference between the highest yield, 91.93 bu/a and the lowest yield 32.03 bu/a. No varieties were significantly greater in yield than the check Schuyler. Four were significantly less in yield than Schuyler. Table 3.

Barley Winterhardiness Nursery - Tenn. Winter and Blackhawk winter wheat were used as checks. Fall emergence was good but before snow cover came a wind storm carrying sand partially covered parts of the study. Survival notes were taken in April showing stands were greatly reduced. Five varieties had survival levels greater than 50%: Purd. 466A1-17 at 83%; OAC WB90-39 at 65%; OAC WB90-40 at 60%; Nebar, CI 15486 at 60%; and Wy 6529 at 55%. Table 4.

Table 1. Agronomic data from the uniform winter barley nursery grown at Kalispell, MT in 1975. Random block design, four replications. Field R-6c.

Date seeded: September 16, 1974 Date harvested: August 6, 1975
Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	% Winter Survival	% Plump
Mich. 69-518-57		63.25	45.0	160.75b	39.25a	53.75	45.00
Mo.B 2146	Mo.B1337/Tschermak	34.30b	48.0	158.50b	43.25a	25.00	69.25a
Mo.B 2171	Mo.B1300/Tschermak	34.33b	48.5	158.00b	41.25a	21.25	85.50a
VA.72-44-525	Harrison/3/C.Capa/ Wong//	65.80	48.0	160.00b	36.25	52.50	48.50
VA.70-44-213		61.25	47.1	159 .75b	36.00	47.50	49.25
NE 72637	Nebra sel.	53.80b	49.0	162.00b	37.00	45.00	69.75a
15486	Nebra, NB69135	60.78	49.5	157.75b	40.50a	41.25	66.50a
9168	Mo. B-475	66.63	46.7	157.00b	44.75a	68.75a	62.25a
	Mo. B2126	51.08b	49.5	159.25b	47.50a	47.50	79.50a
	Mo. B2191	54.10b	49.7	157.00b	48.00a	72.50a	94.50a
	Mo. B2186	55.53b	49.2	159.00b	40.50a	75.00a	90.25a
13855	Okla. S-633717	64.33	48.2	168.50a	28.00b	37.50	14.50b
	Okla. S-682344	75.90	47.0	166.00a	40.25a	53.75	55.00
15236	OAC, WB 55-2	67.83	46.5	158.25b	38.25a	47.50	82.00a
15235	Paoli	68.40	48.7	157.25b	33.75	57.50a	57.75a
6561	Reno	70.43	46.0	159.00b	41.00a	70.00a	48.00
8067	Hudson	78.05	50.0	158.75b	40.00a	52.50	48.00
11887	Schuyler 1/	70.30	48.4	164.00	35.25	37.50	45.75
N.Y. 5619-1E		57.30	48.0	158.75b	36.00	45.00	62.75a
6050	Kentucky 1	62.53	47.8	163.50	46.50a	50.00	59.00a
13876	Ky 66-7-63-1294	59.60	50.1	154.00b	34.25	51.25	66.25a
15491	OAC WB 74-23	59.43	47.8	159.00b	35.75	50.00	69.00a
15492	OAC WB 74-64	51.33b	45.2	163.00	41.50a	41.25	59.75a
15197	Kamiak	76.98	49.6	157.00b	37.25	52.50	63.75a
7580	Kearney	56.75	48.3	158.25b	37.50	30.00	53.00
	$\bar{x}$	60.80	48.07	159.77	39.18	49.05	61.79
	F 2/	4.60**	.00	37.91**	18.89**	3.89**	23.18**
	S.E.$\bar{x}$	5.12	.00	0.52	1.06	6.83	3.55
	L.S.D. (.05)	14.42	.00	1.46	2.99	19.21	10.00
	C.V. %	8.43	.00	.32	2.72	13.91	5.75

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

Table 2 . Seven year summary of the uniform winter barley nursery grown at Kalispell, MT. 1968-1975.

C.I. or State No.	Variety	1968	1969	1970	1971	1972	1974	1975	Ave.	Sta. Yrs.	% Schuyler
CI 9168	Mo.B-475	81.0	36.4	70.8	88.8	54.2	40.8	66.6	62.7	7	76
CI 6561	Reno	85.3	47.4	72.7	78.4	69.3	49.9	70.4	67.6	7	82
CI 8067	Hudson	109.7	42.8	74.2	107.4	61.1	53.1	78.1	75.2	7	92
CI 11887	Schuyler	114.7	60.1	82.8	113.4	77.6	55.8	70.3	82.1	7	100
CI 6050	Kentucky 1	65.5	42.2	78.0	82.7	70.9	54.4	62.5	65.2	7	79
CI 7580	Kearney	51.9	35.4	57.2	65.2		31.8	56.8	49.7	6	60
CI 13876	Ky 66-7-63-1294			78.5	89.9	59.2	34.6	59.6	64.4	5	81
CI 13855	Okla. S-633717				92.5		69.9	64.3	75.6	3	95
	Mo.B 2186					44.1	34.8	55.5	44.8	3	66
CI 15486	Nebra, NB 69135					53.7	42.1	60.8	52.2	3	77
CI 15236	OAC,WB 55-2					44.8	43.0	67.8	53.2	3	78
CI 15235	Paoli					51.6	29.6	68.4	49.9	3	73
N.Y. 5619-1E						12.8	62.6	57.3	44.2	3	65
CI 15197	Kamiak					57.8	57.7	77.0	64.2	3	95
VA. 70-44-213							41.0	61.3	51.2	2	81
	Mo.B 2126						39.0	51.1	45.1	2	71
	Mo.B 2191						30.9	54.1	42.5	2	67
	Okla. S-682344						83.7	75.9	79.8	2	126
CI 15491	OAC WB 74-23						39.1	59.4	49.3	2	78
CI 15492	OAC WB 74-64						29.7	51.3	40.5	2	64
Mich. 69-518-57								63.3	63.3	1	90
Mo. B2146	Mo.B1337/Tschermak							34.3	34.3	1	49
Mo. B 2171	Mo.B1300/Tschermak							34.3	34.3	1	49
VA. 72-44-525	Harrison/3/C. Capa/Wong//							65.8	65.8	1	94
NE 72637	Nebra Sel.							53.8	53.8	1	77

Table 3. Agronomic data from the western winter barley nursery grown at Kalispell, MT in 1975. Random block design, four replications. Field R-6c.

Date seeded: September 16, 1974 Date harvested: August 11, 1975
Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	% Plump	% Winter Survival
CI 15197	Kamiak	91.93	49.6	157.25b	32.75	82.75a	40.00
W 6529	Wyoming selection	81.03	49.6	164.50b	38.25a	21.00b	31.25
NY 6005-18	Traill/Hudson	78.55	49.5	160.00b	32.50	83.00a	27.50
CI 13340	Luther	77.63	48.7	171.75a	31.25	60.25	25.00
CI 11887	Schuyler 1/	73.28	48.5	167.50	32.00	62.25	35.00
WA 1094-67	Luther/WA1255-60	70.50	47.8	164.50b	29.75	80.00a	17.50
WA 1245-68	Luther/Alpine// Bore/3/WA 305	69.53	47.2	163.00b	28.25b	89.25a	20.00
WA 3021-70	Luther/Short-305	65.15	48.2	168.25	26.50b	81.25a	30.00
W 6823	Wyoming selection	64.83	45.9	164.00b	38.00a	49.75b	31.25
CI 8067	Hudson	63.28	48.9	159.00b	34.50	55.75	28.75
Belts. 67-1623	Jaydee/4, Hudson	62.75	45.7	165.75b	31.25	69.75	27.50
WA 1331-68	Luther/WA 1255	62.75	48.4	170.50a	30.00	69.00	11.25
72-Ab 65	Wade/Luther	61.00	48.6	168.75a	32.25	79.25a	20.00
WA 2196-68	Luther/Hudson	58.60	45.7	165.75b	25.50b	41.50b	30.00
OR 7129	Luther/Hudson	51.35	47.8	165.25b	30.75	33.75b	11.25
W 6531	Wyoming selection	49.25	48.6	162.50b	36.50a	78.50a	7.50b
	Ackerman's 989	35.80b	49.5	161.25b	35.75a	85.30a	17.50
WA 2464-70	Ackerman's	34.45b	48.7	164.75b	36.50a	84.00a	10.00
72-Ab 89	Steveland/Luther	33.73b	49.4 3/	170.00	27.00b	83.60a	3.75b
72-Ab 58	63Ab2961/Ione	32.03b		167.00	34.25	84.50a	3.75b
	$\bar{x}$	60.87	48.23	164.80	32.61	67.93	21.44
	F 2/	4.66**	.00	16.40**	11.99**	33.40**	1.88*
	S.E.$\bar{x}$	9.06	.00	1.08	1.23	3.92	9.07
	L.S.D. (.05)	25.68	.00	.76	3.48	11.13	25.68
	C.V. %	14.90	.00	.66	3.76	5.78	42.29

1/ Check variety
2/ Value for variety comparison
3/ Inadequate grain to obtain test weight
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

Table 4. Survival data from the 1974-75 barley winterhardiness nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT.

C.I. or State No.	Variety	% Survival Rep. 1	Rep. 2	Ave.
CI 6034	Tenn. Winter (check)	0	0	00
CI 5529	Dicktoo	0	0	00
CI 15486	Nebar	50	70	60
NE 72637		10	10	10
NE 72640	1/	30	50	40
CI 1442	Kharkof (wheat)	90	100	95
OK 7110566	Harrison/Will	5	10	08
OK 7110729	Harrison/Will	5	5	05
OK 6915604	CI 10879/Kerr	5	0	03
CI 936	Trebi	0	10	05
CI 6034	Tenn. Winter (check)	15	10	13
CI 15235	Paoli	20	40	30
Purd. 466A1-17	1/	85	80	83
CI 9168	Mo. B-475	5	5	05
	Mo. B2126	0	0	00
Mo. B2487	Mo. B1589/Carstens	0	5	03
Mo. B2500	Mo. B1589/Carstens	5	10	08
Mo. B2146	Mo. B1337/Tschermak	0	0	00
Mo. B2171	Mo. B1300/Carstens	5	5	05
Mo. B2247	Mo. B1400/Tschermak	0	0	00
CI 6034	Tenn. Winter (check)	5	15	10
Mo. B2434	Mo. B1773/Carstens	0	5	03
Mo. B2318	Tschermak Sel. 7	0	0	00
Mo. B2414	Mo. B1589/Carstens	0	0	00
Mo. B2124	Mo. B-475/Carstens	0	0	00
CI 6051	Mo. Ey. Bdls.	10	40	25
	OAC WB 74-23	10	10	10
	OAC WB 90-27 2/	30	40	35
	OAC WB 90-39 2/	60	70	65
	OAC WB 90-40 2/	50	70	60
CI 6034	Tenn. Winter (check)	0	0	00
CI 7580	Kearney	5	0	03
CI 12218	Blackhawk (wheat)	90	95	93
Va. 70-44-213	3/	10	10	10
Va. 72-11- 18	3/	10	10	10
Va. 72-44-362	3/	10	10	10
Va. 72-44-525	3/	10	10	10
CI 6728	Wong	10	25	18
CI 6561	Reno	30	70	50
CI 15493	Kanby	0	0	00
CI 6034	Tenn. Winter (check)	0	5	03
CI 6050	Kentucky 1	5	10	08
WY 6529		60	50	55
WY 6531		10	0	05
WY 6817		20	5	13
WY 6823		10	10	10
CI 15197	Kamiak	50	40	45
WN 1094-67		10	5	08

Table 4 . (con't)

C.I. or State No.	Variety	% Survival Rep. 1	Rep. 2	Ave.
	Ackerman's 989	10	0	05
WN 1245-68		40	30	35
CI 6034	Tenn. Winter (check)	0	0	00
WN 2464-70		0	5	03
WN 4170/12222	1/	5	0	03

1/ Parentage not received
2/ OAC selections from U.S. male sterile composite cross bulk
3/ Harrison/3/Cebada Capa/Wong/2/Awnleted Hudson Sel.

