# TWENTY-FIFTH ANNUAL REPORT

1973

Research Report #56

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

Route 4
Kalispell, Montana

Prepared By

Vern R. Stewart
Associate Agronomist & Superintendent

Leon E. Welty
Assistant in Agronomy

# FISCAL PROJECT REPORT FOR 1973

## ADMINISTRATION 750

The activities in the Administrative Project are concerned with personnel and direction of research projects.

Personnel - The position of Ranch Labor II held by Mr. Paul Boss was changed to Agricultural Research Aid II and increased from grade 8 to grade 10 in the classified system.

Hal Reintjes from the Personnel Office at Montana State University visited the research center and reviewed the personnel system. He discussed the various aspects of labor-management relationships. The visit was informative, but also disturbing.

Mr. Leon Welty arrived January 9, to begin his new duties as an Assistant in Agronomy. His effective date of employment was January 15. The time between January 9 and 15 was spent in moving into Residence #2. Billie Jean and Brett, wife and son, respectively arrived January 11, 1973.

Mr. Paul Boss continued to have back trouble which resulted in considerable reduction in work efficiency. In addition several days sick leave were taken for medical treatment. He was sent to a pain clinic in Billings, Montana in October, but that resulted in no help or improvement of his health. It is estimated by the author that his working ability is reduced 50 to 60 percent on an overall basis.

Mrs. Jeanette Calbick was granted six weeks sick leave for major surgery from May 15 until June 27.

Dale Mahugh who has worked as a student since 1969 joined the classified staff as Research Assistant I, July 1, 1973. Mahugh completed the requirements for the Bachelor of Science degree at Montana State University in Agri Business curriculum. He has the responsibility for variety testing and some supervision of student help. He has asisted in tabulation of research data this past season.

In 1973 there were 11 people employed during the growing season.

Richard Nelson, a student at Flathead Valley Community College, worked from April 5 to May 15. He left to secure a job with a higher pay scale.

Three work study students were employed this season. They were Donna Bennett, Julie Ruff and Kenneth Kephart. All are students at Montana State University.

Donna and Julie have completed three seasons. Julie is a microbiology major and Donna a chemistry major. In 1973, Julie made many of the agronomic measurements in small grains, and most of the population counts in the Weed Investigation project. Donna was assigned to the forage project and secured many of the scientific measurements required in the research program.

Kenneth, was the "all around" man and worked where needed. For the most part he worked under the supervision of Paul Boss, and did most of the summer fallow work. Ken has advised us that he is changing his major from Agricultural Education to Agronomy.

Two young people worked through the NYC program. They were Gary Rutledge and Connie Lanfear. Gary was a good employee and worked well with his handicap. This did not seem to reduce his ability to carry "his" end of the load. Connie had a real psychological problem and the administrator directing the program terminated her after two days of work.

Colleen Ambrose, student at Carroll College, was a first season employee. Very capable young person. She began May 14 and worked until August 24.

Charles Loewen began working July 12 and continued thru potato harvest. His termination date was October 19. Charles was a good employee. He had had no previous experience in this area, but took direction well, learned rapidly and did excellent work.

Vickie Bitney worked 10 weeks starting May 21 and quiting July 27. Vickie did not have the stamina to work a full day at a sustained pace. She did take directions well and usually tried to do her best.

Jim Caverly Jr. worked only a few weeks during the growing season, starting July 16 and returning to high school September 4. Jim was a young but willing worker. It is planned that he will be a seasonal employee in 1974.

Mrs. Mary Mahugh worked from May 15 thru June 26 as secretary during the period Mrs. Calbick was on sick leave.

Activities participated in during the calendar year of 1973 are made a part of this report. Also a list of visitors at the research center is included.

ACTIVITIES:

| DATE | ACTIVITY | STAFF | LOCATION |
|---|---|---|---|
| Jan. 11 | CRD Meeting | Stewart | Kalispell |
| 17-18 | Research Center Staff Meeting | Stewart<br>Welty | Lewistown |
| 22 | Irrigated Pasture Meeting | Stewart<br>Welty | Kalispell |
| 25 | Weed Meeting | Stewart | Kalispell |
| Feb. 6- 7 | Fertilizer Meeting | Stewart<br>Welty | Bozeman |
| 13 | Ag Council | Stewart<br>Welty | Kalispell |
| 23 | Biological Weed Control School | Stewart<br>Welty | Missoula |
| 26-Mar. 2 | Annual Planning Conference | Stewart<br>Welty | Bozeman |
| Mar. 9 | Visited CDA Agri. Res. Station | Stewart<br>Welty | Lethbridge, Canada |
| 13 | Ag Council | Welty | Kalispell |
| 22 | Federal Land Bank Meeting | Stewart | Kalispell |
| 23 | County Agents Up-Dating Meeting | Stewart<br>Welty | Plains |
| 23 | Talk at Eastside Grange | Stewart<br>Welty | Creston |
| 24 | Talk at Western Mont. Seed Growers | Stewart<br>Welty | Charlo |
| 27-28 | Pesticide Seminar | Stewart<br>Welty | Yellow Bay |
| Apr. 10 | Ag Council | Welty | Kalispell |
| 11 | Weed School | Stewart | Ronan |
| 19-20 | Staff Conference | Stewart | Bozeman |
| May 8-10 | Conservation Days | Stewart | Kalispell |
| 8 | Talk at Ag Council | Stewart | Kalispell |
| 16 | Tour of Center by 3rd grade, Peterson School | Stewart | Station |
| 29 | Tour of Center by 6th grade, Russell School | Stewart | Station |
| June 28 | Tour of Center by FHS Biology Class | Stewart<br>Welty | Station |
| July 17-18 | Summer Staff Conference | Stewart<br>Welty | Miles City |
| 24 | Vo-Ag Advisory Council Meeting | Stewart | Kalispell |
| 26 | Field Day, Western Agri. Res. Center | Stewart<br>Welty | Corvallis |
| Aug. 17 | Observe new harvesting equipment | Stewart | Moccasin |
| Oct. 18-21 | Meeting with Director & checking off-station plots | Stewart | Bozeman |

Activities (con't)

| | | | | |
|---|---|---|---|---|
| Nov. | 1-2 | Monsanto Chemical Company Seminar | Stewart | Lethbridge, Canada |
| | 8 | CRD Meeting | Stewart | Kalispell |
| | 13-15 | American Society of Agronomy Meeting | Stewart Welty | LasVegas, Nevada |
| Dec. | 3-4 | Montana Grain Growers Assoc. Meeting | Stewart Welty | Great Falls |
| | 4-5 | Research Center Assoc. Meeting | Stewart Welty | Great Falls |
| | 6 | CRD Meeting | Stewart | Kalispell |
| | 11 | Ag Council | Stewart | Kalispell |

VISITORS:

The following persons visited the station in 1973.

| MONTH | VISITOR | REPRESENTING | ADDRESS |
|---|---|---|---|
| Jan. | Jesse Sparks | Farmer | Columbia Falls |
| | Gordon Grier | Farmer | Bigfork |
| | Clyde Pederson | Farmer | Kalispell |
| | Les Cooper | Farmer | Kalispell |
| Feb. | Hal Reintjes | Personnel Service MSU | Bozeman |
| | Kent Romney | Amchem Products | Loveland, Colo. |
| | Duane Carlson | Farmer | Columbia Falls |
| | John Heikens | Farmer | Bigfork |
| | Wayne Paxton | Niagara Chemical Co. | Billings |
| | Neal McAlpin | Farmer | Polson |
| March | Bill Collins | Farmer | Columbia Falls |
| | Don Graham | Soil Scientist, WMRC | Corvallis |
| | Ron Taylor | Student | Bigfork |
| | Jim Caverly, Jr. | Student | Bigfork |
| | R. W. Hufford | Hufford & Hufford Inc. | Spokane, Wn. |
| | Steven C. Fransen | Student, MSU | Bozeman |
| | Gale & Sherman Quiram | Students, MSU | Bozeman |
| | Roger Scott | Geigy Chemicals | Twin Falls, Idaho |
| | Chet Mahugh | Insurance Salesman | Kalispell |
| April | Lou Flanagen | Velsicol Chemical Corp. | Walla Walla, Wn. |
| | Bill Brady | Big Red Equipment | Kalispell |
| | Stan Gossack | International Harvester | Great Falls |
| | Art Shaw | Extension Agronomist MSU | Bozeman |
| | Vance Raines | Student | Drummond |
| | Delbert Martin | Farmer | Columbia Falls |
| | Paul Lynn | Farmer | Columbia Falls |
| | Wes Roath | Retired Agronomist | Bigfork |
| | Arnie Grob | Farmer | Kalispell |

Visitors (con't)

| | | | |
|---|---|---|---|
| May | Dr. Chuma Agbrekoba | Chevron Chemical Co. | Fresno, Calif. |
| | Dr. Joseph White | Chevron Chemical Co. | Fresno, Calif. |
| | Homer Metcalf | Plant & Soil Science, MSU | Bozeman |
| | Don Graham | Soil Scientist, WARC | Corvallis |
| | Mike Jackson | Extension Weed Specialist | Bozeman |
| | Don Claeys | Van Waters & Rogers | Spokane, Wn. |
| | Scott Cooper | USDA, ARS | Bozeman |
| | Ray Ditterline | Plant & Soil Science, MSU | Bozeman |
| | Rollie Sears | Grad. Student, MSU | Bozeman |
| | William Blake | Motor Pool | Helena |
| | Henry Dahl | Motor Pool | Helena |
| June | Don Graham | Soil Scientist, WARC | Corvallis |
| | Burton Isch | Farmer | Kalispell |
| | Richard Nilles | Velsicol Chemical Co. | Yakima, Wn. |
| | Bob Scott | Velsicol Chemical Co. | Spokane, Wn. |
| | Jack Davis | Farmer | Kalispell |
| | Bill O'Conner | Farmer | Kalispell |
| | Mr. & Mrs. Walt Robbin | Farmers | Bigfork |
| | Mrs. Jean Helps | Housewife | Bigfork |
| | Kent Romney | Amchem Products | Loveland, Colo. |
| | Harry McNeal | USDA, MSU | Bozeman |
| July | Steve & Carol Schumacher | | Ft. Benning, Ga. |
| | Mr. & Mrs. Lyle McMillen | | Petersburg, Canada |
| | Bill Knipe | Agronomist, Northrup King | Woodland, Calif. |
| August | Mr.& Mrs. Paulson & sons | | California |
| | Clark Amen | American Cyanamid Co. | Corvallis, Ore. |
| | Art Jensen | American Cyanamid Co. | Orinda, Calif. |
| | Al Jarvi | Agronomist, Ram Bar Corp. | Phoenix, Ariz. |
| | Mr. and Mrs. Rupp | | Ohio |
| | Ray & Kathy Carratt | | Austrialia |
| | Charles Bowman | MSU | Bozeman |
| | Martin J. Burris | Assoc. Dir. Ag. Exp. Sta. | Bozeman |
| | Tom Neidlinger | Rohm & Hass | Portland, Ore. |
| Sept. | Howard Buck | Truck Farmer | Columbia Falls |
| | Dick Neilson | PPG Industries Inc. | Portland, Ore. |
| | Jess Blasdel | Farmer | Kalispell |
| Oct. | Jerry Waller | State Conservation Agronomist | Bozeman |
| | Arnold Quale | District SCS | Kalispell |
| | Jack Cloninger | Soil Scientist SCS | Kalispell |
| | Marshall Beatty | Montana Highway Dept. | Kalispell |
| | Gary Carlson | Monroe Calculator Co. | Missoula |
| Nov. | Wes Roath | Retired Agronomist | Bigfork |
| | Warren Lewis | Chevron Chemical Co. | San Francisco, Calif. |
| Dec. | Warren Lewis | Chevron Chemical Co. | San Francisco, Calif. |
| | Ron Asheim | TAP | Bozeman |
| | Henry Murry | Real Estate | Missoula |
| | Bill Brady | Big Red Equipment | Kalispell |

# PHYSICAL PLANT 751

Improvements and additions to the physical plant are reported under this project.

A concrete floor was put in the Forage Research Building. Funds were secured from the Directors Office reserve. This has greatly increased the utility of this building.

Additional insulation was placed in Residence #2. This should aid in reducing heat loss from the building, with a net effect of reducing heating costs.

Two rooms in Residence #2 were carpeted in 1973. The floor covering in these two bedrooms had not be replaced since 1949.

Two sides of the Crops Research Building were painted in 1973, the west and south sides. The ceiling in the office was also painted during the winter.

# GENERAL FARM 752

This is a supporting project for all other research projects. In this report general farm activities and the purchase of all equipment will be reported.

The International Harvester Company was no longer able to lease farm equipment to the experiment station system, therefore the remaining equipment on lease was purchased.

Below is listed the farm and scientific equipment purchased using state and ERF funds.

State Funds:
- Forage Plot Harvester (partial) - 755
- International 666 Hydrostatic Diesel Tractor - 752
- Forage Trailer - 755
- No. 210 Windrower - 752
- #430 Twin Baler - 752
- #127 Cub Cadet Tractor - 752
- Toro Lawn Mower - 751
- Cattle equipment:
  - Internal Suspension Gate - 755
  - Model #10 - 100 Cow Portable Corral - 755
  - Cattle Headgate - 755
  - Mineral Feeders - 755

Wheat Research and Marketing Committee: 698
- International 45 Vibra Shank Cultivator & Mulcher
- Howe-Richardson Scale Model #6400
- 30 Stack-N-Pans and 5 Dollies
- Stand Sizer Shaker with Sieves
- Portable Bag Closer
- Hand Truck

Endowment and Research Foundation Funds: 715
- Forage Plot Harvester (partial)
- Monroe Electric Calculator Model #650 (partial)
- 2 side Chairs for Office

Forage Variety Testing: 160
- Monroe Electric Calculator Model #650 (partial)

Miscellaneous hand tools were purchased as needed.

Development of the irrigation system was continued during the year. Charles Bowman and students conducted a survey and did some engineering on this project. At the end of 1973 it was decided to drill a deep well for irrigation. The well is planned to provide 800 to 1000 gallons per minute. Work is continuing on this project.

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DISTRIBUTION OF THE
1973 N. W. Agricultural Research Center Report

| Copies | |
|---|---|
| 2 | Office of Director, Montana Agricultural Experiment Station |
| 1 | Plant and Soil Science Department - Dr. Kurt Feltner |
| 4 | Research Staff at Northwestern Agricultural Research Center<br>C. W. Roath<br>Vern R. Stewart<br>Leon E. Welty<br>Library |
| 11 | County Extension Agents in Northwestern Montana<br>Program Coordinator - Thaddeus Wojciechowski<br>Deer Lodge-Powell - Robert E. Durham<br>Flathead - Merle M. Lyda<br>Granite - E. Reginald Hoff<br>Lake - G. Edward Bratton<br>Lincoln - R. E. Wilcox<br>Mineral - Russell J. Luoma<br>Missoula - Gerald W. Marks<br>Ravalli - G. Robert Johnson<br>Sanders - Alan D. Knudson<br>Silver Bow - David O. Dickens |
| 5 | Northwest Montana Banks<br>Bank of Columbia Falls - Columbia Falls<br>Conrad National Bank - Kalispell<br>First National Bank - Kalispell<br>Valley Bank - Kalispell<br>Western Montana National Bank - Missoula |
| 1 | ASC Office - Don Hughes |
| 1 | FHA Office - Marvin Jones |
| 1 | SCS Office - Arnold Quale |
| 4 | Feed Mills<br>Equity Supply Company - Kalispell<br>Kalispell Feed & Grain Supply Inc. - Kalispell<br>Peavey Company Producer Service - Ronan<br>Western Seed and Supply Company - Charlo |

PUBLICATIONS AND TALKS 1973

1. Stewart, V. R., 1973 Weed Control Research (Talk given at the Northwestern and Western Agricultural Research Centers Advisory Committee Meeting, Polson, February 20)

2. Stewart, V. R., 1973 Changes in Recommended Small Grain Varieties (Talk given at the Western Montana County Extension Up-Dating Meeting, Plains, MT, March 23)

3. Stewart, V. R., 1973 Your Experiment Station (Talk given at the Eastside Grange, March 23)

4. Stewart, V. R., 1973 Certified Seed Production of New Small Grain Varieties (Talk given Western Montana Seed Growers Cooperative, Charlo, March 24)

5. Stewart, V. R., 1973 Weeds and Their Control (Talk given at Weed Workshop, Ronan, Montana, April 11)

6. Stewart, V. R., 1973 Summary of Research Work at the Northwestern Agricultural Research Center (Talk given at the Kalispell Agricultural Council, May 8)

7. Stewart, V. R., 1973 Ways to Control Various Pollution Factors (Talk given at 7th Grade Conservation Days, May 7,8,9 - 900 students)

8. Welty, Leon E., 1973 Evaluation of Two Irrigated Pasture Mixtures (Talk given at the Eastside Grange, March 23; Advisory Commitee Meeting, February 20, and Kalispell Agricultural Council, May 8)

9. Welty, Leon E. & R. T. Ramage, 1973 Effect of Hill Spacing and Number Plant per Hill on Yield and Yield Components of Four Barley Cultivars. Barley Newsletter Vol. 16 March.

# CLIMATOLOGICAL DATA

Northwestern Agricultural Research Center
Kalispell, Montana

A cooperative project, between the United States Weather Service and the Northwestern Agricultural Research Center, to secure weather data was established in March 1949, with Mr. C. W. Roath as observer. Instruments were installed in February of 1949, with records starting March 1, 1949. This data is published monthly in the "Climatological Data", the official Weather Service publication. Included in the daily observations are the maximum and minimum temperatures, amount of precipitation, amount of snowfall and the amount of snow on the ground. These observations are made at 8:00 a.m. each day. When first initiated the observations were made at 5:30 p.m. This change was made in July 1970.