TITLE: Spring Oats

PROJECT: Small Grains Investigations MS 756

YEAR: 1975

PERSONNEL: Leader - Vern R. Stewart
Research Technician - Nancy Campbell
Cooperators - Feed Crops Committee, MSU

LOCATION: Northwestern Agricultural Research Center

DURATION: Indefinite

OBJECTIVES: To determine the adaptation of new and introduced oat varieties.

1975 EXPERIMENTS:

Uniform Northwestern States Oat Nursery

SUMMARY OF 1975 RESULTS:

Uniform Northwestern States Oat Nursery - Yields were good this year with a mean of 157.49 bu/a. No entries were significantly greater in yields than the check, Cayuse. Four entries were significantly less than Cayuse. Lodging was fairly severe this year. The lodging severity mean was 6.49. Seven entries had lodging severities significantly less than Cayuse's 8.33 reading. Due to the unfavorable weather conditions at harvest time straw-grain ratios and forage yields were unobtainable. Table 1.

Using Park as a check over several years, many varieties show a yield superior to that of Park. ID635280-7 yield was 33% higher than Park over a four year period. Table 2.

SPRING OAT VARIETIES

SPRING OAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

1. Cayuse - irrigated or dryland
2. Park - irrigated or high moisture conditions
3. Basin - dryland
4. Otana - irrigated or high moisture conditions

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Cayuse
   a. Pale green plant color, yellow kernels at maturity, developed in New York
   b. High yielding ability
   c. Low test weight
   d. Maturity - early to mid-season
   e. Very strong straw strength
   f. Resistant to Victoria blight and Helmenthosporium blight
   g. Tolerant to "red leaf" disease of oats

2. Park
   a. White, plump, short kernels, developed by Idaho and Montana
   b. High yielding ability
   c. High test weight
   d. Maturity - mid-season
   e. Strong straw strength
   f. Susceptible to Victoria blight
   g. Resistant to prevalent stem rust races

3. Basin
   a. White, short, plump kernels with occational weak awns, developed in Montana
   b. High yielding ability
   c. High test weight
   d. Strong straw strength
   e. Maturity - mid-season
   f. Resistant to covered and loose smut
   g. Resistant to most common stem rust races (not to races 7 & 7A)
   h. Excellent oat for combining

4. Otana
   a. Kernel white and plump
   b. Dark or blue green foliage
   c. High yielding
   d. Excellent test weight
   e. Medium to strong straw
   f. Maturity - mid-season
   g. Resistant to Victoria blight

Table 1. Agronomic data from the uniform northwest states oat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT, 1975. Ramdon block design, three replications.
Date seeded: May 9, 1975 Date harvested: September 10, 1975
Size of plot: 16 sq.ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev. %	Lodging Sev.
WA 6161	CI2874/Cayuse	182.56	32.10	203.00a	36.33	63.33	8.00
WA 6160	CI2874/Cayuse	181.43	35.00	198.33a	37.00	49.67	4.00b
ID 635280	CI5345x Zanster	180.56	38.20	194.67b	41.00a	40.00	5.33
ID 71670	71AB670	176.43	33.10	198.33a	37.00	70.00	8.33
ID 721723	Minn.II-22-220/Cayuse	175.75	30.20	204.00a	34.33	33.33	8.00
WA 6013		174.37	31.30	203.00a	34.67	78.33	8.33
CI 8263	Cayuse 1/	171.93	35.30	196.67	36.00	66.67	8.33
CI 6611	Park	170.18	35.90	196.33	42.67a	33.33	4.00b
ID 712506	CI5345/Zanster	167.93	37.60	194.00b	39.67a	51.33	2.67b
CI 9081	Random	167.06	31.70	191.67b	37.33	41.67	7.00
ID 71694	71AB694	164.62	34.40	196.67	34.67	75.00	8.33
WA 6159	CI2874/Cayuse	162.93	34.80	199.67a	32.33b	59.67	5.33
ID 71692	71AB692	162.93	33.10	196.33	37.67	78.33	7.33
ID 71716	71AB716	162.18	32.50	199.33a	36.67	90.00	7.67
ID 683975	Cauyse x Glen	161.24	34.80	196.67	34.33	78.33	7.67
ID 71718	71AB718	155.11	33.40	198.00	36.67	90.00	8.00
MT 7402	Hudson	150.92	32.00	194.33b	39.00	30.00	3.67b
CI 7557	Russell	150.36	36.40	193.33b	39.67a	41.67	4.00b
WA 6031		149.92	29.90	199.67a	32.67b	53.33	6.33
ID 721076	65AB4602/Cayuse	149.11	34.60	199.67a	35.00	28.33	6.67
WA 6015		148.36	30.40	201.33a	34.33	38.33	4.67b
WA 6014		148.11	33.10	199.67a	36.67	93.00	8.67
CI 5346	Basin	143.55	34.40	195.33	40.00a	63.33	7.67
CI 7989	Harmon	143.05	34.90	195.00b	44.33a	68.33	7.67
OT 618	Glen/OT606	141.67b	35.50	195.33	43.00a	16.67b	3.67b
CI 2053	Markton	130.17b	35.50	192.00b	43.00a	78.00	7.33
CI 2027	Gopher	122.54b	34.70	191.33b	40.00a	50.00	5.67
CI 6661	Rodney	114.66b	35.60	194.67b	43.33a	73.33	7.33
	$\bar{x}$	157.49	33.94	197.08	37.83	58.33	6.49
	F 2/	2.71**	.00	41.47**	8.51**	1.63*	2.56**
	S.E.$\bar{x}$	10.64	.00	.53	1.16	16.39	1.14
	L.S.D.(.05)	30.16	.00	1.50	3.29	46.46	3.22
	C.V.%	6.76	.00	.27	3.07	28.11	17.50

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check .05 level
b/ Values significantly less than the check .05 level

Table 2. Summary of the oat yield data from the uniform oat nursery, Northwestern Agricultural Research Center, Kalispell, Montana, 1966-75.

C.I. or State No.	Variety	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Park
CI 5346	Basin	140.6	120.2	149.1	151.5	148.7	177.0	144.2	114.4	181.6	143.4	147.1	10	113
CI 6111	Park	112.9	108.3	120.3	171.4	127.1	190.6	67.8	115.1	123.2	170.0	130.7	10	100
CI 6661	Rodney	116.4	126.2	121.4	126.2	132.2	169.9	87.9	104.0	180.2	114.6	127.9	10	98
CI 2027	Gopher	154.4	116.8	101.0	134.9	127.4	168.9	76.7	99.0	149.8	122.4	125.1	10	96
CI 8263	Cayuse	154.4	142.6	130.0	138.1	158.7	195.9	140.7	113.6	162.5	171.8	150.8	10	115
CI 2053	Markton		89.9	101.7	120.2	120.5	175.1	77.5	87.1	147.0	130.1	116.6	9	88
ID 683975	Cayuse x Glen						183.6	103.2	124.9	154.2	161.1	145.4	5	109
CI 9081	Random						197.7	106.9	116.5	193.0	166.9	156.2	5	117
ID 635280	CI 5345 x Zanster							142.9	127.6	183.6	180.4	158.6	4	133
ID 71694	71AB694								125.9	178.9	164.5	156.4	3	115
WA 6014									118.3	183.9	148.0	150.1	3	110
ID 71716	71AB716								118.2	198.6	162.1	159.6	3	117
ID 71692	71AB692								113.1	182.4	162.8	152.8	3	112
ID 71670	71AB670								110.7	161.2	176.3	149.4	3	110
WA 6013									108.7	190.7	174.3	157.9	3	116
WA 6031									104.2	178.4	149.8	144.1	3	106
WA 6015									104.2	170.6	148.2	141.0	3	104
ID 71718	71AB718								115.2	183.4	154.9	151.2	3	111
MT 7402	Hudson									187.2	150.8	169.0	2	115
OT 618	Glen/OT606									174.2	141.6	157.9	2	108
WA 6159											162.8	162.8	1	96
WA 6160											181.3	181.3	1	107
WA 6161											182.4	182.4	1	107
ID 712506											167.8	167.8	1	99
ID 721076											148.9	148.9	1	88
ID 721723											175.6	175.6	1	103
CI 7557	Russell										150.2	150.2	1	88
CI 7989	Harmon										142.9	142.9	1	84

TITLE: Spring Wheat

PROJECT: Small Grains Investigation MS 756

YEAR: 1975

PERSONNEL: Leader - Vern R. Stewart
Research Technician - Nancy Campbell
Cooperators - F. H. McNeal and M. A. Berg
Cooperating Agencies - Montana Agricultural Experiment Station
Field Crops Branch, ARS, USDA
Montana Wheat Research & Marketing Committee

OBJECTIVES:

1. To determine the adaptability of new introduced spring wheat varieties and selections by comparisons with recommended varieties.
2. Study the semi-dwarf strains of spring wheat for use under irrigated conditions.
3. To aid in basic genetic research in spring wheat and the overall breeding program.

1975 EXPERIMENTS:

1. Advanced Yield Nursery (dryland)
2. Western Regional Spring Wheat Nursery (dryland)
3. Private Variety Nursery (dryland)
4. Flag Leaf Nursery (dryland)

1975 RESULTS BY NURSERY:

Advanced Yield Nursery - The mean yield for the nursery was 78.45 bu/a, which is less than the 1974 mean of 89.44 bu/a. Six entries had yields significantly greater than the check, Norana. No entries had yields significantly less than Norana. Test weights were low this year, some germination had occurred prior to harvesting. MT 749, the highest yielder, and MT 7340 had the highest test weights of 60.0 lbs/bu. Many entries had heading dates significantly earlier than Norana. Lodging was fairly severe this year with a mean lodging severity of 6.02 compared with 3.07 last year. Rainy weather prior to harvest accentuated these conditions. No entries were significantly greater than Norana, but four had lodging severity's significantly less than Norana. Leaf and stripe rust readings tend to be lower this year than last. Table 1.

In the ten year summary only one variety, MT 741, has yielded less than the check, Thatcher. All the other varieties have outyielded Thatcher. Table 2.

Western Regional Spring Wheat Nursery - Yields tend to be lower this year than last year. Twenty varieties had yields significantly less than the check, Fielder. No varieties were significantly greater than Fielder. There were 16 soft white, 1 hard white and 11 hard red varieties. In comparing the red and white varieties, it was found that the reds average yield was higher than the white; 81.75 bu/a and 73.45 bu/a respectively. Test weights for all varieties were low, some germination had occurred prior to harvest. The mean test weight was 53.62. Lodging severity readings were more critical this year. The lodging severity mean last year was 4.33 compared to 6.91 this year. The rainy conditions before harvest helped increase the amount of lodging. Five entries had lodging severities significantly less than Fielder. Table 3.

In the summary of yields over several years Fielder was used as a check. No variety had a higher yield average than Fielder. Table 4.

Spring Wheat (con't)

Private Variety Nursery - This nursery contains lines and varieties developed by commercial companies which were compared to several established varieties used as checks. Norana was used as a check for statistical purposes. Only one variety, MT 41 a private entry, was significantly greater in yield than Norana. Test weights were low in all entries with Profit 75 having the highest at 58.80 lbs/bu. There was some germination prior to harvest. Table 5.

Flag Leaf Nursery - This nursery will be included in the Wheat Report as pertains to its significance. Dr. F. H. McNeal will write this report. Table 6 shows agronomic data collected for this study.

SPRING WHEAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

Hard Red Varieties

1. Norana - non irrigated and irrigated
2. Shortana - non irrigated and irrigated
3. Thatcher - dryland
4. Fortuna - dryland

Soft White Varieties

1. Twin - non irrigated and irrigated
2. Fielder - irrigated and non irrigated

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Norana

   a. Bearded variety, developed in Montana
   b. Very high yielding ability
   c. Semi-dwarf type
   d. Maturity - mid season to late
   e. Good test weight
   f. Excellent straw strength
   g. Good shattering resistance
   h. Resistant to stem rust
   i. Resistant to lose smut
   j. Resistant to moderately resistant to stripe rust
   k. Good milling and baking quality

2. Shortana

   a. Bearded variety developed in Montana
   b. High yielding variety
   c. Semi-dwarf type
   d. Maturity - mid season to late
   e. Low test weight
   f. Excellent straw strength
   g. Good shattering resistance
   h. Moderately resistant to stem rust
   i. Susceptible to leaf rust
   j. Resistant to stem rust
   k. Moderately resistant to stripe rust
   l. Acceptable milling and baking quality

3. Thatcher

   a. Beardless variety developed in U.S.A.
   b. Fair yielding ability
   c. Medium height
   d. Early maturity
   e. Good test weight
   f. Fair to good lodging resistance
   g. Good shattering resistance
   h. Susceptible to leaf rust
   i. Resistant to stripe rust
   j. Good milling and baking quality

Recommended Varieties (con't)

4. Fortuna

a. Beardless variety developed in North Dakota
b. Good yielding ability
c. Medium to tall height
d. Medium maturity
e. High test weight
f. Poor to fair lodging resistance
g. Somewhat susceptible to shattering
h. Resistant to most common races of stem rust
i. Resistant to most common races of leaf rust
j. Fair to good milling and baking quality

Soft White Varieties

1. Twin (to be removed in 1977)

a. Beardless variety developed in Idaho
b. Very high yielding ability
c. Semi-dwarf type
d. Medium to late maturity
e. Low test weight
f. Excellent straw strength
g. Good shattering resistance
h. Resistant to stripe rust
i. Resistant to stem rust
j. Susceptible to leaf rust
k. Susceptible to powdery mildew
l. Pastry quality is satisfactory

2. Fielder

a. Bearded variety developed in Idaho
b. Very high yielding ability
c. Semi-dwarf type
d. Medium to late maturity
e. Fair test weight
f. Good straw strength
g. Good shattering resistance
h. Moderately resistant to stripe rust
i. Slight resistance to leaf rust

VARIETY TO BE CONSIDERED FOR RECOMMENDATION

Hard Red Spring

1. Borah

a. Bearded
b. Very high yielding ability
c. Semi-dwarf type
d. Medium maturity
e. Low to fair test weight
f. Resistant to shattering
g. Resistant to stripe rust
h. Susceptible to leaf rust
i. Stem rust resistant

Table 1. Agronomic data from the advanced yield nursery grown at Kalispell, Montana in 1975. Random block design, four replication.

Date seeded: May 9, 1975 Date harvested: September 22, 1975 Size of plot: 16 sq. ft.

C.I. or State No	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging		% Leaf Rust	Stripe Rust	
						Prev.%	Sev.		Sev.	Prev.%
MT 749	REDR68-SI/3/N10/B14//5*C	96.66a	60.00	189.75b	33.25	65.00	5.50	1.25	.00b	.00
CI 17267	Borah	95.01a	57.10	189.75b	30.25b	87.50a	6.00	.00	.00b	.00
MT 7416	REDR68/3/N10/B14//6*CNT	89.98a	58.10	189.50b	33.25	75.00a	5.75	1.25	2.50	3.75
MT 7418	REDR68/3/N10/B14//6*CNT	89.90a	59.40	189.75b	35.00	60.00	4.00b	.00	.00b	.00
MT 738	NRN10/BVR14//6*CNT/3/SI	88.08a	58.60	192.00	35.50	45.00	6.25	1.25	3.75a	5.00
MT 7336	PK176/Sheridan	86.43a	59.40	189.75b	33.25	30.00	6.25	2.50	1.00	1.25
MT 7156	SI/3/NRN10/BVR14//5*CNT	85.23	58.40	191.75	32.00	45.00	6.25	.00	.00b	.00
CI 13986	Era	84.65	56.20	193.00	32.25	70.00	7.75	.00	.75	1.25
MT 737	NRN10/BVR14//6*CNT/3/SI	83.30	59.50	191.00b	37.25a	32.50	4.50b	.00	1.75	2.50
CI 15930	Olaf	82.58	57.10	190.00b	34.75	45.00	5.75	.00	.00b	.00
MN 6433	II-55-14/II-60-105	81.90	56.30	191.75	34.25	70.00	7.25	.00	3.25	5.00
MT 7421	REDR68/3/N10/B14//6*CNT	80.90	59.40	190.75b	35.50	40.00	4.75b	1.25	.00b	.00
MT 747	REDR68-SI/3/N10/B14//5*C	80.45	58.30	189.00b	32.00	58.75	6.50	1.25	1.75	2.50
MT 7340	S6579//55-11/57-62	79.73	60.00	191.75	41.25a	63.75	6.00	.00	3.50	6.25
CI 17282	Crosby	79.55	57.70	189.75b	43.25a	72.50	5.75	.00	2.75	5.00
MT 734	NRN10/BVR14//6*CNT/3/SI	79.33	56.50	191.50	37.00a	62.50	5.50	.00	2.00	3.75
CI 13333	Wells	78.78	59.20	192.25	47.00a	82.50a	6.50	.00	4.50a	6.25
CI 15892	Ward (Durum)	77.83	59.30	190.75b	41.50a	17.50	4.25b	.00	3.25	3.75
MT 7313	NRN10/BVR14//6*CNT/3/SI	76.85	57.90	191.25	37.50a	47.50	6.50	.00	1.25	2.50
CI 17289	Ellar	75.20	58.40	189.00b	39.00a	40.00	5.25	1.25	.75	1.25
CI 15926	Wared	74.12	56.10	193.00	33.25	66.25	7.00	2.50	.50	1.25
CI 15927	Norana (MT 7042)[1/]	72.67	56.90	192.75	33.75	43.75	6.75	.00	2.00	3.75
MT 746	REDR68-SI/3/N10/B14//5*C	72.22	58.40	190.25b	34.00	60.00	6.50	1.25	.00b	.00
CI 13775	Manitou, R.L. 4159	69.30	57.20	189.50b	40.25a	77.50a	5.75	1.25	.00b	.00
CI 13596	Fortuna	68.90	57.30	190.75b	41.25a	78.75a	6.00	1.25	1.50	2.50
MT 744	FTA-B5291/3/N10/B14//4*C	68.15	56.00	190.25b	37.25a	72.50	6.50	.00	2.00	3.75
CI 10003	Thatcher	65.95	57.20	190.25b	40.75a	65.00	6.00	10.00a	.00b	.00
MT 711	Fortuna/62-85	65.32	58.60	193.25	39.75a	83.75a	7.25	.00	.00b	.00
CI 17286	Tioga	63.30	58.10	191.50	42.50a	68.75	6.25	.00	6.25a	41.25a
MT 741	FTA/4/SI/3/N10/B14//5*CN	61.20	56.20	190.25b	33.50	77.50a	6.50	.00	.00b	.00

Table 1 . (con't)

	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.	Lodging Sev.	% Leaf Rust	Stripe Rust Sev.	Stripe Rust Prev.%
$\bar{x}$ 2/	78.45	57.96	190.86	36.71	60.13	6.02	.87	1.50	3.42
F 2/	3.74**	.00	24.92**	25.92**	2.97**	3.14**	3.44**	7.65**	8.69**
S.E.$\bar{x}$	4.72	.00	.25	.80	10.27	.49	1.02	.59	2.52
L.S.D. .05	13.26	.00	.69	2.26	28.84	1.37	2.86	1.66	7.09
C.V. %	6.02	.00	.13	2.19	17.08	8.09	116.47	39.37	73.88

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level
a/ Values significantly greater than the check .05
b/ Values significantly less than the check .05

Table 2. Summary of dryland hard red spring wheat yields for the Advanced Yield Nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana, 1966-1975.

C.I. or State No.	Variety	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Thatcher
CI 10003	Thatcher	62.2	60.6	63.4	69.5	55.5	72.5	64.7	55.0	71.9	65.9	64.1	10	100
CI 13333	Wells	67.9	62.8	63.1	64.8	53.7	66.8	54.1	49.9	83.8	78.8	64.6	10	101
CI 13775	Manitou	67.5	57.5	57.6	70.7	66.9	67.1	61.5	53.8	77.5	69.3	64.9	10	101
CI 13596	Fortuna	66.2	56.4	74.7	88.9	41.9	76.8	56.2	60.5	81.9	68.9	67.2	10	105
CI 13986	Era				93.1	82.2	90.0	96.1	69.6	102.9	84.7	88.4	7	136
CI 15927	Norana						90.8	87.6	69.7	98.4	72.7	83.8	5	127
MT 7156	SI/3/NRN10/BVR14//5*CNT							83.9	72.7	99.1	85.2	85.2	4	132
MT 711	Fortuna/62-85							71.9	67.3	88.6	65.3	73.3	4	114
CI 17286	Tioga							62.7	58.6	80.9	63.3	72.6	4	113
MT 738	NRN10/BVR14//6*CNT/3/SI								75.1	101.5	88.1	88.2	3	137
MN 6433	II/55-14/II-60-105								61.5	88.7	81.9	77.4	3	120
CI 17267	Borah								69.5	102.9	95.0	89.1	3	139
CI 15930	Olaf								58.0	84.8	82.6	75.1	3	117
CI 1789	Ellar								59.6	75.7	75.2	70.2	3	109
CI 15926	Wared									98.0	74.1	86.1	2	125
CI 15892	Ward (Durum)									93.4	77.8	85.6	2	124
MT 737	NRN10/BVR14//6*CNT/3/SI									90.3	83.3	86.8	2	126
MT 734	NRN10/BVR14//6*CNT/3/SI									90.2	79.3	84.7	2	123
MT 7313	NRN10/BVR14//6*CNT/3/SI									89.6	76.9	83.2	2	121
MT 749	REDR68-SI/3/										96.7	96.7	1	147
MT 7416	REDR68/3/N10										90.0	90.0	1	137
MT 7418	REDR68/3/N10										89.9	89.9	1	136
MT 7336	PK176/SHER10										86.4	86.4	1	131
MT 7421	REDR68/3/N10										80.9	80.9	1	123
MT 747	REDR68-SI/3/										80.5	80.5	1	122
MT 7340	S6579//55-11										79.7	79.7	1	121
CI 17282	Crosby										79.6	79.6	1	121
MT 746	REDR68-SI/3/										72.2	72.2	1	110
MT 744	FTA-B5291/3/										68.1	68.1	1	103
MT 741	FTA/4/SI/3/N										61.2	61.2	1	93

Table 3. Agronomic data from the Western Regional Spring Wheat nursery grown at Kalispell, Montana in 1975. Field No. Y-5. Random block design, four replications.