In 1969 soil thermometers were installed as part of the weather instruments. These give readings at the 4 inch and 8 inch soil depth levels.

Most of the data presented herein is presented on a crop year basis. This is done because the growing season for winter annuals begins in September. Some data is presented on a calendar year basis.

During the 1972-73 crop year we had a frost free period of 103 days, 5 days less than the 24 year average of 108 days. The last killing frost was observed on May 22, 1973 and the first fall frost occurred on September 2, 1973, 11 days prior to average freeze date.

Precipitation for the 1972-73 crop year was the lowest ever recorded at the Northwestern Agricultural Research Center. Total precipitation this crop year was 12.35 inches. The 1949-73 average is 18.99 inches.

During the crop year a brief report was written each month about weather conditions and included in a monthly report to growers. These reports are made a part of the weather report for permanent filing.

September 1972: The month of September provided us with excellent weather for seeding and harvesting. Very little time was lost due to rain for the first three weeks of the month and then we had some moisture the last week of September. Checking the fields and nurseries, I found that most of the winter wheat nurseries have emerged and appear to be in good stand. The highest temperature for the month occurred on September 5th with a temperature of 82 degrees and low occurred on the 24th with a temperature of 24 degrees. The first frost occurred on the 10th of September when the temperature dropped to 29 degrees.

October 1972: The month of October had many cloudy and foggy days. There was good emergence of winter wheat the first part of the month and then during the middle part of the month there was real good emergence of weeds (winter annuals), especially field gromwell and fanweed.

October was somewhat cooler than the average with 3.4 degrees below normal. The average maximum temperature was 2 degrees below the average, the minimum temperature was 2 degrees below the average. The high occurred on the 14th of the month and the low on the 29th and 30th.

November 1972: No comments.

December 1972: Weather was a big topic of discussion in Montana and throughout much of the nation during December. Our weather hit us the first day of December when the temperature was 49 degrees and then dropped very rapidly that evening to a rather cold 10 degrees with snow and blowing snow. The temperature continued to drop, remaining in the zero area for approximately two weeks.

Our minimum was 21 degrees below zero, the mean average temperature was 19.9 degrees for December, which is a 6 degree departure from normal. Whether there was any damage to winter wheat during the extreme cold with the light snow cover remains to be see next spring. Precipitation for the month was 2.19 inches. The average for December is 1.66.

On the 23rd of December all the snow was gone from the valley floor. On December 28 and 29, five inches of new snow fell. Fortunately the temperature did not go very low during this snow free period, and I doubt that there will be any injury to winter wheat during the period.

January 1973: January was a typical month in many respects. The frist 3 days were in the high 30's, then the temperature dropped to below zero for night time temperatures with the high being 18 degrees above for 12 days. The low, 22 degrees below zero was the low for the month occurring January 9 and 11. Temperatures climbed to 50 degrees on January 15 and 16 (high for the month) and remained quite warm for the next 15 days, then there was a slight cooling trend.

We began the month with 3 inches of snow on the ground, and by mid-month the snow was gone. A freezing rain January 13 added to the peril of driving and walking.

We had 20 days in which the sun shone during the month which is a January record.

The effect of the open winter on winter grains is still in question. At this date it is hard to tell if there will be any adverse effect.

February 1973: No records were kept at the center on the number of sunny days in February, but it must be a record. I noted in the local paper we usually have 2 sunny days in February.

This was the second driest February on record with .56 inches precipitation. The driest occurred February 1964 when there was only .41 inches of precipitation. Temperatures did not vary too much from the long time mean.

February began quite warm then the temperature dropped to 0 degrees on the 7th and 8th. About the 16th temperatures moderated with a high of 55 degrees occurring on the 27th. There was little or no snow cover throughout the month.

March 1973: March weather was somewhat of a repeat of February, dry and above normal temperatures. As you look at the recorded data by the month, one would think the thermometer has "stuck". Maximum temperatures were in the 40's and 50's, minimum in the high 20's and low 30's.

We again had many sunny days and have seen good growth of winter wheat. The alfalfa has started, much earlier than usual this season. There was some winter wheat loss because of the open winter. At this writing I do not have an estimate of loss. Here at the research center we had very little loss of winter wheat.

Precipitation levels are down from the long time average. From September 1 to March 31 we have received 7.99 inches. The long time average for the same period is 9.91 inches, thus our moisture is about 80% of normal. January, February and March have only been about 50% of normal. The mountain snow pack in the area is 40% of the average. At this point we need to hope and pray for May and June rains.

April 1973: Temperatures were fairly consistant throughout the month, however, it was slightly cooler than the long time average. The high temperature was 67 degrees occurring on the 12th day.

While some parts of Montana and other parts of the United States continue to get rain beyong their desires, we in Northwestern Montana in general have been very short of moisture. A recent publication from the agricultural statistician indicates that Polson was the only weather station reporting above normal precipitation. Kalispell reported 52%. From January 1, our moisture average is 45% of normal.

Winter wheat is responding quite slowly because of the dry and rather cool weather. It should be noted that many fields of winter wheat north of the station winter killed. Alfalfa is growing and doesn't appear to be suffering yet from lack of moisture, however moisture reserves are low as indicated from the soil probing we have done.

May 1973: Temperatures during May were fairly close to normal for the long time average. The high temperature occurred May 17, when the temperature reached 86 degrees F. The low May 1, at 20 degrees F.

Moisture was really lacking during the month. Because of the dry conditions Lake Blaine Creek, our irrigation water source is not available. Thus we are now pumping water from Mill Creek 3/4 mile east of the station. We have irrigated the pastures, and once over the legumes. In my 21 years on the station I never recall irrigating forages in May.

Winter wheat was under strees, but .62 of precipitatio May 25 was a life saver. Sub soil moisture is still fairly short, so we are hoping for more rain.

June 1973: Water, the lack of it was our main concern in June. Precipitation for the month was 2.14 inches, the long time average is 3.10 inches. Most hay was put up with little or no rain falling on it. We have quality hay, but quanity is limited. At this writing all cereal grains could use moisture. Rains that feel in June were timely for winter wheat, but spring barley is showing the lack of moisture at this writing.

July 1973: July - Hot - Fifteen days above 85 degrees, and five days above 90 degrees, with a high of 97 degrees July 11. Precipitation was .01 inch for the month, 1.19 inches below the 24 year average. Evenings were cool and low for the month was recorded July 2nd. Some potatoes were injured in the north end of the valley.

August 1973: Hot - Nineteen days above 85 and nine of these above 90 degrees. A record July 30 thru August 5, it was above 90 degrees. There were a couple real cool evenings when the temperature dropped to 33 and 34 degrees, August 19 and 29 respectively. Precipitation for the month was .63 inches, .86 inches below normal. Will need considerably more moisture before we have good moisture for winter wheat seeding.

We calculated precipitation for the crop year, September 1 thru August 31. The mean for 24 years is 19.00 inches, this crop year we had 12.35 inches, the lowest recorded since records were started in 1949. The previous low occurred in 1954-55 when we recorded 12.75 inches. In summary "DRY".

Table 1. Summary of climatic data by months for the 1972-73 crop year (September to August) and average for the period 1949-73 at the Northwestern Agricultural Research Center, Route 4, Kalispell, Montana.

| Item | Month and Year | | | | | | | | | | | | Total or Average Growing Season |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sept. 1972 | Oct. 1972 | Nov. 1972 | Dec. 1972 | Jan. 1973 | Feb. 1973 | Mar. 1973 | Apr. 1973 | May 1973 | June 1973 | July 1973 | Aug. 1973 | |
| Precipitation (inches) Current Year | 1.38 | 1.84 | .80 | 2.19 | .52 | .56 | .70 | .45 | 1.13 | 2.14 | .01 | .63 | 12.35 |
| Ave. 1949 to 1972-73 | 1.50 | 1.53 | 1.49 | 1.65 | 1.63 | 1.10 | 1.04 | 1.17 | 2.01 | 3.10 | 1.30 | 1.49 | 19.01 |
| Mean Temperature (F) Current Year | 50.02 | 40.3 | 33.7 | 19.9 | 20.7 | 27.8 | 37.7 | 42.2 | 51.5 | 57.5 | 65.1 | 64.5 | 42.6 |
| Ave. 1949 to 1972-73 | 53.8 | 43.5 | 33.0 | 26.0 | 21.9 | 28.1 | 33.0 | 43.0 | 51.9 | 58.4 | 64.2 | 63.2 | 43.3 |
| Last killing frost in spring* 1973 | May 22 (31 degrees) | | | | | | | | | | | | |
| Ave. 1949-73 | May 28 | | | | | | | | | | | | |
| First killing frost in fall* 1973 | September 2 (31 degrees) | | | | | | | | | | | | |
| Ave. 1949-73 | September 13 | | | | | | | | | | | | |
| Frost-free period 1973 | 103 days | | | | | | | | | | | | |
| Ave. 1949-73 | 108 days | | | | | | | | | | | | |
| Maximum summer temperature | 97 degrees F. on July 11, 1973 | | | | | | | | | | | | |
| Minimum winter temperature | 22 degrees below zero on January 11, 1973 | | | | | | | | | | | | |

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

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1973.

| | Average temperature by month and year Degrees Fahrenheit | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | $\bar{x}$ for Years |
| 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 |
| $\bar{x}$ | 53.7 | 43.6 | 33.0 | 25.6 | 21.9 | 28.1 | 32.9 | 43.0 | 51.9 | 58.5 | 64.1 | 63.3 | |

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, 1973.

| | Average Maximum Temperature by Month & Year Degrees Fahrenheit | | | | | | | | | | | | $\bar{x}$ for |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Years |
| 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 | 38.2 | 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* |
| $\bar{x}$ | 68.7 | 54.8 | 40.4 | 32.5 | 29.3 | 32.2 | 42.8 | 54.8 | 65.7 | 72.0 | 81.0 | 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, 1973.

| | Average Minimum Temperature by Months & Years Degrees Fahrenheit | | | | | | | | | | | | $\bar{x}$ for |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Years |
| 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 |
| $\bar{x}$ | 38.7 | 32.3 | 25.5 | 19.5 | 14.5 | 19.8 | 23.0 | 31.0 | 38.0 | 44.8 | 47.3 | 46.3 | |

Mean temperature for all years = 31.7

* Denotes years above average.

Table 5. Summary of precipitation records obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1973

| Year | Total Precipitation in Inches by Month & Years | | | | | | | | | | | | Total for Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | .01 | 1.31 | .55 | 1.42 | .67 | .53 | .76 | 1.18 | 6.57 | 2.49 | 1.61 | 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 |
| $\bar{x}$ | 1.50 | 1.52 | 1.49 | 1.65 | 1.63 | 1.10 | 1.04 | 1.17 | 2.01 | 3.10 | 1.29 | 1.49 | |

Mean precipitation for all crop years = 18.99 inches.

* Denotes years above average precipitation.

Table 6. Precipitation by day for crop year, September 1, 1972 thru August 31, 1973. Northwestern Agricultural Research Center, Kalispell, Montana.

| Date | Sept. 1972 | Oct. 1972 | Nov. 1972 | Dec. 1972 | Jan. 1973 | Feb. 1973 | Mar. 1973 | Apr. 1973 | May 1973 | June 1973 | July 1973 | Aug. 1973 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | T | | .47 | | | | | |
| 2 | | .10 | .05 | .42 | | | .03 | | | | | |
| 3 | | | .02 | | | | | | | .29 | | |
| 4 | | | .02 | | | T | | | | .26 | | |
| 5 | | | .31 | | .05 | | .01 | | .14 | | | |
| 6 | .14 | | | | T | | .07 | .11 | | | .01 | .09 |
| 7 | .01 | | | | | | T | | | | T | .02 |
| 8 | | | | | | | | | .10 | .02 | | |
| 9 | .04 | | | | | | | | .05 | | | |
| 10 | T | T | T | | | T | | | .04 | | | |
| 11 | | .64 | | .01 | .01 | .52 | .04 | | .03 | | | .03 |
| 12 | .11 | T | | .07 | .19 | T | | | | | | |
| 13 | .02 | | | .02 | .17 | | .01 | .01 | | .01 | | |
| 14 | | | | T | .07 | | | .01 | | .44 | | |
| 15 | | | | | | | | | | .80 | | |
| 16 | | | .01 | | .02 | .03 | | | | | | |
| 17 | .06 | T | | | T | | .05 | .16 | | .08 | | |
| 18 | | | | .09 | T | T | | | | .02 | | |
| 19 | .26 | | .18 | | .01 | | | | | .05 | | |
| 20 | .06 | | T | .01 | | | | | | | | |
| 21 | | T | T | .08 | T | | | | | | | |
| 22 | T | T | | .80 | | | | T | | T | | T |
| 23 | .08 | | | .22 | | | | | | | | .02 |
| 24 | .20 | .14 | .05 | T | | | | .04 | T | T | | .12 |
| 25 | | | | T | | | | .11 | .62 | | | .02 |
| 26 | .19 | .04 | .16 | | | .01 | .02 | | .11 | .17 | | |
| 27 | .19 | .50 | | | | | | T | .01 | | | |
| 28 | | .15 | T | .23 | | | T | | | | T | |
| 29 | .02 | .27 | | .10 | | | | | .01 | | | |
| 30 | | | | .05 | | | | .01 | | | | |
| 31 | | | | .09 | T | | | | .02 | | | .33 |
| Total | 1.38 | 1.84 | .80 | 2.19 | .52 | .56 | .70 | .45 | 1.13 | 2.14 | .01 | .63 |

Table 7. Frost free period at the Northwestern Agricltural Research Center from 1950 thru 1973.

| 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 |
| $\bar{x}$ for all years | May 28 | 30 | Sept. 13 | 30 | 108 |

Table 8. Temperature extremes at the Northwestern Agricultural Research Center. Kalispell, Montana from 1950 thru 1973.

| | Minimum | | Maximum | |
|---|---|---|---|---|
| Year | 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 |
| 1967 | 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 |

Table 9. Summary of temperature records obtained at the Northwestern Agricultural Research Center, January 1950 thru December 1973.

| | Average Temperature by Month and Years | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Degrees Fahrenheit | | | | | | | | | | | | $\bar{x}$ for |
| Date | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Years |
| 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* |
| $\bar{x}$ | 21.9 | 28.1 | 32.9 | 43.0 | 51.9 | 58.5 | 64.2 | 63.3 | 53.8 | 43.6 | 32.6 | 26.3 | |

Mean temperature for all years = 43.4

* Denotes years above average mean.

Table 10. Summary of precipitation records obtained at the Northwestern Agricultural Research Center, January 1950 thru December 1973.

| Date | Total Precipitation (Inches) by Months and Years | | | | | | | | | | | | Total for Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 |
| $\bar{x}$ | 1.63 | 1.10 | 1.04 | 1.17 | 1.97 | 3.10 | 1.29 | 1.49 | 1.51 | 1.54 | 1.54 | 1.69 | |

Mean annual precipitation for 24 years = 19.13

* Denotes years above average.

TITLE: Chemical Weed Control in Legumes

PROJECT: Weed Investigations MS 754

YEAR: 1973

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

LOCATION: Northwestern Agricultural Research Center
Field numbers; X-4, R-14 and P-3

OBJECTIVES:

1. To determine the effectiveness of certain herbicides for the control of weeds when establishing new seedings of legumes.
2. To find a herbicide that will effectively control weeds in established stands of legumes.

SIGNIFICANT FINDINGS:

Experiment I - EPTC in combination with the protectant gave 70 to 96 percent weed control. Legume stands were found to be non-significant because of herbicide treatment.

Experiment II - Sumitol and metribuzin gave excellent control of all weed species. Yields were non significant. Percent weeds in hay is closely related to the visual score for weed control.

Experiment III - Combinations of 2,4-DB amine and "LoDrift" resulted in reduced weed control.

MATERIAL AND METHODS:

Three experiments were conducted in 1973. Two on new seedings and one on an established stand of alfalfa. A total of 11 chemicals were used in these studies and are listed in table 1.

Weed species in the new seedings were: red root pigweed (Amaranthus retroflexus L.); lambsquarter (Chenopodium album (L)); field pennycress (Thlaspi arvense (L.)); quackgrass (Agropyron repens (L.)) and Canada thistle (Cirsium arvense).

Predominate species in the established stand of alfalfa were: dandelion (Taraxacum officenale (L.)); quackgrass (Agropyron repens (L.)); bluegrass (Poa partensis); plantain (Plantago sp); and shepherd's purse (Capella bursa-pastoris).

Rates of carrier ($H_2O$) and plot sizes vary for each experiment, thus plot size and carrier volume will be discussed under results and discussions. Climatic conditions at time of application are found in the individual tables.

Measurements include: crop injury; weed control (visual) and populations. Legume stands were measured using a quadrant 2" x 36" with 20 divisions 2" x 2". Results are reported on basis of percent.

Samples when requested or required were taken to measure residue of herbicides in the plant.

RESULTS AND DISCUSSION:

Experiment I - Weed control in new legume seeding.

This study was conducted on Corvallis silty clay loam soil. Conditions at time of application of herbicides and seeding of legume were very dry.

Included with the herbicides in this study were protectants and materail to reduce drift of herbicides.

The preplant materials were sprayed on the plots which were 10' x 20' and incorporated with a tandem disk. To prepare a firm seed bed a culti-packer was used. Legumes were seeded five days after the herbicides were applied. Emergence of legumes was five days after planting. The post emergence treatments were applied when the legumes were in the three to five leaf stage.

Pigweed control was statistically significant. EPTC at nine pounds per acre without and with a protectant resulted in effective control. The dinitro analines generally were not effective in the control of pigweed, except the two pound per acre treatment of A820 with "LoDrift". This was not true of A820 at two pounds per acre without the "Lo Drift" addition. 2,4-DB amine alone and in combination with "LoDrift" did not give effective control of pigweed.

The lambsquarter population in this study was very erratic.