Date seeded: May 9, 1975 Date harvested: September 15, 1975 Size of plot: 16 sq. ft.

C.I. or State No	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height Inches	Lodging Prev.	Lodging Sev.	% Leaf Rust	Powdery Mildew	Stripe Rust Type	Stripe Rust Prev.
WA 6019	NS 3880-227/13438//13735	95.63	56.30	192.75b	38.50a	62.50	6.00b	11.25	3.50a	.50b	1.25
CI 17268	Fielder[2/]	95.51	56.70	193.50	35.00	77.50	7.25	1.25	1.75	4.00	5.00
CI 17267	Borah	94.36	57.00	190.00b	30.50b	66.25	6.00b	2.50	1.50	.00b	.00
UT498165	UT256-7-21-4/Pilot	89.48	53.70	193.25	30.25b	75.00	6.50	6.25	1.50	.00b	.00
ID 47	Sonora 64/Winalta	89.18	55.60	192.00b	33.50	82.50	7.25	2.50	5.00a	1.50b	2.50
MT 7156	SI/3/NRN10/BVR14//5*CNT	89.03	58.50	193.00	33.50	52.50b	6.50	.00	1.00	1.50b	3.75
WA 6101	LRN 10/BVR11//P14/3/101	86.28	53.80	198.00a	36.25	77.50	7.50	.00	6.25a	.00b	.00
WA 6105	HRY/KRN//AO/HRPC/3/13730	83.60	54.00	192.00b	37.75a	82.50	6.25	1.25	1.50	.00b	.00
WA 6100	LRN 10/BVR11//P14/3/101	83.25b	53.40	198.00a	34.50	55.00b	6.75	.00	5.50a	.00b	.00
ID725073	N10/ST//ID/3/ID59/4/LM66	81.70b	54.90	192.50b	37.00	85.00	6.75	11.25	2.75	.75b	6.25
WA 6018	NS 3880-227/13438//13735	81.38b	56.80	193.75	36.25	36.25b	5.75b	5.00	3.75a	.00b	.00
ID 106	Twin/Triple Dirk	81.23b	52.40	193.00	34.50	80.00	7.50	1.25	1.00	.00b	.00
UT498327	UT256-7-21-4/Pilot	78.73b	54.00	190.75b	30.25b	57.50b	6.00b	6.25	4.25a	4.00	36.25a
ID 87	Aberdeen 6535-114-5-5-1	78.60b	56.20	195.75a	37.25a	88.75	8.00	1.25	1.75	.00b	.00
ID 107	TZPP/3*AN//B61-136	78.18b	56.70	192.50b	35.75	85.00	6.25	.00	1.00	.50b	1.25
ID725078	Idaed 59/4*Lemhi 62	76.78b	53.20	194.00	42.75a	86.25	7.00	11.25	1.50	.75b	6.25
WA 6158	HRY/KRN//AO/HRPC/3/13730	75.60b	54.90	193.75	39.25a	67.50	6.00b	1.25	1.50	.75b	1.25
ID725071	NRN10/ST//IDD/3/IDD59	74.15b	58.30	191.25b	40.50a	71.25	6.50	7.50	2.75	1.50b	5.00
ID 94	Aberdeen 6535-114-5-4-2	73.67b	54.60	195.75a	37.50a	93.50	8.00	1.25	4.25a	.00b	.00
ID725075	Idaed 59/4*Lemhi 62	71.95b	52.40	193.75	42.00a	88.75	6.75	11.25	1.25	.50b	1.25
ID725076	Idaed 59/4*Lemhi 62	71.67b	51.20	194.75a	41.50a	82.50	7.25	11.25	1.25	.50b	1.25
UT498222	UT256-7-21-4/Pilot	71.62b	52.50	192.00b	31.75b	80.00	7.25	25.00a	5.75a	1.75b	3.75
UT498259	UT256-7-21-4/Pilot	68.10b	50.50	191.25b	29.50b	66.25	7.25	23.75a	5.00a	3.50	11.25
ID 105	Twin*3//227196/A63166S	64.52b	46.50	193.25	34.25	91.25	8.00	25.00a	1.00	.00b	.00
ID 104	SPF*3/3/ULKA/FR//LMK 66	64.27b	45.40	191.50b	32.00b	82.50	8.00	52.50a	2.25	.00b	.00
ID725077	Idaed 59/4*Lemhi 62	54.37b	54.60	194.50a	43.75a	87.50	7.25	13.75a	1.75	1.00b	2.50
WA 6157	N6600313/Twin	54.34b	47.00	196.00a	36.50	87.50	8.00	15.00a	7.25a	.50b	1.25
CI 4734	Federation	40.74b	50.40	195.25a	41.75a	67.50	6.00b	7.50	8.00a	4.75	13.75a
	$\bar{x}$[1/]	76.71	53.62	193.49	36.21	75.57	6.91	9.15	3.05	1.01	3.71
	F[1/]	9.17**	.00	57.31**	29.63**	3.76**	3.91**	6.59**	24.90**	6.03**	8.99**
	S.E.$\bar{x}$	4.27	.00	.26	.74	7.05	.37	4.44	.42	.57	2.42
	L.S.D.(.05)	12.01	.00	.74	2.09	19.83	1.03	12.49	1.18	1.59	6.81
	C.V. %	5.57	.00	.14	2.06	9.33	5.32	48.51	13.72	56.04	65.36

Table 3 . (con't)

1/ Value for variety comparison
2/ Check variety
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check .05
b/ Values significantly less than the check .05

Table 4. Summary of the Western Regional Spring Wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT, 1971 thru 1975.

C.I. or State No	Variety	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Fielder
CI 4734	Federation	51.3	65.3	69.4	69.4	40.7	59.2	5	59
CI 17268	Fielder	106.0	93.4	94.8	108.8	95.5	99.7	5	100
CI 17267	Borah	89.2	88.3	93.1	89.5	94.4	90.9	5	91
ID 47	Sonora 64/Winalta			94.1	107.0	89.2	96.8	3	97
WA 6019	NS3880-227//3438//13735			92.6	104.4	95.6	97.5	3	98
UT498259	UT256-7-21-4/Pilot			88.4	100.7	68.1	85.7	3	86
WA 6018	NS3880-227/13438//13735			85.3	99.4	81.4	88.7	3	89
UT498327	UT256-7-21-4/Pilot			89.6	96.2	78.7	88.2	3	88
ID725073	N10/ST//ID/3/ID59/4/Lm66			89.7	88.9	81.7	86.8	3	87
ID725071	NRN10/ST//IDD/3/IDD59			74.1	86.4	74.2	78.2	3	78
ID725075	Idaed 59/4*Lemhi 62			85.4	85.5	72.0	81.0	3	81
ID725077	Idaed 59/4*Lemhi 62			77.7	79.8	54.4	70.6	3	71
ID725078	Idaed 59/4*Lemhi 62			80.9	76.4	76.8	78.0	3	78
ID725076	Idaed 59/4*Lemhi 62			78.2	65.4	71.7	71.8	3	72
ID 94	Aberdeen 6535-114-5-4-2				111.9	73.7	92.8	2	91
ID 87	Aberdeen 6535-114-5-5-1				107.2	78.6	92.9	2	91
MT 7156	SI/3/NRN10/BVR14//5*CNT				88.6	89.0	88.8	2	87
UT498165	UT256-7-21-4/Pilot					89.5	89.5	1	94
WA 6101	LRN10/BVR11//P 14/3/101					86.3	86.3	1	91
WA 6105	HRY/KRN//AO/HRPC/3/13730					83.6	83.6	1	88
WA 6100	LRN10/BVR11//P14/3/101					83.3	83.3	1	87
ID 106	Twin/Triple Dirk					81.2	81.2	1	85
ID 107	TZPP/3*AN//B61-136					78.2	78.2	1	82
WA 6158	HRY/KRN//AO/HRPC/3/13730					75.6	75.6	1	79
UT498222	UT256-7-21-4/Pilot					71.6	71.6	1	75
ID 105	Twin*3//227196/A63166S					64.5	64.5	1	68
ID 104	SPF*3/3/ULKA/FR//LMK66					64.3	64.3	1	67
WA 6157	N6600313/Twin					54.3	54.3	1	57

Table 5. Agronomic data from the private variety nursery grown at Kalispell, Montana, 1975. Random block design, four replications, Field Y-5.

Date seeded: May 9, 1975 Date harvested: September 15, 1975 Size of plot: 16 sq. ft.

C.I. or State No	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.%	Lodging Sev.	Leaf Rust	Stripe Rust Prev.%	Stripe Rust Sev.
MT 41	RPB 10-70 SF4(N.AM.)	97.61a	56.50	191.25b	32.75b	52.25	4.00b	1.25	.00b	.00b
MT 45	Profit 75 (W.S.)	94.71	58.80	190.50b	33.50	57.50	4.75b	.00	.00b	.00b
CI 17268	Fielder	94.43	56.40	193.25a	34.50	68.75	7.00	5.00	.00b	.00b
MT 40	74V2322(N.K.)	90.70	54.80	189.50b	31.00b	42.50	4.75b	.00	2.50	2.00
MT 43	NA-707 (N.AM.)	87.70	54.50	190.25b	31.25b	52.50	7.50	5.00	5.00	2.25
MT 34	Prodax	86.35	53.30	191.00b	31.75b	72.50	6.50	21.25	.00b	.00b
CI 15927	Norana (MT 7042) 1/	86.18	56.00	192.50	34.75	48.75	6.50	3.75	5.00	2.00
CI 13986	Era	85.80	57.70	193.00	34.00	62.50	7.50	1.25	1.25b	.50
MT 44	Bounty 309 (Cargill)	84.60	55.00	189.50b	33.25	52.50	6.25	6.25	3.75	2.25
MT 42	RPB 6-70 (N.AM.)	81.50	56.40	189.75b	24.00b	32.25	1.75b	7.50	1.25b	.25b
MT 28	Sicco	81.03	56.80	196.25a	40.25a	72.50	7.25	60.00a	.00b	.00b
CI 13596	Fortuna	75.50b	57.50	191.25b	43.25a	85.00	6.00	.00	3.75	1.50
MT 35	N1-67	73.27b	56.00	195.75a	37.50a	85.00	7.25	80.00a	.00b	.00b
CI 10003	Thatcher	68.75b	57.20	190.00b	42.25a	62.50	5.50	62.50a	1.25b	.50
	$\bar{x}$	84.87	56.21	191.70	34.57	60.50	5.89	18.13	1.70	.80
	F 3/	5.65**	.00	93.35**	55.29**	1.60NS	8.51**	14.96**	2.31*	2.51*
	S.E.$\bar{x}$	3.51	.00	.23	.67	12.07	.56	7.14	1.27	.60
	L.S.D.(.05)	10.04	.00	.65	1.92	34.50	1.60	20.42	3.64	1.73
	C.V.%	4.14	.00	.12	1.95	19.95	9.47	39.41	75.09	75.16

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level
a/ Values significantly greater than the check .05
b/ Values significantly less than the check .05

Table 6. Agronomic data from the flag leaf nursery grown at Kalispell, Montana in 1975. Random block design, four replications. Field Y-5.