EPTC was weak on field pennycress, however the population of this species was very variable throughout the study. 2,4-DB amine generally gave better control of field pennycress than 2,4-DB ester. The dinitro analines did not provide good control of this species.

An analysis of variance of the total weed population showed weed control differences to be statistically significant. Percent weed control was calculated from population counts using the non weeded check as no control (0%). EPTC in combination with the protectants provided 70 to 96 percent control. The dinitro analines were quite weak in control, as were the 2,4-DB amines.

Stands of legumes were not statistically different because of treatments. The lowest stand (occupancy) was recorded for the non weeded check. The lower stand of sainfoin is probably due to seeding rate and seed size, which would result in lesser plants of sainfoin compared to alfalfa.

The C.V.'s indicate the variable population of weeds. See table 2 for complete tabulation of data.

Experiment II - Control of weeds in established stands of alfalfa.

Several herbicides were evaluated for control of weeds in established stands of alfalfa. Applications were made in early spring just as the alfalfa was beginning to "green up". Most of the products should have been applied a few days earlier, but the spring of 1973 was "rushing forward".

The herbicides were applied in an aqueous solution at 40 gallons per acre.

Following application, some yellowing of alfalfa plants was noted in the sumitol, metribuzin and paraquat treatments. At harvest time the alfalfa had regained a normal color in all treatments. Bioxone, two pounds per acre, did not kill dandelions, but did cause a severe retardation in their growth. Bioxone, four pounds per acre caused a slight suppression of the alfalfa plants.

Data secured from this experiment were, crop injury, weed score, percent weeds in harvested hay, and yield. Two harvests were made during the growing season.

Crop injury was slight with all products, with paraquat and metribuzin having the highest rating.

There exists a real close relationship between weed score (visual) and percent weeds in hay. Sumitol and metribuzin both provide excellent weed control at all rates. Yields were not statistically different, however bioxone at two pounds was the highest yielding treatment. Table 3.

Experiment III - "Lo Drift" Study.

This study was designed to measure the effect of "Lo Drift" on the control of weeds in new legume seedings when combined with a phenoxy compound. A slight yield reduction was noted when "Lo Drift" was used with the ester formulation of 2,4DB.

Two, four-DB amine and 2,4-DB ester were used with and without "Lo Drift". "Lo Drift" was used at twice the rate recommended, because of a miscalculation. This caused some mechanical problems and a reduction in volume applied. The study was located in a field where EPTC at four pounds per acre had been applied preplant incorporate before seeding alfalfa. Plots were 15 feet wide and 695 feet long. Three samples for yield were taken at random in plot area.

Yield differences were not found to be statistically significant, however the highest yielding treatment was 2,4-DB amine at .75 pounds per acre.

The addition of "Lo Drift" to the 2,4DB amine reduced the weed control score. Table 4.

Table 1. Chemicals used in experiments.

| Common Name 1/ | Trade Name or Other | Chemical Name | Company |
|---|---|---|---|
| GS 14254 | Sumitol | 2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine | CIBA-Geigy |
| EPTC | Eptam | S-ethyl dipropylthiocarbamate | Stauffer |
| BAS 3921H | Basalin | N-Propyl-N-(2-chloroethyl-3,3,3,-trifluoro-2,6-dinitro-p-toluidine | BASF |
| 2,4-DB | Butyrac 118 | 4-(2,4-dichlorophenoxy)butyric acid | Amchem |
| | Kerb | 3,5-dichloro-N-(1,1-dimethyle-2-propynyl benzamide | Rohm & Haas |
| metribuzin | Sencor Lexone | 4-amino-6-t-butyl-3-(menthylthio)-as-triazin-5 (4H)-one | Chemagro DuPont |
| paraquat | | 1,1'-dimethyl-4,4'bipyridinium ion | Chevron |
| bioxone | Probe | 2-(3-4-dichlorophenyl)-4-methyl-1,2,4-oxadiaolidine-3,5-dione | Velsicol |
| simazine | Prencip | 2-chloro-4,6,bis(ethylamino)-s-triazine | CIBA-Geigy |
| R25788 | | N,N-Diallyl-2,2-dichloroacetamide | Stauffer |
| R29148 | | Chemistry not available | Stauffer |
| A820 | Arnex | N-Secondary-butyl-4-tertiary-butyl-2,6-dinitroaniline | Amchem |
| | LoDrift | Polyvinyl polymer | Amchem |

1/ designation used in this report

Table 2. Effect of herbicides on weed species and stand of sainfoin and alfalfa when applied as an assist in establishment of legume stands. Northwestern Agricultural Research Center, Kalispell, Montana, 1973. Field No. R-14.

Date seeded: July 3, 1973 Plot size: 200 square feet (10x20)

| Treatment | | Weeds per square foot[5] | | | | | % Weed Control[8] | Occupancy Counts %[6] | |
|---|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | Pigweed | Lambsquarter | Field Pennycress | Other | Total Weeds | | Alfalfa | Sainfoin |
| Eptc | 4 | .22a[7] | 0 | .22 | 0 | .44c[7] | 84 | 66 | 42 |
| Eptc | 6 | .33a | 0 | .22 | .22 | .78bc | 72 | 62 | 33 |
| Eptc | 9 | .11 | 0 | .33 | 0 | .44c | 84 | 78 | 39 |
| Eptc + 25788[1] | 4 + .33 | .22a | 0 | .22 | 0 | .44c | 84 | 81 | 59 |
| Eptc + 25788[1] | 6 + .50 | .11 | 0 | .22 | 0 | .33c | 88 | 81 | 58 |
| Eptc + 25788[1] | 9 + .75 | .67a | 0 | .11 | 0 | .78bc | 72 | 74 | 25 |
| Eptc + 25788[2] | 4 + .75 | .11 | 0 | .44 | 0 | .55c | 80 | 80 | 52 |
| Eptc + 25788[2] | 6 + .75 | .11 | 0 | 0 | .11 | .22c | 92 | 71 | 38 |
| Eptc + 25788[2] | 9 + .75 | 0 | 0 | 0 | .11 | .11d | 96 | 80 | 44 |
| Eptc + 29148[1] | 4 + .33 | 0 | .11 | 0 | .22 | .33c | 88 | 71 | 43 |
| Eptc + 29148[1] | 6 + .50 | .44a | 0 | .11 | .22 | .78bc | 72 | 88 | 56 |
| Eptc + 29148[1] | 9 + .75 | .45a | 0 | .11 | 0 | .56c | 80 | 77 | 47 |
| Eptc + 29148[2] | 4 + .75 | .33a | 0 | 0 | 0 | .33c | 88 | 82 | 45 |
| Eptc + 29148[2] | 6 + .75 | .11 | 0 | .33 | 0 | .44c | 84 | 88 | 48 |
| Eptc + 29148[2] | 9 + .75 | .11 | 0 | 0 | 0 | .11d | 96 | 75 | 41 |
| Bas 3921 | .75 | .11 | 0 | 1.22 | 0 | 1.33abc | 52 | 88 | 50 |
| Bas 3921 | 1.0 | .22a | 0 | .45 | .11 | .78bc | 72 | 77 | 50 |
| Bas 3921 | 1.5 | .33a | .11 | .44 | 0 | .89bc | 68 | 74 | 36 |
| A820 | 1.0 | .89a | 0 | .67 | 0 | 1.33abc | 52 | 75 | 45 |
| A820 | 1.5 | .56a | 0 | .11 | .11 | .78bc | 72 | 75 | 35 |
| A820 | 2.0 | .44a | 0 | .22 | 0 | .67c | 76 | 70 | 36 |
| A820 + LD[3] | 1.0 | .89a | 0 | 0 | .11 | 1.00abc | 64 | 65 | 35 |
| A820 + LD[3] | 1.5 | .45a | 0 | .55 | .11 | 1.11abc | 60 | 77 | 37 |
| A820 + LD[3] | 2.0 | .11 | 0 | .55 | .22 | .89bc | 68 | 76 | 50 |
| | | | | Post emergence | | | | | |
| 2,4-DB amine | 3/4 | .55a | 0 | .11 | 0 | .67c | 76 | 65 | 40 |
| 2,4-DB amine | 1 | .56a | 0 | 0 | .11 | .67c | 76 | 84 | 35 |
| 2,4-DB amine +LD[3] | 3/4 | 1.33a | 0 | .22 | .33 | 1.59abc | 43 | 73 | 38 |
| 2,4-DB amine +LD[3] | 1 | .67a | 0 | .44 | .11 | 1.22abc | 56 | 84 | 40 |
| 2,4-DB ester | ½ | .78a | 0 | 0 | 0 | .78abc | 72 | 75 | 46 |

Table 2. (con't)

| Treatment Herbicide | Rate #/A | Weeds per square foot[5/] Pigweed | Lambsquarter | Field Pennycress | Other | Total Weeds | % Weed Control[8/] | Occupancy Counts %[6/] Alfalfa | Sainfoin |
|---|---|---|---|---|---|---|---|---|---|
| 2,4-DB ester | 3/4 | 1.44a | 0 | .89 | 0 | 2.33ab | 16 | 72 | 34 |
| 2,4-DB ester+LD[3/] | ½ | .78a | 0 | .22 | .44 | 1.44abc | 48 | 83 | 48 |
| 2,4-DB ester+LD[3/] | 3/4 | .44a | 0 | .22 | 0 | .67c | 76 | 81 | 38 |
| Check, hand weeded | 0 | .89a | 0 | .89 | .11 | 1.89abc | 0 | 73 | 37 |
| Check, non weeded | 0 | 1.78a | 0 | 1.00 | 0 | 2.78a | 0 | 58 | 40 |
| Mean | | .49 | .01 | .31 | .08 | .88 | | 76 | 43 |
| F[4/] | | 1.72* | .95 N.S. | 1.57 N.S. | .94NS | 3.35** | | .67N.S. | 1.08N.S. |
| S.E.$\bar{x}$ | | .323 | .027 | .251 | .114 | .335 | | 9 | 7.7 |
| C.V. % | | 66 | 414 | 81 | 146 | 38 | | 11.63 | 17.97 |

Application Data:

| | Preplant | Post emergence |
|---|---|---|
| Date | 6-28-73 | 7-23-73 |
| Temperature | 75 degrees | 70 degrees |
| Humidity | 43% | 50% |
| Wind velocity | calm | calm |
| Cloud cover | clear | clear |

1/ Protectant applied as a tank mix
2/ Protectant applied as a seed treatment
3/ LoDrift 6 oz./100 gallon $H_2O$
4/ F-value for treatment comparison
5/ Average of 3 counts per plot, 3 replications one square foot
6/ Based on four measurements per plot, 3 replications
7/ Items having common letters are not significantly different from one another (.05) Duncans Multiple Range Test
8/ Using non weeded check as no control - 0%

Table 3. Effect of certain herbicides on yield, weed control of several species and crop tolerance when applied to an established stand of alfalfa prior to green up in the spring. Northwestern Agricultural Research Center, Kalispell, Montana, 1973. Field No. Y-7.

| Treatment | | Crop Injury[1] | Weed Score[2] | % Weeds[3] | Yield[4] |
|---|---|---|---|---|---|
| Herbicide | Rate #/A | 0-10 | 0-10 | | Tons/acre |
| Sumitol | 1.5 | 1 | 7 | 2.6def[5] | 3.20 |
| Sumitol | 2.0 | 1 | 8 | .9ef | 3.74 |
| Metribuzin | .5 | 2 | 9 | 3.9cdef | 3.65 |
| Metribuzin | 1.0 | 2 | 8 | .1f | 3.29 |
| Metribuzin | 1.5 | 2 | 9 | .2f | 3.16 |
| Simazine | 1.0 | 1 | 1 | 19.0a | 3.63 |
| Simazine | 2.0 | 1 | 1 | 14.5ab | 3.05 |
| Paraquat | .25 | 1 | 4 | 11.4abcd | 3.52 |
| Paraquat | .50 | 1 | 6 | 15.8ab | 3.76 |
| Paraquat | 1.0 | 2 | 7 | 9.6bcde | 3.87 |
| Check | 0 | 0 | 0 | 14.5ab | 3.29 |
| Bioxone | 2.0 | 1 | 5 | 12.1abc | 3.85 |
| Bioxone | 4.0 | 1 | 7 | 1.1ef | 3.83 |
| Mean | | | | 8.13 | 3.53 |
| F-value for treatment comparison | | | | 5.79** | .56 |
| S.E.$\bar{x}$ | | | | 2.85 | .389 |
| C.V. % | | | | 35.00 | 11.04 |

Application Data:

| | |
|---|---|
| Date applied | 4/5/73 |
| Wind velocity | 0-6 mph |
| Temperature | 42 degrees |
| Humidity | 42% |
| Cloud cover | Partly cloudy |

1/ Crop injury 0 = No injury; 10 all plants killed
2/ Weed score 0 = no control; 10 = complete control
3/ % of weeds all species, by weight in harvested hay
4/ Corrected to 12% moisture
5/ Items having common letters are not significantly different one from another (.05) Ducans Multiple Range Test

Primary weed species: dandelion (Taraxacum officinale); quackgrass (Agropyron repens); bluegrass (Poa pratensis); plantain (Plantago sp.) and shepherd's purse (Capella bursa-pastoris)

Table 4. 2,4-DB amine and 2,4-DB ester in combination with LoDrift for control of annual weeds in a new seeding of alfalfa. Northwestern Agricultural Research Center, Kalispell, Montana, 1973. Field No. X-4

Plot size: 15 x 595 feet Size harvest: 20 square feet

| Treatment | | | Weed Score | Yields-Tons/a[3/] | | | | |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | LoDrift[1/] | 0-10[2/] | I | II | III | Total | $\bar{x}$ |
| 2,4-DB amine | .75 | | 8 | 1.38 | 1.50 | 1.59 | 4.47 | 1.49 |
| 2,4-DB amine | 1.0 | | 8 | .80 | 1.41 | 1.29 | 3.50 | 1.17 |
| 2,4-DB ester | .5 | | 7 | .87 | 1.08 | 1.31 | 3.26 | 1.09 |
| 2,4-DB ester | .75 | | 7 | .81 | 1.81 | 1.39 | 4.01 | 1.34 |
| 2,4-DB amine + LD[2/] | .75 | 16 oz. | 4 | 1.39 | 1.27 | 1.60 | 4.26 | 1.42 |
| 2,4-DB amine + LD[2/] | 1.00 | 16 oz. | 4 | 1.13 | 1.36 | 1.24 | 3.73 | 1.24 |
| 2,4-DB ester + LD[2/] | .50 | 16 oz. | 8 | 1.14 | 1.31 | 1.33 | 3.78 | 1.26 |
| 2,4-DB ester + LD[2/] | .75 | 16 oz. | 9 | 1.14 | 1.16 | 1.05 | 3.35 | 1.12 |
| Check | 0 | 0 | 0 | .98 | 1.47 | 1.20 | 3.65 | 1.21 |

| | |
|---|---|
| Mean | 1.26 |
| F[4/] | 1.15NS |
| S.E.$\bar{x}$ | .1095 |
| C.V.% | 8.45 |

1/ Ounces per 100 gallons of $H_2O$

2/ Weed Score - 0 = no control
10 = complete control

3/ Sample selected at random throughout the 595 foot long plot, 15 feet wide (Size of sample 20 square feet)

4/ Value for treatment comparison

NOTE: Area was treated with Eptc prior to application of 2,4-DB and combinations. Primary weed species: field pennycress (Thlaspi arvense); Canada thistle (Cirsium arvense)

TITLE: Control of spring and winter annuals in small grains.

PROJECT: Weed Investigations MS 754

YEAR: 1973

PERSONNEL: Leader - Vern R. Stewart
Cooperators - Weed research committee
- Chemical company Research and Development Representatives

LOCATION: Northwestern Agricultural Research Center: Field numbers; R-14, R-5b, R-2b.
Paul Boss farm, Kalispell, Montana

OBJECTIVES:
1. Find a herbicide that will effectively and economically control winter annuals in winter wheat with little or no deleterious effect on wheat yields.
2. Find a herbicide or herbicides that will effectively control wild oats in spring and winter wheat.

SIGNIFICANT FINDINGS:

Experiment I - Bromoxynil + MCP gave the most effective weed control with a minimum damage to the wheat crop.

Experiment II - Bentazon gave excellent control of red spurry and resulted in the highest yield of wheat.

Experiment III - Triallate controlled domestic oats in barley effectively.

Experiment IV - Triallate at 1.25 pounds per acre was the most effective for wild oat control. Protectants and extenders did not enhance the activity of triallate.

MATERIALS AND METHODS:

Four experiments were conducted on small grains in 1972-73. A total of 21 chemicals were used at various rates in these experiments. Products used are found in table 1.

The weeds in these experiments were natural populations except one, when domestic oats were used in lieu of a natural wild oat population. The weed species were: field gromwell (Lithospermum arvense (L)); wild oats (Avena fatua (L)); false flax (Camelina microcarpa (Andrz)); tumble mustard (Sesymbrium altissium (L)); field pennycress (Thlaspi arvense (L.)); red spurry (Spergularia ruba (L)).

Specific details on procedures for each experiment are included with the results and discussion. Generally weed scores (visual), yield data were obtained from most experiments. In some studies additional measurements were made and these are included in the results and discussion.

RESULTS AND DISCUSSION:

Experiment I - Herbicides were applied to an established stand of Crest winter wheat growing in a very fine sandy loam soil. Applications were made November 10, 1972, when the wheat was in the four to five leaf stage. The predominate weed species at the time of application was field gromwell. Wheat stands were excellent (100 %) on the date of application.

Bromoxynil plus MCP gave excellent weed control. Bioxone and terbutryn gave excellent control of fall weeds, but did not effectively control spring germinating annuals. Bentazon did not give effective weed control when fall applied.