Date seeded: May 9, 1975 Date harvested: September 22, 1975 Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.%	Lodging Sev.	% Leaf Rust	Powdery Mildew 1/	Stripe Rust Prev.%	Stripe Rust Sev.
CI 15927	Norana (MT 7042) 2/	91.83	57.40	192.00	34.00	57.25	2.50	1.25	1.00	2.25	5.0
MT 7154		86.15	56.90	191.25	34.00	11.25	6.75	.00	3.75	3.50	10.0
IA 1110	Iassul	67.40	56.10	194.75	45.25	77.50	6.50	.00	1.25	4.00	7.5
AR 66	Ariana 66	64.05	52.10	199.00	42.75	41.25	4.50	.00	1.00	.00	0.0
PI178693	PI178692/MT 7154, High	59.64	56.10	191.50	42.25	87.50	6.25	16.25	2.00	5.50	15.0
PI178697	PI178692/Ariana 66, Low	59.57	56.40	191.00	41.00	87.50	6.50	30.00	2.25	4.50	7.5
PI178692	PI178692/Iassul, Low	57.14	55.00	192.75	44.25	92.50	7.25	3.75	6.75	6.75	12.5
PI178698	PI178692/Ariana 66, High	57.07	55.00	192.25	44.25	80.00	6.25	12.50	3.00	4.25	11.2
PI178694	PI178692/MT 7154, Low	55.99	54.30	192.00	41.25	87.50	6.25	15.00	1.50	5.50	18.8
PI178695	PI178692/Iassul, High	53.59	54.60	194.00	45.25	87.50	6.50	5.00	1.50	6.25	16.2
PI178696	PI178692	34.24	50.70	193.00	40.75	85.00	6.00	28.75	4.25	4.50	6.2
	$\bar{x}$	62.43	54.96	193.05	41.36	72.25	5.93	10.23	2.57	4.27	10.0
	F 3/	17.95**	.00	38.33**	10.90**	10.53**	6.73**	4.79**	1.62NS	7.51**	1.7NS
	S.E.$\bar{x}$	3.69	.00	.37	1.21	7.86	.51	5.13	1.39	.69	4.16
	L.S.D. (.05)	10.65	.00	1.06	3.48	22.69	1.47	14.82	4.02	2.00	12.02
	C.V. %	5.91	.00	.19	2.92	10.87	8.6	50.19	54.15	16.25	41.61

1/ 0-9 rating
2/ Check variety
3/ Value for variety comparison
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level

TITLE: Winter Wheat

PROJECT: Small Grains Investigations MS 756

YEAR: 1975

PERSONNEL: Leader - Vern R. Stewart
Research Technician - Nancy Campbell
Cooperator - G. A. Taylor
Cooperating Agencies - Montana Agricultural Experiment Station
Montana Wheat Research and Marketing Committee

OBJECTIVES:

1. To obtain the information necessary for making varietal recommendations and evaluating new varieties and selections.
2. To cooperate in a breeding program in Northwestern Montana designed to produce high yielding varieties with particular emphasis on quality, disease resistance - dwarf smut and stripe rust. Other agronomic characteristics such as straw strength, winter hardiness etc. will be evaluated in this program.

1975 EXPERIMENTS:

1. Western Regional Hard Red Winter Nursery
2. Off Station Nurseries
3. Western Regional White Winter Nursery
4. Crest Line Row Yield Nursery
5. Breeding Material

SUMMARY OF 1975 RESULTS:

Western Regional Hard Red Winter Nursery -

Kalispell - The nursery's yields and test weights were lower than that of last year. This was probably brought about by the hot, dry weather in July. Four entries' yields were significantly greater than the check, Crest. One entry had a yield significantly less than Crest.

Lodging was less severe than last year. There was a lodging severity of 7.88 last year compared to 3.19 this year.

There were six entries that had a significantly greater amount of dwarf smut than Crest. ID 92, one of the high yielding entries had no dwarf smut. Nine other entries also had no dwarf smut. Because of the low level of dwarf smut in susceptible varieties, those entries with low readings could, in fact, be escapes and one could not conclude that they are resistant lines from these data. Table 1.

Stillwater - The nursery at Stillwater had to be abandoned this year because of an extremely poor stand. Most entries failed to come up due to dry soil conditions.

Off Station Nurseries - Four off station nurseries were planted in the fall of 1974. Two were harvested and are reported below. The nursery in Sanders County had to be abandoned because of hail damage.

The nursery in Missoula County was abandoned because of its irregular growth. It is thought that this irregularity was caused by a herbicide injury.

Summary of 1975 Results (con't)

Lake County - Yield data was found to be non-significant. Yields and test weights ran low this year. McDermid was the highest yielding entry at 31.4 bu/a and the lowest was Paha at 13.3 bu/a. Five test weights were unobtainable because of insufficient amounts of grain. Table 2.

Ravalli County - Yields and test weights tend to be low this year. Nugaines was the only entry with a yield significantly less than the check, Crest. No yields were significantly greater than Crest. Five test weights were unobtainable because of insufficient amounts of grain. Sprague and Luke were the only two entries who's lodging severity was significantly greater than Crest. Table 3.

Western Regional White Winter Nursery - The hot, dry weather in July contributed greatly to the nursery's over all low yields, a mean of 49.73 bu/a and low test weights, a mean of 54.63 lb/bu this year. No entries were found to have yields or test weights significantly greater than the check, Nugaines. Five entries had yields significantly less than Nugaines.

Dwarf smut was not observed in three entries this year. The entries were Moro, WA 5826 and WA 6145. Stripe rust readings were not obtained this year. Table 4.

Using Nugaines as a check variety for several years, nine varieties have shown yields superior to Nugaines. WA 6145 exceeded Nugaines in yield and has good dwarf smut resistance. McDermid, OR 67205, and OR 7147 exceeded Nugaines in yield and have shown some resistance to dwarf smut. The other high yielding entries haven't shown substantial amounts of resistance to dwarf smut. Table 5.

Crest Line Row Yield Nursery - Table 6, gives yield data from several selections from the variety Crest. The F test for the lines was non-significant for yield. Significant differences were noted for heading date, plant height and lodging readings.

Breeding Material - Allan Taylor selected dwarf smut free plants and our staff harvested and threshed the seed. This was sent to Taylor for his use in the breeding program.

WINTER WHEAT VARIETIES

WINTER WHEAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

Hard Red Varieties

1. Crest
2. Winalta
3. Cheyenne

Soft White Varieties

1. Nugaines
2. Luke

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Crest
   a. Bearded Variety, developed in Montana
   b. High yielding potential in dwarf smut and stripe rust areas
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Moderate shattering resistance
   h. Resistant to stripe rust and dwarf smut
   i. Susceptible to stem rust and sawfly infestation
   j. Not extremely winter hardy
   k. Adequate baking and milling quality

2. Winalta
   a. Bearded variety
   b. Fair yielding
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Good shattering resistance
   h. Susceptible to dwarf smut and sawfly infestations
   i. Resistant to stripe rust
   j. Moderate resistance to stem rust

3. Cheyenne
   a. Bearded variety
   b. Good yielding ability
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Susceptible to shattering
   h. Moderate resistance to stripe rust
   i. Susceptible to dwarf smut, stem rust and sawfly infestation
   j. Good milling and baking qualities

Recommended Varieties (con't)

Soft White Varieties

1. Nugaines
   a. Bearded variety
   b. Good yielding ability
   c. Semi-dwarf type
   d. Maturity - mid-season
   e. Good test weight
   f. Very strong straw strength
   g. Resistant to shattering
   h. Resistant to stripe rust
   i. Susceptible to dwarf smut
   j. Good baking and milling quality for cake flours

2. Luke
   a. Bearded variety
   b. Good yielding ability
   c. Semi-dwarf type
   d. Maturity - mid-season
   e. Fair test weight
   f. Poor to fair straw strength
   g. Resistant to shattering
   h. Resistant to dwarf smut and stripe rust
   i. Foot rot tolerant
   j. Good baking and milling quality for cake flours

Sequence in R-7: Alfalfa yields are above average for the four year period. However, they are about one ton per acre less than we find in Sequence R-3 and R-5. Barley yields at 31.5 bushel per acre were slightly less than those found in R-2 and R-4. The hard red spring variety was 29.7 bushel per acre, which is considerably less than the wheat in Sequence R-5. Stands were very poor in the winter wheat which can be attributed in part to the very low rainfall in September and October. Table 1.

ANNUAL ECONOMIC EVALUATION 1974: Sequence R-5 gave the greatest return per acre this season, followed closely by Sequence R-3. It is interesting to note that there is little difference between Sequence R-2, R-4 and R-7. Those cropping sequences which contain alfalfa resulted in greater return than those with just small grains. The exception being the continuous cropping sequence R-7. Table 1.

FOUR YEAR ECONOMIC EVALUATION: In this four year summary we have only subtracted fertilizer costs when making this analysis. Cost for tillage and chemicals for weed control are not included. Such an analysis should and could be made using cost figures from standardized custom rates.

Sequence R-3, 5 year legume - with winter grain fallow alternating has a return of $98.15 per acre which is the highest in the test. The continuous cropping sequence is the lowest at $73.22 per acre.

Sequences where we are using a hard red winter variety does result in a somewhat lower return per acre. Comparing Sequence R-5 and R-3 over the four year period we find the following: Sequence R-3, $98.15 per acre; Sequence R-5, $85.40 per acre or a difference of $12.75. It should be noted that there is a difference in the length of time of legume in the sequence. Sequence R-3 is five years, whereas Sequence R-5 is three years.

WEEDS: Cheatgrass in 1974 was a problem in winter wheat, however in 1975 we did not have a problem with cheatgrass. As indicated earlier in the report, wild oats were a real problem in 1975 in spring barley. There were just a few wild oats in the continuous cropping sequence. In this sequence we are seeing an increase in quackgrass stands. Broadleaf weeds have been easily controlled with the combination of bromoxynil and MCP for early spring weeds and bromoxynil for fall spraying to control winter annuals.

Table 1. Annual data from cropping sequence study, Northwestern Agricultural Research Center, Kalispell, Montana, 1975

Field Number	Crop	Variety	Pounds/Acre N	P_2O_5	S	% Protein	Test Wt Lbs/bu	Yield/ Acre	Price/ Unit Dollars	Gross[1/] Dollars	Fertilizer Cost	Net/ Sequence	Dollars/ Acre
			Crop Sequence - 3 years: fallow, winter wheat, spring grain seed legume with spring grain and plow down as green manure										
R-2a	Barley	Georgie	65	34	0		44.0	32.3bu	4.10/cwt	63.57	25.76		
R-2b	Fallow												
R-2c	Wheat	Luke	96	42	30		60.0	65.8bu	3.11/bu	204.63	30.31		
									Total	268.20	56.07	212.13	70.71
			Crop Sequence - 15 years: five years legume, winter grain, fallow alternating										
R-3a	Alfalfa							3.3T	45.00/T	148.50			
R-3b	W. Wheat	Luke	96	42	30		58.8	64.0bu	3.11/bu	199.04	30.31		
R-3c	Fallow												
									Total	347.54	30.31	317.23	105.74
			Crop Sequence - 3 years: fallow, winter wheat, spring grain										
R-4a	Barley	Georgie	62	32	0		47.9	35.0bu	4.15/cwt	69.72	24.47		
R-4b	Fallow												
R-4c	W. Wheat	Luke	96	42	30		58.3	66.7bu	3.11/bu	207.44	30.31		
									Total	277.16	54.78	222.38	74.12
			Crop Sequence - 9 years: three years legumes, winter grain, fallow alternating										
R-5a	Fallow												
R-5b	Alfalfa	Ladak 65						3.4T	45.00/T	153.00			
R-5c	W. Wheat	Crest	34	42	30	12.9	60.0	56.6bu	3.43/bu	194.14	13.20		
									Total	347.14	13.20	333.94	111.31
			Crop Sequence - continuous cropping including a legume										
R-7a	Alfalfa							2.2T	45.00/T	99.00			
R-7b	Barley	Centennial	63	33	0		44.8	31.5bu	4.10/bu	61.99	24.98		
R-7c	W. Wheat	Crest	97	42	28	15.1		29.7bu	3.55/bu	105.44	30.31		
									Total	266.43	55.29	211.14	70.38

Table 1. Agronomic data from the western regional hard red winter wheat nursery grown at Kalispell, MT in 1975. Random block design, four replications.

Date seeded: September 19, 1974 Date harvested: August 12, 1975 Size of plot: 16 sq. ft.

C. I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.	Lodging Sev.	Dwarf Smut
ID 92	Minn2601255/C114106//MC	53.67a	57.40	172.00a	37.25	20.00b	2.50b	.00
CI 13844	Wanser	51.89a	58.00	167.50a	43.00a	43.75b	2.50b	.92
ID 745101	ID 5011/ID 5006	51.74a	57.00	172.75a	32.50b	80.50	1.25b	.05
MT 6715	3Yogo/CNN 2-3-13-6	50.72a	58.50	165.25	42.75a	16.25b	3.25b	1.75a
WA 7003	PI173467/IT//Wanser	48.64	58.20	172.25a	40.00a	40.00b	3.50b	1.50a
CI 12933	Itana	48.59	59.00	169.25a	46.00a	17.50b	3.00b	.45
ID 101	A68229WA185	47.84	56.50	168.75a	40.25a	41.25b	7.00a	.00
ID 102	A68230WD311	47.57	58.70	170.00a	44.00a	37.50b	3.50b	.00
ID 745102	BEZ//Burt/178383/3/ARK	47.22	58.50	168.50a	46.25a	33.75b	3.25b	.00
ID 72	CNN*2/PI 178383	47.17	60.00	171.50a	43.50a	76.25	4.25	.00
UT 819164	DM/CLM//Burt/PI178383	46.59	62.00	170.75a	47.00a	99.00	1.00b	.00
UT 84557	DM/173438//CLM/3/DM/4/CO	46.52	59.10	169.25a	44.25a	61.25	3.50b	.00
CI 17296	Hansel	46.27	59.60	169.25a	44.75a	74.75	5.50	.00
ID 745103	Pope//BEZ/3/Burt/178383	45.11	59.30	176.00a	44.25a	12.50b	2.50b	1.12a
ID 103	II-60-157/Wanser//McCall	44.86	55.20	166.25	32.50b	99.00	1.00b	2.05a
CI 13880	Crest 1/	44.84	57.00	166.00	37.75	81.00	4.75	.00
MT 6828	Burt/PI 178383 13-1201	43.61	54.20	166.75	41.00a	77.00	4.00	.37
ID 745104	Pope//BEZ/3/Burt/178383	43.41	58.50	171.00a	43.50a	27.50b	3.00b	.50
UT 819116	DM/CLM//Burt/PI 178383	42.74	57.50	170.75a	41.50a	76.75	1.25b	.00
MT 6930	NB176/Y18181//YTO1174-3	41.19	60.40	170.00a	44.50a	45.00b	3.00b	1.00a
CI 1442	Kharkof	39.14	57.70	172.00a	44.50a	38.50b	3.00b	1.37a
CI 17295	Cardon	33.36b	58.50	170.25a	43.50a	59.50	3.75	.22
	$\bar{x}$	46.03	58.22	169.82	42.02	52.66	3.19	.51
	F 2/	5.00**	.00	40.31**	36.30**	4.80**	16.57**	4.14**
	S. E.$\bar{x}$	2.02	.00	.40	.66	12.32	.35	.33
	L.S.D. (.05)	5.71	.00	1.13	1.86	34.85	1.00	.93
	C.V. %	4.39	.00	.24	1.57	23.40	11.05	63.68

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

Table 2. Agronomic data from the off station winter wheat nursery grown in Lake County on the Jaye Johnson farm, Ronan, MT in 1975. Random block design, four replications.

Date seeded: September 27, 1974 Date harvested: September 5, 1975
Size of plot: 16 sq. ft.

C.I. or State No	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Plant Height	Lodging Prev.	Lodging Sev.
MT 6829		13.8		19.0	31.0	2.3
CI 17295	Cardon (UT 755090)	21.2	55.6	23.0	17.5	2.5
CI 8885	Cheyenne	27.6	56.5	27.5a	22.5	3.0
CI 15327	Sundance	28.3	56.4	27.3a	42.5	5.3a
CI 15317	Franklin	24.1	56.9	28.0a	28.8	4.3
MT 6828	Burt/PI 178383	16.1		21.0	32.3	2.8
ID 0037	Jeff	30.9	56.9	29.8a	40.0	4.0
CI 17296	Hansel (UT 755204)	26.9	55.9	26.5a	32.5	3.3
CI 17298	Peck (ID 71041)	19.1		23.0	32.3	1.8
CI 13968	Nugaines	19.0		21.0	7.5	2.3
CI 14586	Luke	30.4	54.5	21.8	16.3	3.0
CI 14564	Hyslop	28.1	52.9	22.5	11.3	2.0
CI 14565	McDermid	31.4	52.5	20.8	16.3	2.5
CI 14485	Paha	13.3		24.0	33.5	2.0
CI 13880	Crest 1/	22.3	54.5	20.3	15.0	3.0
CI 15376	Sprague	27.3	53.6	23.5	37.5	5.0a
	$\bar{x}$	23.7	55.1	23.7	26.0	3.0
	F 2/	N.S.	0.0	3.5**	N.S.	5.3**
	S.E.$\bar{x}$	5.4	0.0	1.7	14.3	0.6
	L.S.D. (.05)	15.4	0.0	4.9	40.7	1.3
	C.V. %	22.8	0.0	7.2	55.0	15.0

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check .05
b/ Values significantly less than the check .05

Table 3. Agronomic data from the off station winter wheat nursery grown in Ravalli County on the Ross McIntre farm, Stevensville, MT in 1975. Random block design, four replications.

Date seeded: September 26, 1974 Date harvested: September 9, 1975
Size of plot: 16 sq. ft.

C.I. or State No	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Plant Height	Lodging Prev.	Lodging Sev.
MT 6829		17.7		22.3	32.3	1.8
CI 17295	Cardon (UT 755090)	27.0	57.1	24.5	32.3	1.8
CI 8885	Cheyenne	23.5	56.1	21.8	54.5	1.5
CI 15327	Sundance	24.3	53.4	21.3	12.5	2.0
CI 15317	Franklin	17.2		22.5	32.3	1.8
MT 6828	Burt/PI 178383	16.6		21.0	10.0	2.0
ID 0037	Jeff	24.0	56.7	24.3	34.8	2.0
CI 17296	Hansel (UT 755204)	26.6	56.7	24.3	12.5	2.3
CI 17298	Peck (ID 71041)	16.1		19.8b	76.8	1.3
CI 13968	Nugaines	15.3b		17.0b	17.5	2.0
CI 14586	Luke	22.4	51.1	19.3b	50.0	8.0a
CI 14564	Hyslop	25.4	48.2	18.5b	32.5	1.8
CI 14565	McDermid	22.4	48.5	19.3b	22.5	2.0
CI 14485	Paha	19.5	47.6	17.3b	76.8	1.3
CI 13880	Crest 1/	22.9	53.0	22.8	32.5	1.8
CI 15376	Sprague	27.4	54.9	20.0	45.0	7.8a
	$\bar{x}$	21.8	48.6	21.0	35.9	2.5
	F 2/	2.5**	0.0	5.6**	N.S.	86.1**
	S.E.$\bar{x}$	2.6	0.0	1.0	17.5	0.2
	L.S.D. (.05)	7.3	0.0	2.9	49.8	0.6
	C.V. %	11.9	0.0	4.8	48.8	8.9

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check .05
b/ Values significantly less than the check .05

Table 4. Agronomic data from the western regional white winter wheat nursery grown at Kalispell, Montana in 1975. Random block design. Four replications. Field E-1.

Date seeded: September 19, 1974 Date harvested: August 12, 1975 Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Plant Height	Lodging Prev.	Lodging Sev.	% Dwarf Smut
CI 14565	McDermid	57.12	53.00	169.25b	33.25	16.25	2.75	.50
CI 14564	Hyslop	56.82	53.20	170.50b	32.50	54.50a	1.50	.75
OR 7146	C.I. 13748/Moro,826	56.69	54.90	170.00b	34.25a	12.50	3.50a	.50
WA 6099	WA4877/VB66336	56.34	55.20	170.75b	33.50	76.75a	1.25b	1.25
OR 67205	CAP. DESP./SEL. 101//DRV	55.99	52.00	170.75b	29.25b	99.00a	1.00b	.50
CI 14485	Paha	55.64	55.50	172.00	36.75a	15.00	2.25	1.00
OR 7147	C.I. 13748/Moro, 905	53.52	51.60	170.00b	34.75a	10.00	3.00	.50
OR 65116	Nord Desprez/Sel. 101	52.32	52.10	169.75b	32.00	99.00a	1.00b	.75
WA 6145	WA3969//178383/CI 13431	52.29	55.90	171.75	31.75	54.50a	1.50	.00
CI 13968	Nugaines 1/	51.79	56.60	172.00	32.00	12.50	2.25	1.75
WA 5988	Gaines//178383/CI 13431	51.77	54.00	172.00	33.00	34.75	2.00	.50
OR 7142	C.I. 13748/Moro,142	51.39	53.40	170.00b	38.50a	22.50	4.75a	.25
CI 17294	Rew	50.44	56.00	172.50	40.75a	20.00	2.75	6.25a
SS 747	CI13431/CI7805/CI13447/3	47.79	53.70	173.50a	31.75	10.00	3.00	3.25
CI 15376	Sprague	47.47	53.20	170.00b	35.50a	70.00a	6.25a	.25
WA 6146	Gaines/Joel//WA 4766	46.52	55.60	172.75	30.00	15.00	2.00	1.25
ID 725057	ID 5011/WA 4765,Sel. 2	46.47	56.50	176.00a	34.25a	54.50a	1.50	1.50
CI 13438	Hybrid71R261/A	45.26	55.40	170.00b	34.25a	13.75	2.50	8.50a
CI 13740	Moro	44.04b	53.40	170.75b	41.50a	27.50	4.25a	.00
WA 5826	OM/1834-3//178383/13431	43.09b	53.40	175.25a	30.25	32.25	1.75	.00
CI 11755	Elgin	42.26b	57.00	173.25a	41.75a	23.75	3.00	16.25a
CI 17298	Peck	41.36b	56.50	174.00a	40.00a	32.25	2.00	1.00
CI 1442	Kharkof	37.44b	58.40	169.25b	43.50a	65.00a	4.00a	10.75a
	$\bar{x}$	49.73	54.63	171.57	35.00	37.88	2.60	2.49
	F 2/	5.93**	.00	25.23**	28.59**	4.06**	18.79**	11.21**
	S.E.$\bar{x}$	2.34	.00	.37	.77	13.97	.30	1.23
	L.S.D. (.05)	6.60	.00	1.06	2.16	39.41	.84	3.46
	C.V. %	4.70	.00	.22	2.19	36.89	11.45	49.33

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Value significantly greater than the check .05
b/ Value significantly less than the check .05

Table 5. Summary of yields for western regional white winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana, 1966-75.