Blowing sand caused stand reductions with the check being only 55 percent compared to 100 percent in the fall of 1972. In some cases it is difficult to determine what part of the stand loss is wind-sand damage and what part is chemical damage. However, I think we can conclude from these data that bioxone and terbutryn did cause severe stand reduction in wheat stands. Stands in these treatments are 73 percent to 96 percent less than the check. Bioxone appeared to reduce stands more than terbutyrn. Table 2.

Experiment II - This experiment was conducted on an established stand of Crest winter wheat. In the fall of 1972 the area was sprayed with bromoxynil to control winter annuals. In the spring of 1973 a high population of red spurry (Spergularia ruba (L)) appeared in the field. On April 12, 1973 a herbicide study was designed and applications made in an attempt to find a product that would effectively control red spurry. The study consisted of 18 treatments and a check, replicated three times. Measurements secured were yield, crop injury and a visual weed score.

Yields were not significant when analyzed statistically, however the check was the lowest yielding treatment. Crop injury from bioxone and terbutryn treatments were noted but was not reflected in the final yields.

The most effective weed control was obtained with bentazon at four pounds per acre, which caused little or no crop damage. Bioxone and terbutryn also gave up to 90 percent weed control. Table 3.

Experiment III - This study was conducted on Corvallis silty clay loam. Herbicides were applied perplant and incorporated and post emergence when the oats were in the three to seven leaf stage. Ingrid barley was seeded in plots 20 feet long, eight rows, spaced one foot. Seeding rate was 60 pounds per acre.

Domestic oats were seeded at right angles to barley rows. Domestic oats were used because this area did not contain a natural population of wild oats.

Protectants used in this study were used as seed treatments, applied to the seed as a tank mix and incorporated with the herbicide.

Data secured were, yield and visual weed score, which included an estimate on height reduction of oats treated with AC84777. At harvest time 100 grams of harvested grain was selected at random (per plot) to determine the percentage of oats in the barley.

A statistical analysis indicated there were no significant yield difference between treatments, however in the EPTC treatments yields were below the mean. AC84777 treatments resulted in yields below the mean and a reduction in plant height.

EPTC, three pounds per acre with a protectant and without the protectant caused stand loss and retardation of barley. EPTC without the protectant should have killed most of the barley based on previous work. This did not occur because of the seeding technique. The R25788 in powder form, was mixed with barley seed. The cones of the seeder became covered with the protectant and with continous planting from one plot to another all seed became coated to a degree with the protectant. It is felt that this is the reason that EPTC at three pounds per acre did not completely kill the barley.

Triallate, three pounds per acre, was the most effective in the control of oats. There was an 11 bushel difference between the one pound per acre and three pound per acre rate. The use of the protectant with triallate did not make much difference in yield.

There is no evidence to indicate that R25788 was any more effective than R29148 or the reverse.

The least number of oats was found in the triallate treatments. Table 4.

Experiment IV - This experiment was conducted in an area which contained a very high population of wild oats.

Post emergence, pre emergence herbicides, protectants plus carbamate herbicides and an extender with triallate were evaluated. Pre emergence herbicides were preplant incorporated. Following this incorporation wheat and barley were seeded at right angles to the herbicide plots.

A very light shower of rain occurred during the seeding process. The heavy clay soil became wet and the traffic of equipment caused some soil crusting resulting in stand loss of wheat and barley.

Data secured from this study were plant populations of wheat and barley; wild oats numbers in wheat and barley; percent weed control based on population counts; yields of wheat and barley.

Wheat populations were reduced significantly by EPTC and vernolate with protectant, but these stands are not too much lower than the check where there was a very high population of wild oats. Metribuzin was very severe on wheat, however stands were not much less than the check, but plant injury was very great. No statistical significance in treatments was found in barley. AC84777 did not reduce the population of wild oats, but did cause a significant reduction in the height of wild oats and general overall stunting of the plant.

Triallate provided the most effective wild oat control with the least crop damage. The combination of triallate with the protectants or the extender did not enhance the effectiveness of this compound.

Yield differences were significant in both wheat and barley. The highest yields occurred in barley where triallate was used alone at 1.25 pounds per acre. Wheat yields were highest when triallate was combined with the protectant R29148. The AC84777 treatments resulted in significant yield reductions below the triallate 1.25 pound per acre treatment.

Table 1. Chemicals used in the experiments.

| Common Name | Trade Name or Other | Chemical Name | Company |
|---|---|---|---|
| triallate | Fargo | 2,3,3-trichloroallyl NN-diisopropyl-thiolcarbamate | Monsanto |
| bromoxynil | Brominal<br>Buctril | 3,5-dibromo-4-hydroxybenzonitrile(4-cyano-2,6-dibromophenol) | Amchem<br>Rhodia |
| MCPA | | 2-methyl-4-chlorophenoxyacetic acid(4-chloro-2-methylphenoxyacetic acid) | Amchem |
| diuron | Karmex | 3-(3,4-dichlorophenyl)1,1-dimethylurea (N'-(3,4-dichloropheny)NN-dimethylurea | DuPont |
| bentazon | Basagran | 3-isopropyl-1H-2,1,3-benzothiadiazin-(4)3H-one 2,2-dioxide | BASF |
| dicamba | Banvel D | 3,6-dichloro-o-anisic acid | Velsicol |
| 2,4-D | 2,4-D | (2,4-dichlorophenoxy) acetic acid | --- |
| AC 84777 | Avenge | 1,2-dimethyl-3,5-diphenylpyrazolium methyl sulfate | American Cyanamid Co. |
| terbutryn | Igran | 2-(tert-butylamino)4-(ethylamino)-6-(methylthio)-s-triazine | CIBA-Geigy |
| bioxone | Probe | 2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione | Velsicol |
| | Dow Co 290[1/] | 3,6 dichloro picolinic acid | Dow |
| | R 21403 | (thiocarbamate herbicide)[1/] | Stauffer |
| EPTC | Eptam | S-ethyl dipropylthiocarbamate | Stauffer |
| vernolate | Vernam | S-propyl dipropylthiocarbamate | Stauffer |
| | PPg 124 | p-chorophenyl N-methyl carbamate | PPG Industries |
| | R 25788 | N,N-Diallyl-2,2-dichloroacetamide | Stauffer |
| metribuzin | Sencor<br>Lexone | 4-amino-6-tert-butyl-3-(methylthio-as-triazin-5(4H)one | Chemagro<br>DuPont |
| | Triton X100 | alkyl phenoxy polyethoxy ethanol | |
| | X-77 | alkyarylpolyoxyethylene Glycols | Colliodal Pro. |
| molinate | Ordram | S-ethyl hexahydro-1H-azepine-1-carbothioate | Stauffer |
| propanil | Stam F-34<br>Rogue | 3',4'-dichloropropionanilide | Roham & Haas<br>Monsanto |

1/ Name and structure confidential.

Table 2. Effect of certain herbicides on control of field gromwell (Lithospermum arvense (L)) in fall seeded winter wheat (variety Crest). Field number R-5c, Northwestern Agricultural Research Center, 1972-73.

Date seeded: September 21, 1972 Experiment I

| Treatment | | Weed[1/] | % | |
|---|---|---|---|---|
| Herbicide | Rate #/A | Control | Stand | Remarks |
| Bromoxynil + MCP | 3/8+3/8 | 10a[2/] | 57ab[2/] | Few gromwell, false flax[3/] and wild buckwheat[3/]. |
| Bromoxynil + diuron | ¼+3/10 | 7bc | 30cde | Few gromwell, false flax[3/], good fall weed control. |
| Bromoxynil + diuron | ½+3/10 | 7bc | 30cde | Few false flax[3/], fanweed, gromwell, mustard,[3/] blowing sand damaged stand. |
| Bromoxynil | 3/8 | 8ab | 35bcd | Profuse false flax[3/], excellent gromwell control. |
| Bentazon | .5 | 4d | 60a | Gromwell, false flax[3/], some mustard[3/]. |
| Bentazon | 1.0 | 7bc | 28cdef | Gromwell, mustard[3/], false flax[3/], fanweed[3/], blowing sand damaged stands. |
| Bentazon | 1.5 | 5cd | 40bc | Few gromwell, weak weed control. |
| Terbutryn | 1.0 | 6c | 5fg | False flax[3/], good fall weed control. |
| Terbutryn | 1.5 | 8ab | 7efg | Prevalent false flax[3/], good fall weed control. |
| Terbutryn | 2.0 | 9ab | 15def | Excellent weed control, few false flax[3/]. |
| Bioxone | 2.0 | 7bc | 7efg | False Flax[3/], good fall weed control. |
| Bioxone | 3.0 | 8ab | 4g | False flax[3/]. |
| Bioxone | 4.0 | 8ab | 2g | False flax[3/], blowing sand damaged stand. |
| Check | 0 | 0e | 55ab | Field gromwell, false flax, mustard predominate, wind damaged stand. |
| | $\bar{x}$ | 6.7 | 26.7 | |
| | F[4/] | 14.69** | 6.33* | |
| | S.E.$\bar{x}$ | .645 | 7.416 | |
| | C.V.% | 9.65 | 28.00 | |

Application data:

| | |
|---|---|
| Date applied: | November 10, 1972 |
| Temperature: | 44 degrees |
| Humidity: | 65% |
| Cloud cover: | clear |
| Wind velocity: | calm |

1/ 0-10 = 0 = no control; 10 = complete control (weed score is for fall weed control)
2/ Items having common letters are not significantly different (.05). Duncans Multiple Range test.
3/ These species were spring germinating annuals and are not reflected in the fall weed control score.
4/ Value for treatment comparison.

Table 3. Evaluation of several herbicides for control of red spurry in Crest winter wheat. 1972-73. Northwestern Agricultural Research Center, Kalispell, Montana. Field R-2b.

Date seeded: September 21, 1972 Date harvested: August 28, 1973
Size of plot: 14 square feet

| Treatment | | Yield | Crop Injury | Weed Score |
|---|---|---|---|---|
| Herbicide | Rate #/A | bu/a | 0-10[1/] | 0-10[2/] |
| Bioxone + dicamba | 3/4 + 1/8 | 57.4 | 2.0ab[3/] | 7.3bcd[3/] |
| Bioxone | 2.0 | 56.2 | 2.7a | 9.0abcd |
| MCPA + dicamba | 5/16+3/16 | 50.2 | 1.0bc | 2.3fghi |
| Bentazon | .5 | 58.8 | .7bc | 6.0cde |
| Bentazon | 1.0 | 51.3 | 1.3bc | 9.3abc |
| Bentazon | 2.0 | 62.5 | 1.0bc | 9.7ab |
| Bentazon | 4.0 | 62.4 | 1.3bc | 10.0a |
| 2,4D + Dow 290 | 1/8 + ½oz | 53.8 | 1.0bc | 1.7hi |
| 2,4D + Dow 290 | ¼ + 1 oz | 56.0 | 1.0bc | 2.7fgh |
| 2,4D + Dow 290 | 3/8 +1½oz | 61.4 | 1.0bc | 2.0ghi |
| 2,4D + Dow 290 | ½ + 2 oz | 58.2 | 1.0bc | 4.0efg |
| Terbutryn | 1.0 | 53.8 | 2.7a | 10.0a |
| Terbutryn | 2.0 | 66.4 | 2.7a | 10.0a |
| Terbutryn + MCPA | 1 + 3/8 | 64.4 | 1.7ab | 10.0a |
| Bromoxynil + MCP | 3/8 + 3/8 | 57.6 | 1.0bc | 4.7def |
| Bromoxynil + dicamba | 3/8 + 1/8 | 57.1 | 1.3bc | 2.0ghi |
| Diuron + dicamba | .3 + 1/8 | 59.1 | 1.3bc | 4.3ef |
| Diuron + bromoxynil | .3 + ¼ | 53.3 | 1.3bc | 5.0de |
| Check | 0 | 41.1 | 0.0c | 0.0i |
| | $\bar{x}$[4/] | 56.9 | .8 | 5.8 |
| | F[4/] | 1.24 N.S. | .44* | 18.06* |
| | S.E.$\bar{x}$ | 5.17 | .428 | 0.801 |
| | C.V. % | 9.10 | 55.56 | 13.72 |

Application data:

| | |
|---|---|
| Predominant weed species: | Red Spurry |
| State of growth of wheat: | Fully tillered |
| Date applied: | April 12, 1973 |
| Temperature: | 44 degrees |
| Humidity (RH): | 50% |
| Cloud cover: | Partly cloudy |
| Wind Velocity: | 3-6 mph |

1/ 0-10 = 0 = no injury; 10 = all plants killed
2/ 0-10 = 0 = no control; 10 = complete control
3/ Items having common letters are not significantly different (.05). Duncans Multiple Range Test
4/ Value for treatment comparison.

Table 4. Summary of data from herbicides used to control oats in spring barley. (Variety Ingrid) Northwestern Agricultural Research Center, Route 4, Kalispell, Montana, 1973. Field No. R-14

Date seeded: May 29, 1973 Date harvested: September 14, 1973 Size of plot: 32 square feet

| Treatment | | Yield | Weed Control | % Oats[7] | |
|---|---|---|---|---|---|
| Herbicide | Rate #/A | bu/a | 0-10 | in Barley | Remarks |
| Check | 0 | 49.7 | 0fe[5] | 43 | |
| R21403 | 3 | 40.3 | 5de | 33 | Fairly good control of oats, discoloration of barley. |
| R21403 | 4 | 46.1 | 4de | 28 | Reduction in barley stand, weed control quite good. |
| R21403 | 6 | 45.4 | 7bc | 22 | Some retardation, weed control quite good. |
| EPTC + 25788[1] | 1.5+.125 | 49.1 | 7bc | 20 | Some crop injury. |
| EPTC + 25788[1] | 2.0+.167 | 39.3 | 8ab | 15 | Some crop injury. |
| EPTC + 25788[1] | 3.0+.25 | 50.8 | 9a | 16 | Considerable crop injury and stand loss. |
| EPTC + 25788[2] | 1.5+.75 | 49.6 | 6cd | 25 | |
| EPTC + 25788[2] | 2.0+.75 | 59.5 | 7bc | 14 | |
| EPTC + 25788[2] | 3.0+.75 | 42.3 | 8ab | 10 | Crop injury, retardation, stand loss. |
| EPTC | 1.5 | 55.1 | 7bc | 22 | Stand reduction, pretty good oat control. |
| EPTC | 2.0 | 44.5 | 9a | 18 | Crop injury, stand loss. |
| EPTC | 3.0 | 41.1 | 9a | 29 | Crop injury, stand loss, retardation in barley. |
| Triallate | 1.0 | 58.8 | 9a | 6 | |
| Triallate | 2.0 | 46.0 | 9a | 2 | |
| Triallate | 3.0 | 47.6 | 9a | 1 | |
| Triallate+25788[2] | 1.0+.125 | 45.3 | 8a | 5 | |
| Triallate+25788[2] | 2.0+.167 | 49.4 | 9a | 3 | |
| Triallate+25788[2] | 3.0+.25 | 40.6 | 9a | 4 | Some burning of leaf tips. |
| Molinate+propanil[3] | 4.1+2.6 | 54.6 | 4de | 21 | |
| Molinate+propanil[3] | 2.05+1.3 | 47.8 | 6cd | 21 | Real deep green color, looked like nitrogen response. |
| AC84777+X77[3] | .5 + .5[8] | 38.4 | 27%[6]a | 13 | Lighter color than check, retardation in barley. |
| AC84777+X77[3] | .75 + .5[8] | 36.1 | 27%[6]a | 4 | Reduction in barley, not good color. |
| AC84777+X77[3] | 1.0 + .5[8] | 31.1 | 17%[6]ab | 1 | Reduction in barley growth. |
| AC84777+Triton100[3] | .5 + .5[8] | 42.2 | 33%[6]a | 16 | Little stand reduction, retardation in barley and height in oats. |
| AC84777+Triton100[3] | .75 + .5[8] | 46.3 | 33%[6]a | 3 | Some reduction in barley. |
| AC84777+Triton100[3] | 1.0 + .5[8] | 47.9 | 30%[6]a | 2 | Some reduction in barley. |
| EPTC + 29148[2] | 1.5 +.125 | 45.2 | 7bc | 15 | Little stand loss. |
| EPTC + 29148[2] | 2.0 +.167 | 50.2 | 7bc | 12 | |
| EPTC + 29148[2] | 3.0 +.25 | 44.5 | 9a | 6 | |
| EPTC + 29148[1] | 1.5 +.125 | 55.0 | 7bc | 8 | Reduction in stand. |

Table 4. (con't)

| Treatment Herbicide | Rate #/A | Yield bu/a | Weed Control 0-10 | % Oats[7] in Barley | Remarks |
|---|---|---|---|---|---|
| EPTC + 29148[1] | 2.0 +.167 | 44.0 | 8ab | 12 | Some stand loss, retardation. |
| EPTC + 29148[1] | 3.0 +.167 | 52.0 | 9a | 10 | Stand loss, reduction & retardation in barley. |
| Triallate+29148[2] | 1.0 +.125 | 44.0 | 9a | 5 | Lighter color, some reduction. |
| Triallate+29148[2] | 2.0 +.167 | 46.2 | 9a | 4 | |
| Triallate+29148[2] | 3.0 +.25 | 41.8 | 9a | 1 | |

| | | 0-10 | % | |
|---|---|---|---|---|
| $\bar{x}$ | 46.4 | 7.5 | 23.8 | 12.8 |
| F[4] | 1.18 | 14.0* | 3.95* | 11.70* |
| S.E.$\bar{x}$ | 5.5 | .524 | 5.99 | 2.916 |
| C.V.% | 11.91 | 10.00 | 25.19 | 22.71 |

Application data:

| | | |
|---|---|---|
| Date applied: | May 28, 1973 | June 26, 1973 |
| Temperature: | 66 degrees | 72 degrees |
| Humidity: | 28% | 50% |
| Cloud cover: | clear | cloudy |
| Stage of growth: | preplant incorporate | oats 3-7 leaf stage |

1/ Tank mix
2/ Seed treatment
3/ Post emergence 3-7 leaf stage
4/ Control of domestic oats; 0-10 = 0 = no oat control; 10 = all oats killed;
5/ Items having common letters are not significantly different (.05). Duncans Multiple Range Test.
6/ Value for % of height reduction.
7/ Oats were separated from barley after threshing.
8/ Surfactant % of total volume of $H_2O$ and products.