C. I. or State No.	Variety	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Ave.	Sta. Yrs.	% Nugaines
CI 1442	Kharkof	52.1	47.4	58.5	58.9	56.4	62.1	59.7	45.3	27.7	37.4	50.5	10	68
CI 11755	Elgin	52.3	49.6	80.5	51.2	74.1	73.0	70.8	50.9	59.2	42.3	60.4	10	82
CI 13740	Moro	85.9	57.2	86.3	65.7	75.4	68.3	68.5	65.6	60.3	44.0	67.6	10	92
CI 13968	Nugaines	79.7	58.7	85.8	63.2	77.6	102.8	73.0	68.5	77.9	51.8	73.9	10	100
CI 14485	Paha			98.1	65.4	87.0	101.2	88.9	71.1	95.0	55.6	82.8	8	110
CI 14564	Hyslop			90.1	62.7	87.3	113.1	90.1	63.1	96.3	56.8	82.4	8	110
CI 14565	McDermid					88.8	111.9	95.8	63.4	84.7	57.1	83.6	6	111
WA 5826	OM/1834-3//178383/13431							69.4	66.0	91.1	43.1	67.4	4	99
WA 5988	Gaines//178383/CI13431								69.3	84.7	51.8	68.6	3	104
ID 725057	ID5011/WA4765, Sel. 2								67.5	95.1	46.5	69.7	3	105
OR 67205	Cap. Desp./Sel 101//Drv.								63.3	100.0	56.0	73.1	3	110
OR 65116	Nord Desprez/Sel 101								61.6	81.2	52.3	65.0	3	98
WA 6099	WA4877/VB66336									89.0	56.3	72.7	2	112
OR 7147	CI13748/Moro, 905									85.4	53.5	69.5	2	107
CI 15376	Sprague									81.7	47.5	64.6	2	99
OR 7146	CI13748/Moro, 826									73.2	56.7	65.0	2	100
WA 6145	WA3969//178383/CI13431										52.3	52.3	1	101
OR 7142	CI13748/Moro 142										51.4	51.4	1	99
CI 17294	Rew										50.4	50.4	1	97
SS 747	CI13431/CI7805/CI13447/3										47.8	47.8	1	92
WA 6146	Gaines/Joel//WA4766										46.5	46.5	1	90
CI 13438	Hybrid 71R261/A										45.3	45.3	1	87
CI 17298	Peck										41.4	41.4	1	80

Table 6. Agronomic data from the crest line row yield nursery grown at Kalispell, MT in 1975. Random block design, four replications.

Date seeded: September 19, 1974 Date harvested: August 12, 1975
Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Heading Date	Plant Height	Lodging	
					Prev.	Sev.
MT 7591	Crest 57	53.99	165.00	39.75	80.00	5.00
MT 7579	Crest 40	52.22	165.00	42.00	75.00	4.75b
MT 7593	Crest 30	52.04	165.00	40.00	92.50	5.25
MT 7589	Crest 53	52.02	165.00	39.00b	70.00	4.00b
MT 7592	Crest 58	51.24	165.00	40.00	53.50	3.75b
MT 7575	Crest 35	51.02	165.00	39.00b	73.50	5.75
MT 7574	Crest 31	50.74	165.00	40.25	85.00	5.00
MT 7586	Crest 49	50.67	165.00	40.25	52.50	4.25b
MT 7582	Crest 44	50.17	165.00	40.75	64.75	4.25b
MT 7583	Crest 45	49.92	165.00	39.25	81.25	5.75
MT 7581	Crest 42	49.64	165.25	38.00b	80.00	5.00
MT 7585	Crest 47	49.49	165.00	39.75	36.25b	4.25b
CI 13880	Crest 1/	49.29	165.00	41.00	75.00	6.00
MT 7580	Crest 41	49.14	165.25	39.75	81.00	5.50
MT 7572	Crest 34	48.99	165.00	40.25	67.50	5.50
MT 7573	Crest 56	48.92	165.00	39.50	85.00	5.00
MT 7578	Crest 39	48.17	165.00	40.25	73.75	4.50b
CI 12933	Itana	47.62	168.25	45.25a	25.00b	3.00b
MT 7587	Crest 50	47.32	165.25	38.50b	47.50	4.25b
MT 7590	Crest 55	47.04	165.00	39.50	67.25	6.00
MT 7588	Crest 51	45.64	165.00	39.75	27.50b	4.00b
MT 7576	Crest 36	45.06	165.00	40.25	51.25	4.00b
MT 7577	Crest 37	44.96	165.00	40.50	92.25	5.50
MT 7584	Crest 46	44.74	165.00	38.50b	36.00b	3.00b
	$\bar{x}$	49.17	165.17**	40.04**	65.55**	4.72**
	F 2/	1.53 NS	13.96**	4.98**	3.20**	5.24**
	S.E.$\bar{x}$	2.01	.18	.63	11.11	.38
	L.S.D. (.05)	5.66	.50	1.78	31.34	1.06
	C.V. %	4.08	.11	1.57	16.95	8.00

1/ Check variety
2/ Value for variety comparison
* Indicates statistical significance at .05 level
** Indicates statistical significance at .01 level
a/ Values significantly greater than the check .05 level
b/ Values significantly less than the check .05 level

YEAR: 1975

TITLE: Investigation of cropping sequence on productivity and quality of cereal grains.

LOCATION: Northwestern Agricultural Research Center, Agricultural Experiment Station, Kalispell, MT 59901.

PERSONNEL: Vern R. Stewart

OBJECTIVES:

1. To determine the most productive cropping sequence.
2. To determine effect of a cropping sequence on:
   (a) weed populations
   (b) fertility levels
   (c) protein levels of wheat
3. To determine the economics of a particular cropping sequence.

PROCEDURE: A total of five cropping sequences were established in 1972. These were established in plots 3.3 acres in size, which allows the use of field equipment for all operations.

Fertilizer application rates were based on soil analysis and experience over the past 10 years in these fields.

Protein data was obtained using the Udy method of analysis.

An economic evaluation is made of this study for a period of four years. Only two of the sequences have gone a full cycle. In this evaluation we have subtracted only the cost of fertilizers from the gross income. The value of crops is based on; actual sales of hay, and price of wheat and barley in the month of December in the year grown. Fertilizer costs were the actual cost of the fertilizer when purchased. These were calculated on the cost of N and P_2O_5 per pound.

RESULTS AND DISCUSSION:

Moisture in 1975, as in 1973 and 1974 was the limiting factor in crop production. Precipitation for the crop year was 16.98 inches, which is two inches below the 26 year average. May, June and July precipitation totaled 3.98 inches whereas, the 26 year average for the same period was 6.25 inches. The high rainfall occurring in August did little to help the 1975 crop. The very low barley yield can, in part, be attributed to the low rainfall in May, June and July. Protein data this season was secured only on the hard red winter wheat varieties. Test weights were obtained on both wheat and barley.

Sequence in R-2: Winter wheat yields are above average, however barley yields are ten bushel per acre below the four year average. Comparing Sequence R-2 with Sequence R-4 we find little difference in yield of either barley or wheat. Note - the difference between these two sequences is, green manure is plowed down in Sequence R-2. Table 1.

Sequence in R-3: Alfalfa yields are somewhat above the four year average, but about what would be expected under these conditions. Winter wheat yields are about five bushels per acre above the four year average. Table 1.

Sequence in R-4: This has been discussed in part, under the heading, Sequence in R-2. In both sequences R-2 and R-4 there was a very high population of wild oats in the spring barley. It should be noted that no herbicide was applied to control the wild oats. This could have in part, accounted for the yield reduction in barley. Table 1.

Sequence in R-5: Hard red winter wheat is used in this sequence. Wheat yields were six bushels per acre above the four year average. Alfalfa yields were about average, to slightly above. These are very close to the average yields found in R-3. Table 1.

Table 2. Summary data from cropping sequence study - three years, fallow, winter wheat, spring grain, Field R-2abc at the Northwestern Agricultural Research Center, Kalispell, Montana, 1972-75.

	Barley					Wheat					4 yr.
	1972	1973	1974	1975	x	1972	1973	1974	1975	x	Ave/A
Yield/acre	46.9 bu	47.8 bu	43.8 bu	32.3 bu	42.7	53.9 bu	48.7 bu	62.1 bu	65.8 bu	57.6	
Fertilizer cost	8.72	17.29	14.92	25.76	16.67	6.53	13.60	26.30	30.31	19.19	
Price of commodity	2.50/cwt	4.50 cwt	6.40 cwt	4.10 cwt	4.38	1.95/bu	4.20/bu	4.36/bu	3.11/bu	3.41	
Gross $	56.30	103.25	134.55	63.57	89.41	105.11	204.54	270.76	204.63	196.26	
Net/acre	47.58	85.96	119.63	37.81	72.74	98.58	190.94	244.46	174.32	177.08	83.27

Table 3. Summary data from cropping sequence study - fifteen years, five years legume, winter grain, fallow alternating, Field R-3abc at the Northwestern Agricultural Research Center, Kalispell, Montana, 1972-75.

	Alfalfa					Wheat					4 yr.
	1972	1973	1974	1975	x	1972	1973	1974	1975	x	Ave/A
Yield/acre	.6 T	2.7 T	4.2 T	3.3 T	2.7	56.3 bu	58.1 bu	60.7 bu	64.0 bu	59.8	
Fertilizer cost	7.60				1.90	13.24	26.46	26.96	30.31	24.24	
Price of commodity	25.00/T	45.00/T	40.00/T	45.00/T	38.75	2.11/bu	4.25/bu	4.36/bu	3.11/bu	3.46	
Gross $	15.00	121.50	168.00	148.50	113.25	118.79	246.93	264.65	199.04	207.35	
Net/acre	7.40	121.50	168.00	148.50	111.35	105.55	220.47	237.69	168.73	183.11	98.15

Table 4. Summary data from cropping sequence study - three years, fallow, winter grain, spring grain, Field R-4abc at the Northwestern Agricultural Research Center, Kalispell, Montana, 1972-75.

	Barley					Wheat					4 yr.
	1972	1973	1974	1975	x	1972	1973	1974	1975	x	Ave/A
Yield/acre	60.4 bu	42.3 bu	42.3 bu	35.0 bu	45.0	71.5 bu	48.6 bu	65.2 bu	66.7 bu	63.0	
Fertilizer cost	8.71	17.29	17.26	24.47	16.93	13.24	26.46	25.64	30.31	23.91	
Price of commodity	2.50/cwt	4.50/cwt	6.40/cwt	4.15/cwt	4.39	2.11/bu	4.25/bu	4.36/bu	3.11/bu	3.46	
Gross $	72.47	88.51	129.95	69.72	90.16	150.87	206.55	284.27	207.44	212.28	
Net/acre	63.76	71.22	112.69	45.25	73.23	137.63	180.09	258.63	177.13	188.37	87.20

Table 5. Summary data from cropping sequence study - nine years, three years legumes, winter wheat, fallow alternating. Field R-5abc, at the Northwestern Agricultural Research Center, Kalispell, Montana, 1972-75.

	Alfalfa					Wheat					4 yr.
	1972	1973	1974	1975	x	1972	1973	1974	1975	x	Ave/A
Yield/acre	3.2 T	.2 T	4.2 T	3.4 T	2.8	62.0 bu	41.9 bu	39.5 bu	56.6 bu	50.0	
Fertilizer cost		14.58			3.71	6.53	13.60	14.42	13.20	12.87	
Price of Commodity	25.00/T	45.00/T	40.00/T	45.00/T	38.80	2.11/bu	4.20/bu	4.46/bu	3.43/bu	3.55	
Gross $	80.00	9.00	168.00	153.00	102.50	130.82	175.98	176.17	194.14	169.28	
Net/acre	80.00	- 5.58	168.00	153.00	98.85	124.29	162.38	161.75	180.94	157.34	85.40

Table 6. Summary data from cropping sequence study - continuous cropping, legumes and small grains, winter and spring.

	1972	1973	1974	1975	$\bar{x}$	4 yr. Ave/A
			ALFALFA			
Yield/acre	.7/T	.15/T	2.9/T	2.2/T	1.5/T	
Fertilizer cost		14.76			3.69	
Price of commodity	25.00/T	45.00/T	40.00/T	45.00/T	38.75/T	
Gross $	17.50	6.75	116.00	99.00	59.81	
Net/acre	17.50	- 8.01	116.00	99.00	56.12	
			SPRING GRAIN			
	Wheat			Barley		
Yield/acre	27.6/bu	36.5/bu	45.6/bu	31.5/bu	35.1/bu	
Fertilizer cost	10.47	16.07	16.80	24.98	17.08	
Price of commodity	1.92/bu	4.50/cwt	6.40/cwt	4.10/cwt		
Gross $	52.99	78.84	140.08	61.99	83.28	
Net/acre	42.52	62.77	123.28	37.01	66.40	
			WINTER WHEAT			
Yield/acre	26.5/bu	30.8/bu	40.6/bu	29.7/bu	31.9/bu	
Fertilizer cost	6.53	13.60	27.18	30.31	19.41	
Price of commodity	1.90/bu	4.20/bu	4.46/bu	3.55/bu	3.53/bu	
Gross $	50.35	129.36	181.08	105.44	116.56	
Net/acre	43.82	115.76	153.90	75.13	97.15	
						73.22

TITLE: Soil Amendments and Chemical Fertilizer on Small Grains

PROJECT: Small Grain Investigation MS 756

YEAR: 1975

PERSONNEL: Leader - Nancy Campbell
Cooperator - Vern R. Stewart

OBJECTIVES: To determine the effectiveness of certain soil amendments to chemical fertilizers with chemical weed control on small grain productivity.

MATERIALS AND METHODS:

This experiment was begun in the spring of 1975 and is planned to be continued for at least three years. Five treatments were established:

I Chemical fertilizer applied as needed with chemical herbicides used for weed control.
IIa Check - no chemical fertilizers, herbicides or soil amendments added.
IIb Check - no chemical fertilizers or herbicides, liquid hog manure applied.
III Two soil amendments added - liquid hog manure and Planters II, no chemical fertilizers or herbicides.
IV One soil amendment added - Planters II, no chemical fertilizers or herbicides.

The soil was tested to a four foot depth for each treatment before seed bed preparation. Each treatment was then disked and harrowed. Four thousand gallons of liquid hog manure was added to Treatments IIb and III before disking. The manure was sprayed on the soil surface with a liquid manure spreader; and disked into the soil.

Centennial barley was seeded with a 12 foot International double disk drill at 50 lbs/a. At the time of seeding Treatment I had 27-14-0 at 196 lbs/a added and Treatments III and IV had Planters II at 225 lbs/a added.

Treatment I was sprayed for weeds on June 6, 1975 with Bromoxynil at 6 oz/a.

Five samples, 16 square feet in size were harvested at random from each treatment using a Jari mower. The samples were then thrashed, cleaned, and weighed.

RESULTS:

Using the analysis from the soil test plus any N or P added, Treatments IIb and III had the highest amount of N, 231 lbs/a and 235 lbs/a respectively, and P, 281 lbs/a and 233 lbs/a respectively. They were also the two highest yielding treatments. Treatment I had 76 pounds of N per acre and 150 pounds of P per acre; its yield, as were Treatments IIb and III, was significantly greater than the check. Treatment IV yielded significantly less than the check. In Treatment IV, no N or P was added, though Planters II adds Ca, Mg, S, B, Co, Mo, and Fe.

Mustard and Russian thistle were farily prominent in Treatments IIa, IIb, III and IV. Russian thistle was especially bad in Treatment IV. Treatment I, which was sprayed, was fairly clean.

Table 1. Results from chemical fertilizer - soil amendment study at the Northwestern Agricultural Research Center, Kalispell, Montana, Field R-8c, 1975.

Date seeded: April 29, 1975 Date harvested: September 8, 1975

	Treatment	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	Pounds/Acre 3/ N	P	K
I	27-14-0 + bromoxynil	26.46a	40.5	89.0	76	150	352
IIa	Check	14.17	1/	92.8	10	166	638
IIb	Check with liquid hog manure	33.43a	40.5	90.0	231	281	634
III	Liquid hog manure + Planters II	29.23a	40.2	79.0	235	233	508
IV	Planters II	6.07b	1/	89.0	14	168	300
	$\bar{x}$	21.87	40.40	87.96			
	F 2/	22.29**	.00	N.S.			
	S.E.$\bar{x}$	2.41	.00	3.21			
	L.S.D.(.05)	7.23	.00	9.62			
	C.V.%	11.02	.00	3.65			

1/ Insufficient grain sample to obtain test weight.
2/ Value for treatment comparison.
3/ Based on results of soil analysis plus additions by fertilizer or hog manure (N based on 4 ft., P and K based on top foot)
* Indicates statistical significance at .05 level.
** Indicates statistical significance at .01 level.
a/ Value significantly greater than the check .05.
b/ Value significantly less than the check .05.

TITLE: Winter Barley Breeding

PROJECT: Small Grains Investigation MS 756

PERSONNEL: Project Leader - Leon E. Welty
Cooperators - Greg Kushnak
Bob Eslick
Vern Stewart

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana
Central Agricultural Research Center, Moccasin, Montana

OBJECTIVES:

1. Recycle male sterile winter barley populations to increase winter-hardiness and snow mold resistance.
2. Make agronomically desirable selections from the above populations according to head length, seed size, number of seeds per head and tiller number.
3. Evaluate these selections for agronomic adaptability and yield with the existing check varieties, Alpine and Schuyler.

PROCEDURES:

A male sterile winter barley population was first planted at the Northwestern Agricultural Research Center in the fall of 1966. This particular population was developed in 1963 by incorporating ms_1 ms_1 into 20 backcrossed winter varieties which was then crossed with the winter barley world collection.

This population has been propagated in many different ways since 1966. Some years portions of the population were harvested in bulk and planted; and in other years male sterile plants were harvested, composited and then planted.

In 1972 a portion of the composite population was harvested in bulk and planted that fall.

In 1973 a portion of the composite population was harvested and planted that fall. In addition, male sterile plants were harvested, composited and planted. These two populations were maintained separately.

In 1974 portions of the bulk population were harvested and planted. Also, male sterile plants were harvested from the male sterile population. Seed from these plants were composited and planted that fall. Sixty three desirable plant selections were obtained from the male sterile and bulk populations in 1974. Ten pounds of seed set on male sterile plants in the male sterile population was planted at Moccasin in the fall of 1974 on approximately one-half acre. After the winter of 1974-75 there was approximately 10 percent survival at Moccasin.

In 1975 six pounds of seed set on male sterile plants from the bulk population was harvested and stored. Sixty pounds of seed set on male sterile plants from the male sterile population was also obtained. Twenty pounds of this seed was planted at Havre and Sidney on about one-half acre to increase selection pressure for winter hardiness. Ten pounds of the same seed was planted at Kalispell to recycle and maintain the population. Thirty-nine of the 63 plant selections obtained in 1974 did not segregate for male sterility and were planted in a yield trial with Alpine and Schuyler. Fifteen of the 63 plant selections obtained in 1974 segregated for male sterility and were planted in 1975 to clean out the male steriles. Six of the 1974

Procedures (con't)

selections were deemed undersirable and discarded. Seed from all those 1974 plant selections that were saved were sent to Moccasin for winter hardiness evaluation. One hundred and thirty four desirable plant types were selected from the male sterile population and 21 from the bulk population in 1975. These selections were planted in head rows with Alpine and Schuyler to evaluate for winterhardiness and agronomic adaptability.

Also, planted at Kalispell in 1975 was seed from plants that survived the 1974-75 winter at Moccasin. Four separate populations were obtained from the above: 1.) composite of seed from nine controlled crosses (hardy x hardy) on sterile plants (F_1); 2.) composite of open pollinated seed from 11 male sterile plants; 3.) composite of seed of 12 hardy fertile plants and 4.) open pollinated seed set on remaining male sterile plants.

A second male sterile winter barley population was planted for the first time at the Northwestern Agricultural Research Center in 1975. Fifty pounds of seed of this population was seeded on approximately two acres. This population which was obtained from R. T. Ramage differs from the first population in that ms_2 ms_2 was incorporated into the winter barley world collection rather than ms_1 ms_1.

TITLE: Evaluation of Seven Junegrass Lines

PROJECT: Miscellaneous Crops Investigations MS 758

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - H. W. Metcalf

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1976

OBJECTIVE: Evaluate seven junegrass (Koeleria cristata) introductions for seed production under irrigated conditions in northwestern Montana.

PROCEDURES:

Seven junegrass introductions were seeded in the northwest corner of Field Y-1 on May 11, 1973 in a randomized complete block design. The seeding rate for all introductions was three pounds per acre. Plots consisted of four rows, 12 feet long with one foot between rows and plots. Fourty pounds of nitrogen per acre was applied in the spring of 1975. Yield and height data were obtained.

RESULTS:

Mean seed yields in 1975 ranged from 803.6 pounds per acre (PI230256) to 2602.6 pounds per acre (PI206274). Heights ranged from 28 to 40 inches.

In 1974 there seemed to be a significant relationship between seed yields and height. The two shortest lines were also the two poorest yielding lines. This relationship did not exist in 1975.

Table 1. Seed yields (lbs/a) and height (inches) of seven irrigated junegrass experimental lines in 1975.

Entry	Replications			Mean	Height
	I	II	III		
PI 230256	809.6	923.5	677.6	803.6	32
PI 302912	1942.9	2734.5	1829.0	2168.8	28
PI 204452	1918.9	2194.8	1960.9	2024.9	36
M 896	1469.2	1463.2	1127.4	1353.3	27
PI 229463	1841.0	1403.2	1703.1	1649.1	40
PI 204455	1697.1	1739.0	1811.0	1749.0	37
PI 206274	2554.6	2818.5	2434.7	2602.6	27

Harvest date = 9-11-75
Mean yield = 1764.5 pounds per acre
F-value for treatment yield comparison = 20.26**
S.E.$\bar{x}$ = 129.5 pounds per acre
S.E.$\bar{d}$ = 183.2 pounds per acre
C.V. = 100s/$\bar{x}$ = 12.7 percent
L.S.D. at 0.05 = 399.2 pounds per acre
L.S.D. at 0.01 = 559.6 pounds per acre

Table 2. Seed yield and height of seven irrigated junegrass experimental lines in 1974 and 1975

Entry	Yield(lbs/a)			Height(inches)		
	1974	1975	Mean	1974	1975	Mean
PI 230256	1617.1	803.6	1210.4	24	32	28
PI 302912	2765.2	2168.8	2467.0	28	28	28
PI 204452	2814.0	2024.9	2419.5	32	36	34
M 896	1499.8	1353.3	1426.6	22	27	25
PI 229463	2489.4	1649.1	2069.3	34	40	37
PI 204455	2528.1	1749.0	2138.6	30	37	34
PI 206274	2760.1	2602.6	2681.4	27	27	27
Mean	2353.4	1764.5	2059.0	28	32	30