Table 5. Evaluation of several herbicides for the control of wild oats in spring wheat and spring barley, 1973. Grown on the Paul Boss farm, Route 4, Kalispell, Montana.

Seeding date: May 4, 1973 Harvest date: August 28, 1973 Size of plot: 10 square feet

| Treatment | | Plant Population[1] | | | | % Weed | Yield Bu/A | |
|---|---|---|---|---|---|---|---|---|
| | | | | Wild Oats | | | | |
| Herbicide | Rate #/A | Wheat | Barley | Wheat | Barley | Control[2/3] | Wheat | Barley |
| | | | | Preplant Incorporate | | | | |
| R21403 | 3 | 7abc[4] | 5 | 15abcdef[4] | 17abcd[4] | 26 | 10.6cdefg[4] | 19.4bcde[4] |
| R21403 | 4 | 7abc | 2 | 12abcdefg | 12abcde | 44 | 11.4cdefg | 11.4de |
| R21403 | 6 | 6abc | 8 | 12abcdefg | 9cde | 51 | 15.2abcde | 15.6cde |
| EPTC + 25788 | 1.5 + .125 | 3cd | 5 | 10cdefg | 15abcde | 42 | 4.6fgh | 11.8de |
| EPTC + 25788 | 2.0 + .167 | 2d | 4 | 17abcde | 16abcde | 23 | 5.4fgh | 16.6cde |
| EPTC + 25788 | 3.0 + .25 | 3cd | 2 | 8efg | 9cde | 61 | 5.3fgh | 13.6cde |
| Vernolate + 29148 | 1.5 + .125 | 3cd | 5 | 15abcdef | 14abcde | 33 | 6.9efgh | 14.8cde |
| Vernolate + 29148 | 2.0 + .167 | 4bcd | 3 | 18abcd | 12abcde | 30 | 8.6efg | 12.6cde |
| Vernolate + 29148 | 3.0 + .25 | 2d | 2 | 13abcdefg | 12abcde | 42 | 6.2efgh | 11.8de |
| Triallate + 29148 | 1.5 + .125 | 5abcd | 4 | 8efg | 6cde | 67 | 21.8a | 24.8ab |
| Triallate + 25788 | 1.5 + .125 | 6abcd | 5 | 8efg | 9cde | 61 | 16.8abcd | 22.8bcd |
| Triallate | 1.25 | 7abc | 4 | 8efg | 7cde | 65 | 16.8abcd | 35.2a |
| Triallate + PPg124 | 1.25 + .30 | 7abc | 5 | 9defg | 10bcde | 56 | 15.0abcde | 29.6ab |
| Triallate + PPg124 | 1.25 + .15 | 6abcd | 4 | 7fg | 7cde | 67 | 18.1abc | 23.8bc |
| Triallate + PPg124 | 1.0 + .25 | 4bcd | 4 | 9defg | 8cde | 61 | 14.6abcde | 17.4cde |
| Triallate + PPg124 | 1.0 + .125 | 6abcd | 5 | 4g | 9cde | 69 | 20.6ab | 21.8bcde |
| | | | | Post Emergence[6] | | | | |
| Metribuzin | .375 | 5abcd | 3 | 9defg | 9cde | 58 | 4.2gh | 16.0cde |
| Metribuzin | .50 | 4bcd | 6 | 7fg | 3e | 77 | 1.3h | 16.8cde |
| AC84777+X77 | .5 + .5%[8] | 6abcd | 4 | 20ab | 23ab | 50 | 9.3defg | 9.6e |
| AC84777+X77 | .75 + .5%[8] | 9a | 3 | 11bcdefg | 14abcde | 40 | 10.6cdefg | 14.0cde |
| AC84777+X77 | 1.0 + .5%[8] | 8ab | 6 | 13abcdefg | 13abcde | 30 | 8.6defg | 11.6de |
| AC84777+triton 100 | .5 + .5%[8] | 5abcd | 3 | 16abcdef | 20ab | 47 | 9.6cdefg | 15.4cde |
| AC84777+triton 100 | .75 + .5%[8] | 8ab | 4 | 12abcdefg | 17abcd | 34 | 10.1cdefg | 14.2cde |
| AC84777+triton 100 | 1.0 + .5%[8] | 7abc | 6 | 10bcdefg | 9cde | 37 | 11.5cdefg | 17.6cde |
| AC84777 + 2,4D | .5 + .375 | 4bcd | 5 | 21a | 20ab | 20 | 13.0bcdef | 16.0cde |
| AC84777+2,4D+X77 | .5 +.375+.5%[8] | 5abcd | 5 | 17abcde | 15abcde | 54 | 13.4bcdef | 15.2cde |
| AC84777+2,4D+X77 | .75 +.375+.5%[8] | 5abcd | 4 | 14abcdef | 10bcde | 40 | 15.7abcde | 13.6cde |
| AC84777+2,4D+X77 | 1.0 +.375+.5%[8] | 6abcd | 3 | 13abcdefg | 11bcde | 44 | 10.7cdefg | 16.8cde |
| Check | 0 | 5abcd | 3 | 19abc | 24a | 0 | 10.7cdefg | 13.0cde |

Table 5 . (con't)

| Treatment | | Plant Population[1/] | | | | % Weed Control[2/3/] | Yield Bu/A | |
|---|---|---|---|---|---|---|---|---|
| | | | | Wild Oats | | | | |
| Herbicide | Rate #/A | Wheat | Barley | Wheat | Barley | | Wheat | Barley |
| | $\bar{x}$ | 5.3 | 4.1 | 12.3 | 12.4 | | 11.3 | 17.0 |
| | F[5/] | 1.76* | 1.29 | 2.36* | 1.74* | | 4.53* | 2.45* |
| | S.E.$\bar{x}$ | 1.383 | 1.772 | 2.851 | 3.838 | | 2.352 | 3.66 |
| | C.V.% | 26.21 | 28.17 | 23.20 | 30.85 | | 20.81 | 21.52 |

| Application data: | Preplant Incorporate | Post Empergence[6/] |
|---|---|---|
| Date: | 5/4/73[7/] | 6/11/73 |
| Temperature: | 45 - 50 degrees | 62 - 68 degrees |
| Wind velocity: | calm | 0 - 6 mph |
| Humidity: | 80% | 22% |
| Cloud cover: | cloudy[7/] | clear |

1/ Plants per square foot.
2/ Based on plant counts using check as no control.
3/ AC84777 treatments - based on height reduction of wild oats using check as 0%.
4/ Items having common letters are not significantly different (.05). Duncans Multiple Range Test
5/ Value for treatment comparison.
6/ 3 - 5 leaf stage of growth of wild oats.
7/ Light rain as we completed preplant incorporation and seeding.
8/ Surfactant % of total volume of $H_2O$ and products.

Table 6. Observations made during the growing season of several herbicides when applied to spring wheat and barley. Paul Boss farm, Route 4, Kalispell, Montana, 1973.

| Treatment | | |
|---|---|---|
| Herbicide | Rate #/A | Remarks |
| | Preplant Incorporate | |
| R 21403 | 3 | Granular material, poor distribution of material. |
| R 21403 | 4 | Granular material, poor distribution of material. |
| R 21403 | 6 | Granular material, very uneven control, poor distribution of material. |
| EPTC + 25788 | 1.5 + .125 | Thinning of stand of wild oats. Those left are growing more vigorously than those in check plot. |
| EPTC + 25788 | 2 + .167 | Retardation in heading, particularly in wheat and barley. Considerable loss of stand. |
| EPTC + 25788 | 3 + .25 | Some crop injury and stand loss. Wild oats growing are very vigorous. |
| Vernolate + 29148 | 1.5 + .125 | Where there is no competition from the grain there are considerable wild oats, whereas among the crop, hardly any wild oats in the treated areas are showing up. |
| Vernolate + 29148 | 2 + .167 | In the area between the wheat and barley which was not seeded there is considerable growth of wild oats. There must be a relationship between treatment and plant competition. |
| Vernolate + 29148 | 3 + .25 | Same as above, some crop injury, thinning of stand. |
| Triallate + 29148 | 1.5 + .125 | Fairly effective job on wild oats even where there is competition. |
| Triallate + 25788 | 1.5 + .125 | Barley withstood the rate, however wheat seems to be injured. |
| Triallate | 1.25 | |
| Triallate + PPg 124 | 1.25 + .30 | |
| Triallate + PPg 124 | 1.25 + .15 | |
| Triallate + PPg 124 | 1.0 + .25 | Plant loss |
| Triallate + PPg 124 | 1.0 + .125 | Some stand loss, pretty good weed control. |
| | Post Emergence | |
| Metribuzin | .375 | Considerable plant injury. |
| Metribuzin | .50 | Considerable plant injury. |
| AC 84777 + X77 | .5 + .5% | Reduction in height of wild oats. |
| AC 84777 + X77 | .75 + .5% | Reduction in height of wild oats. |
| AC 84777 + X77 | 1.0 + .5% | Reduction in height of wild oats. |
| AC 84777 + triton 100 | .5 + .5% | Reduction in height of wild oats. |
| AC 84777 + triton 100 | .75 + .5% | Reduction in height of wild oats. |
| AC 84777 + triton 100 | 1.0 + .5% | Reduction in height of wild oats. |
| AC 84777 + 2,4D | .5 + .375 | Reduction in height of wild oats. |
| AC 84777 + 2,4D + X77 | .5 +.375 + .5% | Reduction in height of wild oats. |
| AC 84777 + 2,4D + X77 | .75+.375 + .5% | Reduction in height of wild oats. |
| AC 84777 + 2,4D + X77 | 1.0 + .375 + .5% | Reduction in height of wild oats. |
| Check | 0 | Reduction in height of wild oats. |

TITLE: Chemical control of weeds in potatoes.

PROJECT: Weed Investigations MS 754

YEAR: 1972

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

LOCATION: Northwestern Agricultural Research Center
Field number: X-1

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.

SIGNIFICANT FINDINGS:

Statistically yields were found to be non significant, however GA10832 as a group of treatments yielded 308 cwt per acre compared with the non weeded check of 255 cwt per acre.

The most effective weed control was obtained with metribuzin at any rate applied. It would appear in the weed spectrum present that metribuzin, .5 pounds per acre, would give adequate weed control. Yields, using this treatment, were 298 cwt per acre. Somewhat higher than the hand weeded check. Table 8.

MATERIALS AND METHODS:

Ten herbicides were evaluated at different rates and in various combinations. Plots were 12' x 40', replicated three times. Each plot consisted of four rows with the two center rows as yield rows. Herbicides were applied in an aqueous solution at 40 gallons per acre. Herbicides were applied pre 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 Lillistion rolling cultivator after the potatoes were hilled. The study was scored for weed control and then cultivated, except for the non weeded check.

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.)); lambsquarter (Chenopodium album (L.)); and green foxtail (Setaria viridis (L.)).

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

RESULTS AND DISCUSSION:

Vernolate was somewhat more effective in the control of weeds than EPTC. Vernolate, 3 pounds per acre, was equal to the four and six pound per acre rate.

The dinitro analines used in the study were weak in over all weed control, however there was a reduction in vigor of the weeds. Part of this ineffectiveness could be due to incorporation, which may have been deeper than recommended. Setaria sp. did come thru in the GS10832 treatments. Trifluralin gave the most effective weed control of this group of herbicides.

Metribuzin gave 100 percent weed control applied post plant pre-emergence, post emergence and in combination with other herbicides. There appears to be little value in combining metribuzin with other herbicides for this weed spectrum. Probe (bioxone) was similar in weed control as that of vernalate except the Setaria sp. which were emerging at the time these readings were made. Table 2.

"Pointed" ends of potatoes were seen in the trifluralin treatments at one pound per acre. Several misshapened tubers were noted in the A820, one pound per acre, treatment. In the alachor plus metribuzin combination some pointed end tubers were seen. Table 3.

Total yields of potatoes and by individual grades are found in table 4 thru 8. No significant differences were found when the data was analyzed statistically in total or by grades. A review of the data was made to see if there were any trends as a result of a particular herbicide or rate of herbicide.

Seed - Yields from the vernolate treatments were higher than the EPTC treatments. Yields decreased as the rate of BAS3921 was increased. This was also noted with trifluralin. In the GA10832 and A820 plots yields increased as the rate of herbicide increased. The combination of metribuzin and EPTC tended to decrease the yields when compared to metribuzin alone. Table 4.

No. 1's - Yields did not vary greatly between herbicides, but there was some variation between rates of individual herbicides. The largest yield (39 cwt/a) was obtained from GA10832, one pound per acre. Table 5.

No. 2's - Trifluralin and GA10832 treatments resulted in a larger yield of this grade with an average of 62 cwt per acre compared to the check with 45 cwt per acre. The remaining herbicide treatments did not vary greatly from the check. Table 6.

Culls - GA 10832 treatments had the highest yield of culls, and as the rate of the product increased the yield of culls decreased. In the EPTC and vernolate treatments cull yields were lower. Table 7.

In Table 8, is found a summary of yield data by potato grade and weed control scores.

Table 1. Herbicides used in the experiments.

| Common Name | Trade Name or Other | Chemical Name | Company |
|---|---|---|---|
| EPTC | Eptam | S-ethyl dipropylthio-carbamate | Stauffer |
| vernolate | Vernam | S-propyldipropylthiocarbamate | Stauffer |
| basalin | BAS 3921 | No chemistry available | BASF |
| trifluralin | Treflan | a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine | Elli Lilly |
| GA 10832 | Tolban | N-(Cyclopropylmethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluldine | CIBA-Geigy |
| A-820 | Amex | N-secondary-butyl-4-tertiary-butyl-2,6-dinitroaniline | Amchem |
| metribuzin | Sencor<br>Lexone | 4-amino-6-tert-butyl-3-(methylthio)-as-triazin-5(4H)one | Chemagro |
| Bioxone | Probe | 2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione | Velsicol |
| Alachlor | Lasso | 2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide | Monsanto |

Table 2. Weed control readings from herbicide study on potatoes, Northwestern Agricultural Research Center, Kalispell, MT. Field No. X-1

| Treatment | | | Weed Control[5/] | |
|---|---|---|---|---|
| Herbicide | Rate #/A | Plot # | 0-10 | Remarks |
| | | Preplant Incorporate | | |
| EPTC | 3 | 101 | 0 | |
| | | 215 | 4 | All we see is fanweed, no grasses |
| | | 321 | 3 | |
| | | $\bar{x}$ | 2def[6/] | |
| EPTC | 4 | 102 | 3 | |
| | | 211 | 4 | |
| | | 302 | 4 | |
| | | $\bar{x}$ | 4bcde | |
| EPTC | 6 | 103 | 4 | |
| | | 216 | 5 | |
| | | 308 | 10 | |
| | | $\bar{x}$ | 6bc | |
| Vernolate | 3 | 104 | 7 | |
| | | 219 | 6 | |
| | | 307 | 8 | |
| | | $\bar{x}$ | 7ab | |
| Vernolate | 4 | 105 | 7 | |
| | | 212 | 4 | |
| | | 320 | 5 | |
| | | $\bar{x}$ | 5bcd | |
| Vernolate | 6 | 106 | 7 | |
| | | 226 | 8 | |
| | | 315 | 3 | |
| | | $\bar{x}$ | 6bc | |
| BAS 3921 | .75 | 107 | 0 | |
| | | 201 | 0 | |
| | | 303 | 0 | |
| | | $\bar{x}$ | 0f | |
| BAS 3921 | 1 | 108 | 0 | |
| | | 228 | 4 | |
| | | 301 | 0 | |
| | | $\bar{x}$ | 1ef | |
| BAS 3921 | 1.5 | 109 | 0 | |
| | | 208 | 2 | |
| | | 329 | 1 | |
| | | $\bar{x}$ | 1ef | |
| BAS 3921 | 2 | 110 | 0 | |
| | | 222 | 0 | |
| | | 312 | 0 | |
| | | $\bar{x}$ | 0f | |

Table 2 . Con't.

| Treatment Herbicide | Rate #/A | Plot # | Weed Control[5/] 0-10 | Remarks |
|---|---|---|---|---|
| | | Post Plant, Pre emergence Incorporate | | |
| Trifluralin | .5 | 111 | 0 | |
| | | 224 | 0 | |
| | | 305 | 0 | |
| | | $\bar{x}$ | 0f | |
| Trifluralin | .75 | 112 | 0 | |
| | | 214 | 5 | |
| | | 310 | 3 | Some setaria |
| | | $\bar{x}$ | 3cdef | |
| Trifluralin | 1 | 113 | 2 | |
| | | 205 | 0 | |
| | | 306 | 6 | |
| | | $\bar{x}$ | 3cdef | |
| GA 10832 | .5 | 114 | 0 | |
| | | 230 | 2 | Considerable setaria in this plot |
| | | 314 | 0 | |
| | | $\bar{x}$ | 1ef | |
| GA 10832 | .75 | 115 | 2 | |
| | | 217 | 5 | |
| | | 316 | 0 | |
| | | $\bar{x}$ | 2def | |
| GA 10832 | 1 | 116 | 0 | One row missing from this plot |
| | | 225 | 0 | |
| | | 330 | 2 | Some setaria |
| | | $\bar{x}$ | 1ef | |
| A 820 | 1 | 117 | 0 | |
| | | 221 | 0 | Some setaria, no fanweed |
| | | 313 | 0 | |
| | | $\bar{x}$ | 0f | |
| A 820 | 1.5 | 118 | 2 | |
| | | 220 | 4 | |
| | | 322 | 2 | |
| | | $\bar{x}$ | 3cdef | |
| A 820 | 2 | 119 | 0 | |
| | | 223 | 5 | |
| | | 304 | 2 | |
| | | $\bar{x}$ | 2def | |
| | | Post Plant Pre emergence | | |
| Metribuzin | .5 | 120 | 10 | |
| | | 213 | 10 | |
| | | 327 | 10 | |
| | | $\bar{x}$ | 10a | |

Table 2 . Con't.

| Treatment | | | Weed Control[5/] | |
|---|---|---|---|---|
| Herbicide | Rate #/A | Plot # | 0-10 | Remarks |
| Probe 75 | 1.5 | 121 | 0 | Quite a little grass showing up |
| | | 207 | 3 | |
| | | 311 | 2 | |
| | | $\bar{x}$ | 2def | |
| Probe 75 | 2 | 122 | 2 | |
| | | 206 | 2 | |
| | | 318 | 9 | |
| | | $\bar{x}$ | 4bcde | |
| Probe 75 | 3 | 123 | 5 | |
| | | 202 | 5 | |
| | | 323 | 5 | Some lambsquarter showing up here |
| | | $\bar{x}$ | 5bcd | |
| | Preplant, Post plant + Post emergence Combinations | | | |
| Alachor[1/] Metribuzin[3/] | 1.5 .5 | 124 | 10 | |
| | | 229 | 10 | |
| | | 328 | 10 | |
| | | $\bar{x}$ | 10a | |
| Metribuzin[3/] + EPTC[1/] | .5 3 | 125 | 10 | |
| | | 204 | 10 | |
| | | 324 | 10 | |
| | | $\bar{x}$ | 10a | |
| Metribuzin[3/] | .5 | 126 | 10 | |
| | | 218 | 10 | |
| | | 326 | 10 | |
| | | $\bar{x}$ | 10a | |
| Metribuzin[2/3/] | .75+.75 | 127 | 10 | |
| | | 210 | 10 | Setaria still growing,will probably expire |
| | | 317 | 10 | |
| | | $\bar{x}$ | 10a | |
| Metribuzin[2/3/] | .5 +.5 | 128 | 10 | |
| | | 209 | 10 | |
| | | 309 | 10 | Few setaria which will probably die |
| | | $\bar{x}$ | 10a | |
| Weeded Check | 0 | 129 | 0 | |
| | | 203 | 0 | |
| | | 319 | 0 | |
| | | $\bar{x}$ | 0f | |
| Non weeded Check | 0 | 130 | 0 | |
| | | 227 | 0 | |
| | | 325 | 0 | |
| | | $\bar{x}$ | 0f | |

Table 2. (con't)

| Herbicide | Rate #/A | Plot # | Weed Control 0-10 [5/] |
|---|---|---|---|
| | | $\bar{x}$ | 3.9 |
| | | F [7/] | 15.55 |
| | | S.E.$\bar{x}$ | .93074 |
| | | C.V.% | 23.66 |

| | 6/1/73 | 6/13/73 | 7/5/73 |
|---|---|---|---|
| Temperature | 62 | 68-74 | 68 |
| Humidity | 50% | 32% | 29% |
| Cloud Cover | Cloudy | Partly cloudy | Cloudy |
| Wind Velocity | 0-3 | 0-3 | 0-3 |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
5/ Weed Score = 0 - No control; 10 - Complete control
6/ Items having common letters are not significantly different .05. Duncan's Multiple Range Test
7/ Value for treatment comparisons

Table 3. Yield and grade data from potato herbicide study. Northwestern Agricultural Research Center, Kalispell, MT, 1973. Field No. X-1

Planting Date: June 1 & 2, 1973
Harvest Date: October 3 & 4, 1973
Size of Plot: .222 sq. ft.

| Treatment | | | Pounds/Plot | | | | | |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | Plot # | #1 | #2 | Seed | Culls | Total | Cwt/A |
| | | Preplant Incorporate | | | | | | |
| EPTC | 3 | 101 | 3 | 40 | 99 | 5 | 147 | |
| | | 215 | 9 | 25 | 88 | 5 | 127 | |
| | | 321 | 5 | 34 | 70 | 6 | 115 | |
| | | Total | 17 | 99 | 257 | 16 | 389 | 254 |
| EPTC | 4 | 102 | 16 | 17 | 104 | 4 | 141 | |
| | | 211 | 7 | 31 | 86 | 3 | 127 | |
| | | 302 | 6 | 33 | 52 | 10 | 101 | |
| | | Total | 29 | 81 | 242 | 17 | 369 | 241 |
| EPTC | 6 | 103 | 12 | 20 | 99 | 8 | 139 | |
| | | 216 | 5 | 16 | 53 | 4 | 78 | |
| | | 308 | 12 | 37 | 91 | 2 | 142 | |
| | | Total | 29 | 73 | 243 | 14 | 359 | 235 |
| Vernolate | 3 | 104 | 7 | 31 | 99 | 12 | 149 | |
| | | 219 | 7 | 19 | 100 | 5 | 131 | |
| | | 307 | 7 | 24 | 109 | 3 | 143 | |
| | | Total | 21 | 74 | 308 | 20 | 423 | 277 |
| Vernolate | 4 | 105 | 8 | 15 | 83 | 7 | 113 | |
| | | 212 | 8 | 28 | 80 | 2 | 118 | |
| | | 320 | 11 | 28 | 101 | 5 | 145 | |
| | | Total | 27 | 71 | 264 | 14 | 376 | 246 |
| Vernolate | 6 | 106 | 13 | 23 | 69 | 2 | 107 | |
| | | 226 | 2 | 34 | 97 | 9 | 142 | |
| | | 315 | 14 | 20 | 96 | 3 | 133 | |
| | | Total | 29 | 77 | 262 | 14 | 382 | 250 |
| BAS 3921 | .75 | 107 | 16 | 19 | 148 | 6 | 189 | |
| | | 201 | 7 | 26 | 93 | 2 | 128 | |
| | | 303 | 5 | 23 | 91 | 5 | 124 | |
| | | Total | 28 | 68 | 332 | 13 | 441 | 288 |
| BAS 3921 | 1 | 108 | 20 | 16 | 104 | 4 | 144 | |
| | | 228 | 12 | 26 | 104 | 4 | 146 | |
| | | 301 | 8 | 26 | 76 | 8 | 118 | |
| | | Total | 40 | 68 | 284 | 16 | 408 | 267 |
| BAS 3921 | 1.5 | 109 | 10 | 20 | 89 | 2 | 121 | |
| | | 208 | 14 | 13 | 105 | 5 | 137 | |
| | | 329 | 5 | 30 | 100 | 2 | 137 | |
| | | Total | 29 | 63 | 294 | 9 | 395 | 258 |
| BAS 3921 | 2 | 110 | 6 | 23 | 108 | 6 | 143 | |
| | | 222 | 8 | 32 | 68 | 11 | 119 | |
| | | 312 | 19 | 41 | 75 | 8 | 143 | |
| | | Total | 33 | 96 | 251 | 25 | 405 | 265 |

Table 3 . Con't.

| Treatment | | | Pounds/Plot | | | | | |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | Plot # | #1 | #2 | Seed | Culls | Total | Cwt/A |
| | | Post plant, Pre emergence Incorporate | | | | | | |
| Trifluralin | .5 | 111 | 0 | 34 | 107 | 2 | 143 | |
| | | 224 | 8 | 34 | 126 | 7 | 175 | |
| | | 305 | 8 | 33 | 95 | 11 | 147 | |
| | | Total | 16 | 101 | 328 | 20 | 465 | 304 |
| Trifluralin | .75 | 112 | 6 | 40 | 92 | 5 | 143 | |
| | | 214 | 18 | 43 | 92 | 9 | 162 | |
| | | 310 | 8 | 21 | 113 | 5 | 147 | |
| | | Total | 32 | 104 | 297 | 19 | 452 | 296 |
| Trifluralin | 1 | 113 | 11 | 28 | 104 | 10 | 153 | |
| | | 205 | 15 | 16 | 86 | 15 | 132 | |
| | | 306 | 8 | 36 | 92 | 6 | 142 | |
| | | Total | 34 | 80 | 282 | 31 | 427 | 278 |
| GA 10832 | .5 | 114 | 20 | 18 | 116 | 9 | 163 | |
| | | 230 | 6 | 41 | 111 | 9 | 167 | |
| | | 314 | 20 | 29 | 82 | 15 | 146 | |
| | | Total | 46 | 88 | 309 | 33 | 476 | 311 |
| GA 10832 | .75 | 115 | 11 | 20 | 92 | 13 | 136 | |
| | | 217 | 7 | 22 | 104 | 5 | 138 | |
| | | 316 | 7 | 45 | 101 | 4 | 157 | |
| | | Total | 25 | 87 | 297 | 22 | 431 | 282 |
| GA 10832 | 1 | 116 | 41 | 29 | 108 | 7 | 185 | |
| | | 225 | 10 | 43 | 99 | 8 | 160 | |
| | | 330 | 9 | 36 | 115 | 2 | 162 | |
| | | Total | 60 | 108 | 322 | 17 | 507 | 332 |
| A 820 | 1 | 117 | 6 | 18 | 96 | 10 | 130 | |
| | | 221 | 16 | 23 | 70 | 5 | 114 | |
| | | 313 | 14 | 36 | 82 | 5 | 137 | |
| | | Total | 36 | 77 | 248 | 20 | 381 | 249 |
| A 820 | 1.5 | 118 | 2 | 25 | 125 | 5 | 157 | |
| | | 220 | 9 | 29 | 111 | 7 | 156 | |
| | | 322 | 14 | 17 | 66 | 2 | 99 | |
| | | Total | 25 | 71 | 302 | 14 | 412 | 269 |
| A 820 | 2 | 119 | 6 | 31 | 101 | 5 | 143 | |
| | | 223 | 10 | 35 | 85 | 5 | 135 | |
| | | 304 | 10 | 41 | 102 | 8 | 161 | |
| | | Total | 26 | 107 | 288 | 18 | 439 | 287 |
| | | Post plant Pre emergence | | | | | | |
| Metribuzin | .5 | 120 | 9 | 25 | 101 | 5 | 140 | |
| | | 213 | 14 | 35 | 91 | 9 | 149 | |
| | | 327 | 14 | 30 | 79 | 2 | 125 | |
| | | Total | 37 | 90 | 271 | 16 | 414 | 271 |

Table 3. Con't.

| Treatment | | Plot # | Pounds/Plot | | | | | Cwt/A |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | | #1 | #2 | Seed | Culls | Total | |
| Probe 75% | 1.5 | 121 | 9 | 24 | 99 | 5 | 137 | |
| | | 207 | 17 | 16 | 98 | 10 | 141 | |
| | | 311 | 20 | 34 | 77 | 12 | 143 | |
| | | Total | 46 | 74 | 274 | 27 | 421 | 275 |
| Probe 75% | 2 | 122 | 9 | 24 | 103 | 7 | 143 | |
| | | 206 | 2 | 23 | 73 | 5 | 103 | |
| | | 318 | 7 | 34 | 84 | 2 | 127 | |
| | | Total | 18 | 81 | 260 | 14 | 373 | 244 |
| Probe 75% | 3 | 123 | 19 | 24 | 103 | 5 | 151 | |
| | | 202 | 4 | 33 | 100 | 5 | 142 | |
| | | 323 | 7 | 32 | 75 | 8 | 122 | |
| | | Total | 30 | 89 | 278 | 18 | 415 | 271 |
| Preplant, Post plant + Post emergence Combinations | | | | | | | | |
| Alachor[1] + Metribuzin[3] | 1.5 + .5 | 124 | 11 | 27 | 113 | 3 | 154 | |
| | | 229 | 10 | 22 | 120 | 3 | 155 | |
| | | 328 | 10 | 27 | 84 | 9 | 130 | |
| | | Total | 31 | 76 | 317 | 15 | 439 | 287 |
| Metribuzin[3] + EPTC[1] | .5 + 3 | 125 | 3 | 11 | 77 | 8 | 99 | |
| | | 204 | 10 | 22 | 120 | 7 | 159 | |
| | | 324 | 17 | 35 | 69 | 12 | 133 | |
| | | Total | 30 | 68 | 266 | 27 | 391 | 256 |
| Metribuzin[3] | .5 | 126 | 17 | 39 | 101 | 8 | 165 | |
| | | 218 | 14 | 16 | 110 | 3 | 143 | |
| | | 326 | 11 | 26 | 107 | 4 | 148 | |
| | | Total | 42 | 81 | 318 | 15 | 456 | 298 |
| Metribuzin[2/3] | .75+.75 | 127 | 4 | 20 | 105 | 5 | 134 | |
| | | 210 | 8 | 26 | 111 | 5 | 150 | |
| | | 317 | 9 | 22 | 93 | 5 | 129 | |
| | | Total | 21 | 68 | 309 | 15 | 413 | 270 |
| Metribuzin[2/3] | .5 +.5 | 128 | 13 | 15 | 95 | 3 | 126 | |
| | | 209 | 7 | 24 | 103 | 2 | 136 | |
| | | 309 | 6 | 43 | 91 | 3 | 143 | |
| | | Total | 26 | 82 | 289 | 8 | 405 | 265 |
| Weeded Check | 0 | 129 | 7 | 22 | 85 | 3 | 117 | |
| | | 203 | 17 | 28 | 115 | 7 | 167 | |
| | | 319 | 8 | 16 | 116 | 2 | 142 | |
| | | Total | 32 | 66 | 316 | 12 | 426 | 279 |
| Non weeded Check | 0 | 130 | 5 | 13 | 81 | 3 | 102 | |
| | | 227 | 9 | 23 | 110 | 4 | 146 | |
| | | 325 | 10 | 37 | 85 | 9 | 141 | |
| | | Total | 24 | 73 | 276 | 16 | 389 | 255 |

Table 3 . (con't)

| Treatment | | | Pounds/Plot | | | | | |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | Plot # | #1 | #2 | Seed | Culls | Total | Cwt/A |
| | | $\bar{x}$ | 20.0 | 53 | 187 | 11.7 | | |
| | | F 4/ | .842 | .876 | .90NS | 1.21 | | |
| | | S.E.$\bar{x}$ | 6.71 | 9.0004 | 18.14 | 3.49 | | |
| | | C.V.% | 33.48 | 16.92 | 9.70 | 29.88 | | |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
4/ Value for treatment comparisons

Table 4. Yield of seed grade potatoes from herbicide study, Northwestern Agricultural Research Center, Route 4, Kalispell, MT.

Planting Date: June 1 & 2, 1973
Harvest Date: October 3 & 4, 1973
Size of Plot: 222 sq. ft.

| Treatment | | Pounds/Plot | | | | Yield |
|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | Cwt/A |
| | | **Preplant Incorporate** | | | | |
| EPTC | 3 | 99 | 88 | 70 | 257 | 168 |
| EPTC | 4 | 104 | 86 | 52 | 242 | 158 |
| EPTC | 6 | 99 | 53 | 91 | 243 | 159 |
| Vernolate | 3 | 99 | 100 | 109 | 308 | 201 |
| Vernolate | 4 | 83 | 80 | 101 | 264 | 173 |
| Vernolate | 6 | 69 | 97 | 96 | 262 | 171 |
| BAS 3921 | .75 | 148 | 93 | 91 | 332 | 217 |
| BAS 3921 | 1 | 104 | 104 | 76 | 284 | 186 |
| BAS 3921 | 1.5 | 89 | 105 | 100 | 294 | 192 |
| BAS 3921 | 2 | 108 | 68 | 75 | 251 | 164 |
| | | **Post plant, Pre emergence Incorporate** | | | | |
| Trifluralin | .5 | 107 | 126 | 95 | 328 | 215 |
| Trifluralin | .75 | 92 | 92 | 113 | 297 | 194 |
| Trifluralin | 1 | 104 | 86 | 92 | 282 | 184 |
| GA 10832 | .5 | 116 | 111 | 82 | 309 | 202 |
| GA 10832 | .75 | 92 | 104 | 101 | 297 | 194 |
| GA 10832 | 1 | 108 | 99 | 115 | 322 | 211 |
| A 820 | 1 | 96 | 70 | 82 | 248 | 162 |
| A 820 | 1.5 | 125 | 111 | 66 | 302 | 198 |
| A 820 | 2.0 | 101 | 85 | 102 | 288 | 188 |
| | | **Post plant, Pre emergence** | | | | |
| Metribuzin | .5 | 101 | 91 | 79 | 271 | 177 |
| Probe 75% | 1.5 | 99 | 98 | 77 | 274 | 179 |
| Probe 75% | 2 | 103 | 73 | 84 | 260 | 170 |
| Probe 75% | 3 | 103 | 100 | 75 | 278 | 182 |
| | | **Preplant, Post plant + Post emergence Combinations** | | | | |
| Alachor[1/] + Metribuzin[3/] | 1.5 .5 | 113 | 120 | 84 | 317 | 207 |
| Metribuzin[3/] + EPTC[1/] | .5 3 | 77 | 120 | 69 | 266 | 174 |
| Metribuzin[3/] | .5 | 101 | 110 | 107 | 318 | 208 |
| Metribuzin[2/3/] | .75+.75 | 105 | 111 | 93 | 309 | 202 |
| Metribuzin[2/3/] | .5 +.5 | 95 | 103 | 91 | 289 | 189 |
| Weeded Check | 0 | 85 | 115 | 116 | 316 | 207 |
| Non Weeded Check | 0 | 81 | 110 | 85 | 276 | 181 |

Table 4 . (Con't)

| Treatment | | Pounds/Plot | | | | Yield |
|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | Cwt/A |
| | | | | $\bar{x}$ | | 187 |
| | | | | F 4/ | | .90NS |
| | | | | S.E.$\bar{x}$ | | 18.14 |
| | | | | C.V.% | | 9.70 |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
4/ Value for treatment comparisons

Table 5. Yield of #1 potatoes from herbicide study, Northwestern Agricultural Research Center, Route 4, Kalispell, MT. Field No. X-1.

| Treatment | | Pounds/Plot | | | | | Yield |
|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ | Cwt/A |
| **Preplant Incorporate** | | | | | | | |
| EPTC | 3 | 3 | 9 | 5 | 17 | 5.7 | 11 |
| EPTC | 4 | 16 | 7 | 6 | 29 | 9.7 | 19 |
| EPTC | 6 | 12 | 5 | 12 | 29 | 9.7 | 19 |
| Vernolate | 3 | 7 | 7 | 7 | 21 | 7.0 | 14 |
| Vernolate | 4 | 8 | 8 | 11 | 27 | 9.0 | 18 |
| Vernolate | 6 | 13 | 2 | 14 | 29 | 9.7 | 19 |
| BAS 3921 | .75 | 16 | 7 | 5 | 28 | 9.3 | 18 |
| BAS 3921 | 1 | 20 | 12 | 8 | 40 | 13.3 | 26 |
| BAS 3921 | 1.5 | 10 | 14 | 5 | 29 | 9.7 | 19 |
| BAS 3921 | 2.0 | 6 | 8 | 19 | 33 | 11.0 | 22 |
| **Post Plant, Pre emergence Incorporate** | | | | | | | |
| Trifluralin | .5 | 0 | 8 | 8 | 16 | 5.3 | 10 |
| Trifluralin | .75 | 6 | 18 | 8 | 32 | 10.7 | 21 |
| Trifluralin | 1 | 11 | 15 | 8 | 34 | 11.3 | 22 |
| GA 10832 | .5 | 20 | 6 | 20 | 46 | 15.3 | 30 |
| GA 10832 | .75 | 11 | 7 | 7 | 25 | 8.3 | 16 |
| GA 10832 | 1 | 41 | 10 | 9 | 60 | 20.0 | 39 |
| A 820 | 1 | 6 | 16 | 14 | 36 | 12.0 | 24 |
| A 820 | 1.5 | 2 | 9 | 14 | 25 | 8.3 | 16 |
| A 820 | 2 | 6 | 10 | 10 | 26 | 8.7 | 17 |
| **Post plant, Pre emergence** | | | | | | | |
| Metribuzin | .5 | 9 | 14 | 14 | 37 | 12.3 | 24 |
| Probe 75% | 1.5 | 9 | 17 | 20 | 46 | 15.3 | 30 |
| Probe 75% | 2 | 9 | 2 | 7 | 18 | 6.0 | 12 |
| Probe 75% | 3 | 19 | 4 | 7 | 30 | 10.0 | 20 |
| **Preplant, Post plant + Post emergence Combinations** | | | | | | | |
| Alachor 1/ + Metribuzin 3/ | 1.5+.5 | 11 | 10 | 10 | 31 | 10.3 | 20 |
| Metribuzin 3/ + EPTC 1/ | .5+3 | 3 | 10 | 17 | 30 | 10.0 | 20 |
| Metribuzin 3/ | .5 | 17 | 14 | 11 | 42 | 14.0 | 27 |
| Metribuzin 2/3/ | .75+.75 | 4 | 8 | 9 | 21 | 7.0 | 14 |
| Metribuzin 2/3/ | .5 +.5 | 13 | 7 | 6 | 26 | 8.7 | 17 |
| Weeded Check | 0 | 7 | 17 | 8 | 32 | 10.7 | 21 |
| Non weeded Check | 0 | 5 | 9 | 10 | 24 | 8.0 | 16 |
| | | | | | $\bar{x}$ | | 20.0 |
| | | | | | F 4/ | | .842NS |
| | | | | | S.E.$\bar{x}$ | | 6.71 |
| | | | | | C.V.% | | 33.48 |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
4/ Value for treatment comparisons

Table 6. Yield #2 potatoes from herbicide study, Northwestern Agricultural Research Center, Kalispell, MT. Field X-1.

| Treatment | | Pounds/Plot | | | | | Yield |
|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ | Cwt/A |
| **Preplant Incorporate** | | | | | | | |
| EPTC | 3 | 40 | 25 | 34 | 99 | 33.0 | 65 |
| EPTC | 4 | 17 | 31 | 33 | 81 | 27.0 | 53 |
| EPTC | 6 | 20 | 16 | 37 | 73 | 24.3 | 48 |
| Vernolate | 3 | 31 | 19 | 24 | 74 | 24.7 | 48 |
| Vernolate | 4 | 15 | 28 | 28 | 71 | 23.7 | 46 |
| Vernolate | 6 | 23 | 34 | 20 | 77 | 25.7 | 50 |
| BAS 3921 | .75 | 19 | 26 | 23 | 68 | 22.7 | 44 |
| BAS 3921 | 1 | 16 | 26 | 26 | 68 | 22.7 | 44 |
| BAS 3921 | 1.5 | 20 | 13 | 30 | 63 | 21.0 | 41 |
| BAS 3921 | 2 | 23 | 32 | 41 | 96 | 32.0 | 63 |
| **Post plant, Pre emergence Incorporate** | | | | | | | |
| Trifluralin | .5 | 34 | 34 | 33 | 101 | 33.7 | 66 |
| Trifluralin | .75 | 40 | 43 | 21 | 104 | 34.7 | 68 |
| Trifluralin | 1 | 28 | 16 | 36 | 80 | 26.7 | 52 |
| GA 10832 | .5 | 18 | 41 | 29 | 88 | 29.3 | 58 |
| GA 10832 | .75 | 20 | 22 | 45 | 87 | 29.0 | 57 |
| GA 10832 | 1 | 29 | 43 | 36 | 108 | 36.0 | 71 |
| A 820 | 1 | 18 | 23 | 36 | 77 | 25.7 | 50 |
| A 820 | 1.5 | 25 | 29 | 17 | 71 | 23.7 | 46 |
| A 820 | 2 | 31 | 35 | 41 | 107 | 35.7 | 70 |
| **Post plant, Pre emergence** | | | | | | | |
| Metribuzin | .5 | 25 | 35 | 30 | 90 | 30.0 | 59 |
| Probe 75% | 1.5 | 24 | 16 | 34 | 74 | 24.7 | 48 |
| Probe 75% | 2 | 24 | 23 | 34 | 81 | 27.0 | 53 |
| Probe 75% | 3 | 24 | 33 | 32 | 89 | 29.7 | 58 |
| **Preplant, Post plant + Post emergence Combinations** | | | | | | | |
| Alachor[1/] + Metribuzin[3/] | 1.5+ .5 | 27 | 22 | 27 | 76 | 25.3 | 50 |
| Metribuzin[3/] + EPTC[1/] | .5+3 | 11 | 22 | 35 | 68 | 22.7 | 44 |
| Metribuzin[3/] | .5 | 39 | 16 | 26 | 81 | 27.0 | 53 |
| Metribuzin[2/3/] | .75+.75 | 20 | 26 | 22 | 68 | 22.7 | 44 |
| Metribuzin[2/3/] | .5 +.5 | 15 | 24 | 43 | 82 | 27.3 | 54 |
| Weeded Check | 0 | 22 | 28 | 16 | 66 | 22.0 | 43 |
| Non weeded Check | 0 | 13 | 23 | 37 | 73 | 24.3 | 48 |
| | | | | | $\bar{x}$ | | 53 |
| | | | | | F[4/] | | .876NS |
| | | | | | S.E.$\bar{x}$ | | 9.0004 |
| | | | | | C.V.% | | 16.92 |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
4/ Value for treatment comparisons

Table 7. Yield data from potatoes treated with various herbicides for weed control (culls). Northwestern Agricultural Research Center, Route 4, Kalispell, MT. Field No. X-1.

| Treatment | | Pounds/Plot | | | | | Yield |
|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ | Cwt/A |
| **Preplant Incorporate** | | | | | | | |
| EPTC | 3 | 5 | 5 | 6 | 16 | 5.3 | 11 |
| EPTC | 4 | 4 | 3 | 10 | 17 | 5.7 | 11 |
| EPTC | 6 | 8 | 4 | 2 | 14 | 4.7 | 9 |
| Vernolate | 3 | 12 | 5 | 3 | 20 | 6.7 | 13 |
| Vernolate | 4 | 7 | 2 | 5 | 14 | 4.7 | 9 |
| Vernolate | 6 | 2 | 9 | 3 | 14 | 4.7 | 9 |
| BAS 3921 | .75 | 6 | 2 | 5 | 13 | 4.3 | 9 |
| BAS 3921 | 1 | 4 | 4 | 8 | 16 | 5.3 | 11 |
| BAS 3921 | 1.5 | 2 | 5 | 2 | 9 | 3.0 | 6 |
| BAS 3921 | 2 | 6 | 11 | 8 | 25 | 8.3 | 16 |
| **Post plant, Pre emergence Incorporate** | | | | | | | |
| Trifluralin | .5 | 2 | 7 | 11 | 20 | 6.7 | 13 |
| Trifluralin | .75 | 5 | 9 | 5 | 19 | 6.3 | 12 |
| Trifluralin | 1 | 10 | 15 | 6 | 31 | 10.3 | 20 |
| GA 10832 | .5 | 9 | 9 | 15 | 33 | 11.0 | 22 |
| GA 10832 | .75 | 13 | 5 | 4 | 22 | 7.3 | 14 |
| GA 10832 | 1 | 7 | 8 | 2 | 17 | 5.7 | 11 |
| A 820 | 1 | 10 | 5 | 5 | 20 | 6.7 | 13 |
| A 820 | 1.5 | 5 | 7 | 2 | 14 | 4.7 | 9 |
| A 820 | 2 | 5 | 5 | 8 | 18 | 6.0 | 12 |
| **Post plant, Pre emergence** | | | | | | | |
| Metribuzin | .5 | 5 | 9 | 2 | 16 | 5.3 | 11 |
| Probe 75% | 1.5 | 5 | 10 | 12 | 27 | 9.0 | 18 |
| Probe 75% | 2 | 7 | 5 | 2 | 14 | 4.7 | 9 |
| Probe 75% | 3 | 5 | 5 | 8 | 18 | 6.0 | 12 |
| **Pre plant, Post plant + Post emergence Combinations** | | | | | | | |
| Alachor 1/ + Metribuzin 3/ | 1.5+ .5 | 3 | 3 | 9 | 15 | 5.0 | 10 |
| Metribuzin 3/ + EPTC 1/ | .5+3 | 8 | 7 | 12 | 27 | 9.0 | 18 |
| Metribuzin 3/ | .5 | 8 | 3 | 4 | 15 | 5.0 | 10 |
| Metribuzin 2/3/ | .75+.75 | 5 | 5 | 5 | 15 | 5.0 | 10 |
| Metribuzin 2/3/ | .5 +.5 | 3 | 2 | 3 | 8 | 2.7 | 5 |
| Weeded Check | 0 | 3 | 7 | 2 | 12 | 4.0 | 9 |
| Non weeded Check | 0 | 3 | 4 | 9 | 16 | 5.3 | 11 |
| | | | | | $\bar{x}$ | | 11.7 |
| | | | | | F 4/ | | 1.21NS |
| | | | | | S.E.$\bar{x}$ | | 3.49 |
| | | | | | C.V.% | | 29.88 |

1/ Preplant incorporate
2/ Post plant pre emergence
3/ Post emergence
4/ Value for treatment comparisons

Table 8. Summary of weed control, yield and grade data from various herbicides used on netted gem potatoes in 1973. Northwestern Agricultural Research Center, Kalispell, Montana. Field No. X-1.

| Treatment | | Weed Score | Yield cwt/acre | | | | |
|---|---|---|---|---|---|---|---|
| Herbicide | Rate #A | 0-10[5/] | # 1's | # 2's | Seed | Culls | Total |
| | | Preplant Incorporate | | | | | |
| EPTC | 3 | 2def[6/] | 11 | 65 | 168 | 11 | 254 |
| EPTC | 4 | 4bcde | 19 | 53 | 158 | 1 | 241 |
| EPTC | 6 | 6bc | 19 | 48 | 159 | 11 | 235 |
| Vernolate | 3 | 7ab | 14 | 48 | 201 | 13 | 276 |
| Vernolate | 4 | 5bcd | 18 | 46 | 173 | 9 | 246 |
| Vernolate | 6 | 6bc | 19 | 50 | 171 | 9 | 249 |
| BAS 3921 | .75 | 0f | 18 | 44 | 217 | 9 | 288 |
| BAS 3921 | 1 | 1ef | 26 | 44 | 186 | 11 | 267 |
| BAS 3921 | 1.5 | 1ef | 19 | 41 | 192 | 6 | 258 |
| BAS 3921 | 2.0 | 0f | 22 | 63 | 164 | 16 | 265 |
| | | Post plant, Pre emergence Incorporate | | | | | |
| Trifluralin | .5 | 0f | 10 | 66 | 215 | 13 | 304 |
| Trifluralin | .75 | 3cdef | 21 | 68 | 195 | 12 | 296 |
| Trifluralin | 1.0 | 3cdef | 22 | 52 | 184 | 20 | 278 |
| GA 10832 | .5 | 1ef | 30 | 58 | 202 | 21 | 311 |
| GA 10832 | .75 | 2def | 16 | 57 | 194 | 15 | 282 |
| GA 10832 | 1.0 | 1ef | 39 | 71 | 211 | 11 | 332 |
| A 820 | 1.0 | 0f | 24 | 50 | 162 | 13 | 249 |
| A 820 | 1.5 | 3cdef | 16 | 46 | 198 | 9 | 269 |
| A 820 | 2.0 | 2def | 17 | 70 | 188 | 12 | 287 |
| | | Post plant, Pre emergence | | | | | |
| Metribuzin | .5 | 10a | 24 | 59 | 177 | 11 | 271 |
| Probe 75% | 1.5 | 2def | 30 | 48 | 179 | 18 | 275 |
| Probe 75% | 2.0 | 4bcde | 12 | 53 | 170 | 9 | 244 |
| Probe 75% | 3.0 | 5bcd | 20 | 58 | 182 | 11 | 271 |
| | | Preplant, Post plant and Post emergence combinations | | | | | |
| Alachor[1/] + metribuzin[3/] | 1.5 + .5 | 10a | 20 | 50 | 207 | 10 | 287 |
| Metribuzin[3/] + EPTC[1/] | .5 +3 | 10a | 20 | 44 | 174 | 18 | 256 |
| Metribuzin[3/] | .5 | 10a | 27 | 53 | 208 | 10 | 298 |
| Metribuzin[2/3/] | .75[2/] + .75[3/] | 10a | 14 | 44 | 202 | 10 | 270 |
| Metribuzin[2/3/] | .5[2/] + .5[3/] | 10a | 17 | 54 | 189 | 5 | 265 |
| Weeded check | 0 | 0f | 21 | 43 | 207 | 8 | 279 |
| Non weeded check | 0 | 0f | 16 | 48 | 181 | 10 | 255 |
| Mean | | 3.9 | 20.0 | 53.0 | 187 | 12 | 272 |
| F[7/] | | 15.55** | .842NS | .876NS | .90NS | 1.21NS | 1.09 NS |
| S.E.$\bar{x}$ | | .930 | 6.71 | 9.00 | 18.14 | 3.49 | 21.23 |
| C.V. % | | 23.66 | 33.48 | 16.92 | 9.70 | 29.88 | 7.80 |

Table 8 . (con't)

| Application data: | 6/1/73 | 6/13/73 | 7/5/73 |
|---|---|---|---|
| Temperature: | 62 degrees | 68-74 degrees | 68 degrees |
| Humidity: | 50 % | 32 % | 29 % |
| Cloud cover: | cloudy | partly cloudy | cloudy |
| Wild velocity: | 0-3 mph | 0-3 mph | 0-3 mph |

1/ pre plant incorporate
2/ post plant pre emergence
3/ post emergence
4/ value for treatment comparison
5/ weed score = 0 = no control; 10 = complete control
6/ items having common letters are not significantly different (.05) Duncan's Multiple Range Test
7/ value for treatment comparison

TITLE: Glyphosate Evaluation

PROJECT: Weed Investigations MS 754

YEAR: 1973

PERSONNEL: Leader - Vern R. Stewart
Cooperators - Monsanto Chemical Company, St. Louis Mo.

LOCATION: Northwestern Agricultural Research Center, Field numbers. R-8c and R-13.
Gregory Bruyer Farm, Route 4, Kalispell, Montana
Robert Stonebrook farm, Plains, Montana

OBJECTIVES: Determine the effectiveness of glyphosate on several perennial weeds, and rates necessary to give effective control.

SIGNIFICANT FINDINGS:

Glyphosate gave excellent control of Canada thistle under high moisture conditions. More material per acre was needed when field bindweed and leafy spurge were under moisture stress.

There was no injury to lilac and caragana when glyphosate was used in these species.

MATERIALS AND METHODS:

Five individual experiments were conducted with glyphosate in 1973. These were all conducted on perennial weeds which included the following species: field bindweed (Convolvulus arvensis (L.)); Canada thistle (Cirsium arvense (L.)); leafy spurge (Euphorbia esula (L.)); and quackgrass (Agropyron repens (L.)). All of these were natural populations of weeds. The location, moisture and soil conditions data will be found under results and discussions for each experiment. The data obtained in general were weed scores (visual observations). In the quackgrass study, wheat was seeded following application of glyphosate and yield of wheat was measured.

RESULTS AND DISCUSSION:

In the fall of 1972, three experiments were established in three locations on or near the Northwestern Agricultural Research Center. The species with which we were concerned were; field bindweed, quackgrass and leafy spurge.

Experiment I - Glyphosate was applied to field bindweed on the Gregory Bruyer farm, Route 4, Kalispell. Applications were made September 4, 1972 to a heavy stand of wild oats and field bindweed. It had been the plan in this study to till the area treated ten days following the application of the herbicide. Fifteen days following application there was excellent control of wild oats, but little or no apparant control of the bindweed. Therefore, the plan to seed to winter wheat was changed to watch for the effect of the glyphosate on the bindweed. In the springof 1973 we found a real dense population of wild oats. An examination of the test area revealed excellent control of field bindweed. The wild oats were removed so the plots could be more carefully evaluated for field bindweed stand.

All rates of glyphosate gave excellent control of the field bindweed. There was an occasional bindweed plant in some plots. Table 1.

Experiment II - In this experiment, glyphosate was applied at four rates (plus check) to a natural stand of quackgrass, six inches tall. Ten days after application the treated plots were tilled and seeded with Gaines winter wheat at right angles to the treatments, September 22, 1972. In the spring of 1973 the test area was sprayed for broadleaf control using bromoxynil + MCP.

The most effective weed control was obtained with two and one-half pounds of glyphosate. As the rate of glyphosate increased the yields also increased, however not all the increases were statistically significant between glyphosate treatments, however all treatemtns were significantly higher in yield than the check. It was noted that the test weight of wheat was higher in the glyphosate plots than the check plot. Table 2.

Experiment III - Applications were made to established stands of leafy spurge in a field of sainfoin and bluegrass on the fifth day of September, 1972. At the time of application the soil conditions were very dry. Leafy spurge, sainfoin and bluegrass were somewhat dormant. In June of 1973, these plots were observed and evaluated with the use of a camera. At the 1 lb/a rate, there was a reduction in the height of the leafy spurge and slight injury was noted when compared with the check. At the 1.5 lbs/a rate, the reduction was somewhat greater than the 1 lb/a rate and more plant injury was noted. The 2 lbs/a rate did not vary too much from the 1 lb/a rate. At the 2.5 lbs/a rate spurge was severely stunted and caused some rosetting at the crown of the plant. This experiment is being continued and will be evaluated again in 1974. In all treatments the spurge was blooming, as was the check, except for the 2.5 lbs/a rate. From the literature available and the evidence presented herein, it would appear that leafy spurge is going to take more glyphosate than some of the other perennials.

Two studies were established on the Robert Stonebrook farm to evaluate the effectiveness of several herbicides on field bindweed and Canada thistle.

Experiment IV - Field Bindweed - Field bindweed was under considerable moisture stress and in bloom at the time of application. Included in this study were glyphosate, 2,4D and the combination of dicamba and 2,4D. 2,4D and dicamba + 2,4D combination resulted in more above ground tissue kill than some of the glyphosate treatments. In the glyphosate plots several plants remained with no apparent injry. A series of pictures of this is on file with Monsanto and at the Northwestern Agricultural Research Center. Four pounds per acre rate of glyphosate was necessary to get an effective control. These data plus other data from the Canada thistle study, which also contained field bindweed, indicated that approximately 2 lbs/a of glyphosate will be needed to get effective control of this species. Table 3.

Experiment V - Canada Thistle - The test site was in a field of established mint with a natural stand of Canada thistle. The site had been irrigated several times during the growing season. Weed control readings were made 24 days following application of the herbicides.

All rates of glyphosate were very effective in the control of Canada thistle. 2,4D and the combination of dicamba and 2,4D were not as effective as they were in the bindweed study. Table 4.

For the record: Glyphosate was applied at 1 lb/a to a dense stand of quackgrass, eight to ten inches tall, May 5, 1973. Approximately ten days after application the plants began to show signs of stress. Approximately two weeks after application the soil was tilled and a vegetable garden was planted. All vegetables grew with no indications of phytotoxicity. The annual weed population was very dense. In the garden area there was some rhubarb planted and an Engleman spruce tree which were sprayed with glyphosate. There was no apparant injury to the plant except they may have been stunted somewhat, but they were not killed nor did the leaves turn brown.

Glyphosate has many possibilities and one of them is the removing of undesirable plants from a desireable plant population. This was done this past season by mixing a solution of glyphosate and water at the recommended spraying rate, then using a glove soaked in the solution, plants to be removed from a plant populatin were grasped, the leaf rubbed. This was very effective in removing quackgrass from a stand of alfalfa. It was also an effective technique for removing quackgrass from a newly established lawn. Glyphosate was used by our station to remove quackgrass from underneath a hedge consisting of caragana and lilac. There was no injury to the lilac or the caragana.

Table 1. Effect of various rates of glyphosate when applied to a natural stand of field bindweed in grain stubble. Gregory Bruyer farm, Route 4, Kalispell, Montana.

Size of plot: 200 square feet.

| Treatment | | Weed Control[1] | | | | |
|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ |
| Glyphosate | 1.0 | 3 | 0 | 3 | 6 | 2.0 |
| Glyphosate | 1.5 | 0 | 1 | 0 | 1 | .3 |
| Glyphosate | 2.0 | 0 | 0 | 7 | 7 | 2.3 |
| Glyphosate | 2.5 | 2 | 0 | 0 | 2 | .7 |
| Check | 0 | 98 | 95 | 90 | 283 | 92.0 |

| | | |
|---|---|---|
| | $\bar{x}$ | 19.9 |
| | F[2] | 595.6 |
| | S.E.$\bar{x}$ | 1.704 |
| | C.V. % | 8.55 |

1/ Average of three measurements from each plot on a diagonal across plot using an one inch square foot quadrant, and visually estimating percent of the quadrant that was filled by field bindweed.

2/ Value for treatment comparison

Application data:

Date: 9/4/72
Temperature: 68 degrees
Humidity: --
Cloud cover: clear
Wind velocity: calm
Stage of growth: blooming

Table 2. Effect of various rates of glyphosate when applied to quackgrass, then seeded to Nugaines fall wheat. Northwestern Agricultural Research Center, Kalispell, Montana. 1972-73. Field No. R-13.

Date seeded: September 22, 1972 Date harvested: August 28, 1973
Size of plot: 18 square feet

| Herbicide | Rate #/A | Weed Score 0-10 1/ | Grams per Plot I | II | III | Total | Yield bu/a | Test Wt. lbs/bu |
|---|---|---|---|---|---|---|---|---|
| Glyphosate | 1.0 | 5.0 | 636 | 726 | 822 | 2184 | 64.73* | 59.1 |
| Glyphosate | 1.5 | 5.7 | 625 | 733 | 923 | 2281 | 67.61* | 59.8 |
| Glyphosate | 2.0 | 5.0 | 884 | 750 | 733 | 2367 | 70.16* | 60.3 |
| Glyphosate | 2.5 | 6.6 | 881 | 783 | 873 | 2537 | 75.20* | 60.3 |
| Check | 0.0 | 0.0 | 554 | 492 | 588 | 1634 | 48.43 | 58.5 |
| $\bar{x}$ | | 4.5 | | | | | 65.2 | |
| F 2/ | | 13.7 | | | | | 4.86 | |
| S.E.$\bar{x}$ | | .699 | | | | | 4.597 | |
| C.V.% | | 15.65 | | | | | 7.05 | |

Application data:

| | |
|---|---|
| Date: | 9/5/72 |
| Temperature: | 46 degrees |
| Humidity: | 60% |
| Cloud cover: | partly cloudy |
| Wind velocity: | calm |

Stage of growth of quackgrass 6" tall at application of herbicide
* Significantly higher in yield than the check .05 level.
1/ Weed score = 0 = no control; 10 = complete control
2/ Value for treatment comparison

Table 3. Effects of certain herbicides on field bindweed applied when in full bloom. Robert Stonebrook far, Plains, Montana. 1973

Date applied: July 24, 1973 Date evaluated: August 16, 1973

| Treatment | | Weed Score[1] | | | | |
|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ |
| Glyphosate | 1.0 | 10 | 2 | 5 | 17 | 6 abc[3] |
| Glyphosate | 1.5 | 4 | 4 | 3 | 11 | 4 bc |
| Glyphosate | 2.0 | 4 | 2 | 4 | 10 | 3 c |
| Glyphosate | 3.0 | 8 | 7 | 8 | 23 | 8 ab |
| Glyphosate | 4.0 | 9 | 9 | 9 | 27 | 9 a |
| 2,4D LV | 2.0 | 10 | 10 | 10 | 30 | 10 a |
| Dicamba + 2,4D | 1 + 2 | 10 | 9 | 10 | 29 | 10 a |
| Dicamba + 2,4D | 2 + 4 | 10 | 10 | 10 | 30 | 10 a |
| Check | 0 | 0 | 0 | 0 | 0 | 0 d |

1/ 0-10 = 0 = no control; 10 = complete control - all plants are brown on date of reading.

2/value for treatment comparison.

Application data:

| | | | |
|---|---|---|---|
| | | $\bar{x}$ | 6.56 |
| Date: | 7/24/73 | F[2] | 21.09** |
| Temperature: | 70 degrees | S.E.$\bar{x}$ | .78173 |
| Humidity: | 20% | C.V. % | 11.93 |
| Cloud cover: | clear | | |
| Wind velocity: | calm | | |
| Stage of growth: | blooming | | |

3/ Items having common letters are not significantly different .05. Duncans Multiple Range Test.

Table 4. Effect of certain herbicides on Canada thistle applied in the bud stage. Grown on the Robert Stonebrook farm, Plains, Montana.

Date applied: July 24, 1973 Date evaluated: August 16, 1973

| Treatment | | Weed Score[1] | | | | | |
|---|---|---|---|---|---|---|---|
| Herbicide | Rate #/A | I | II | III | Total | $\bar{x}$ | Remarks[2] |
| Glyphosate | 1.0 | 10 | 10 | 10 | 30 | 10 | high population |
| Glyphosate | 1.5 | 10 | 10 | 10 | 30 | 10 | few plants |
| Glyphosate | 2.0 | 10 | 10 | 10 | 30 | 10 | few plants |
| Glyphosate | 3.0 | 10 | 10 | 10 | 30 | 10 | very few plants |
| Glyphosate | 4.0 | 10 | 10 | 10 | 30 | 10 | occasional plant |
| 2,4D LV | 2.0 | 5 | 5 | 5 | 15 | 5 | 3/ |
| Dicamba + 2,4D | 1 + 2 | 6 | 7 | 7 | 20 | 7 | 4/ |
| Dicamba + 2,4D | 2 + 4 | 9 | 8 | 8 | 25 | 8 | 4/ |
| Check | 0 | 0 | 0 | 0 | 0 | 0 | |

| | |
|---|---|
| $\bar{x}$ | 7.8 |
| F[5] | 425.02 |
| S.E.$\bar{x}$ | .1667 |
| C.V.% | 2.14 |

Application data:

| | |
|---|---|
| Date: | 7/24/73 |
| Temperature: | 70 degrees |
| Humidity: | 20% |
| Cloud cover: | clear |
| Wind velocity: | calm |
| Stage of growth: | bud stage |

1/ Weed score, 0-10 = 0 = no control; 10 = complete kill.
2/ Bindweed under canopy of Canada thistle.
3/ Thistle yellow green, could not see soil surface to evaluate for bindweed.
4/ Thistle yellow green to brown, could not see soil surface to evaluate for bindweed.
5/ Value for treatment comparison.

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: Through 1975

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 one 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 thirty-two and thirty-four square feet for the dryland and irrigated nurseries, respectively. Cuttings within each nursery were made on an uniform date. 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.

RESULTS: Yields under irrigation (Table 1) varied from 3.77 to 5.75 tons per acre for the alfalfa varieties. Several varieties yielded less than Vernal for first, second and third harvests. The low yields of Mesilla, 502 and BH22 were due to winter kill. Thor and DuPuits were the highest yielding varieties in the nursery in 1973 as they were in 1972. Both the red clover varieties were lower in yield than Vernal with essentially no differences occuring between the two for total yields. However, the regrowth of Hot One was much better than that of Mammoth.

Yields for the alfalfa varieties under dryland (Table 2) varied from 3.76 to 4.93 tons per acre. None of the varieties significantly out yielded Ladak-65 for the first cutting; however, several varieties were significantly lower. Ladak-65 had lower yields than any of the other alfalfa varieties for the second and third cuttings. Ranger, Vernal and 502 had the highest yields in the nursery for 1973. In 1972, Thor and Haymore were the highest yielding entries. Both the red clover varieties were lower in yield than Ladak-65 with Mammoth out yielding Hot One by 0.80 tons per acre. There was very little regrowth for either red clover variety after the first harvest.

Generally, winter kill was more severe under irrigation than it was on dryland. An irrigation x variety interaction was evident.

Table 1. Yields obtained from an irrigated alfalfa nursery at Kalispell, 1973.

| Variety | Harvest | Tons per acre at 12 per cent moisture | | | | | | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| | | Replications | | | | | | |
| | | I | II | III | IV | Total | Mean | |
| Ranger | First | 2.53 | 2.13 | 2.21 | 2.44 | 9.31 | 2.33 | |
| | Second | 2.50 | 1.68 | 1.59 | 1.86 | 7.63 | 1.91 | |
| | Third | 0.77 | 0.79 | 0.68 | 0.96 | 3.20 | 0.80 | |
| | Total | 5.80 | 4.60 | 4.48 | 5.26 | 20.14 | 5.04 | 3.11 |
| Ladak-65 | First | 2.94 | 2.31 | 2.17 | 2.90 | 10.32 | 2.58 | |
| | Second | 1.77 | 1.57 | 1.61 | 1.75 | 6.70 | 1.68 | |
| | Third | 0.60 | 0.50 | 0.51 | 0.53 | 2.14 | 0.54aa | |
| | Total | 5.31 | 4.38 | 4.29 | 5.18 | 19.16 | 4.80 | 3.90 |
| Vernal | First | 3.10 | 2.85 | 2.06 | 2.77 | 10.78 | 2.69 | |
| | Second | 1.78 | 1.78 | 1.78 | 2.00 | 7.34 | 1.84 | |
| | Third | 0.79 | 0.73 | 0.74 | 0.83 | 3.09 | 0.77 | |
| | Total | 5.67 | 5.36 | 4.58 | 5.60 | 21.21 | 5.30 | 3.37 |
| Thor | First | 2.93 | 2.56 | 2.98 | 2.46 | 10.93 | 2.73 | |
| | Second | 2.04 | 1.97 | 2.10 | 1.79 | 7.90 | 1.98 | |
| | Third | 1.02 | 1.03 | 1.04 | 1.08 | 4.17 | 1.04** | |
| | Total | 5.99 | 5.56 | 6.12 | 5.33 | 23.00 | 5.75 | 4.20* |
| Grimm | First | 2.46 | 2.29 | 2.57 | 1.95 | 9.27 | 2.32a | |
| | Second | 1.76 | 1.80 | 2.15 | 2.06 | 7.77 | 1.94 | |
| | Third | 0.89 | 0.95 | 0.98 | 0.94 | 3.76 | 0.94** | |
| | Total | 5.11 | 5.04 | 5.70 | 4.95 | 20.80 | 5.20 | 3.54 |
| NK919 | First | 2.43 | 2.15 | 2.18 | 2.40 | 9.16 | 2.29a | |
| | Second | 1.90 | 1.70 | 1.70 | 1.85 | 7.15 | 1.79 | |
| | Third | 0.96 | 0.94 | 0.75 | 0.92 | 3.57 | 0.89* | |
| | Total | 5.29 | 4.79 | 4.63 | 5.17 | 19.88 | 4.97 | 3.76 |
| Orca | First | 2.29 | 2.66 | 2.27 | 2.20 | 9.42 | 2.36 | |
| | Second | 1.85 | 1.96 | 1.79 | 2.00 | 7.60 | 1.90 | |
| | Third | 0.89 | 0.91 | 0.78 | 0.80 | 3.38 | 0.84 | |
| | Total | 5.03 | 5.53 | 4.84 | 5.00 | 20.40 | 5.10 | 3.33 |
| Mesilla | First | 1.58 | 1.17 | 1.66 | 1.99 | 6.40 | 1.60aa | |
| | Second | 1.50 | 1.31 | 1.21 | 1.59 | 5.61 | 1.40aa | |
| | Third | 0.78 | 0.55 | 0.88 | 0.88 | 3.09 | 0.77 | |
| | Total | 3.86 | 3.03 | 3.75 | 4.46 | 15.10 | 3.77aa | 2.80 |
| Ladak | First | 2.68 | 2.72 | 2.79 | 2.44 | 10.63 | 2.66 | |
| | Second | 1.56 | 1.64 | 1.81 | 1.48 | 6.49 | 1.62 | |
| | Third | 0.58 | 0.60 | 0.53 | 0.48 | 2.19 | 0.55aa | |
| | Total | 4.82 | 4.96 | 5.13 | 4.40 | 19.31 | 4.83 | 3.32 |
| DuPuits | First | 2.57 | 2.26 | 2.30 | 2.24 | 9.37 | 2.34 | |
| | Second | 2.34 | 1.92 | 1.94 | 2.17 | 8.37 | 2.09 | |
| | Third | 0.93 | 1.02 | 0.95 | 1.13 | 4.03 | 1.01** | |
| | Total | 5.84 | 5.20 | 5.19 | 5.54 | 21.77 | 5.44 | 4.19* |
| 502 | First | 1.96 | 1.94 | 1.89 | 1.82 | 7.61 | 1.90aa | |
| | Second | 1.53 | 1.55 | 1.64 | 1.67 | 6.39 | 1.60 | |
| | Third | 0.86 | 0.77 | 0.89 | 0.97 | 3.49 | 0.87 | |
| | Total | 4.35 | 4.26 | 4.42 | 4.46 | 17.49 | 4.37aa | 3.68 |

Table 1. (con't)

| Variety | Harvest | Tons per acre at 12 per cent moisture — Replications I | II | III | IV | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| German | First | 2.67 | 2.56 | 2.15 | 2.45 1/ | 9.83 | 2.46 | |
| | Second | 1.94 | 1.75 | 1.77 | 1.89 1/ | 7.35 | 1.84 | |
| | Third | 0.84 | 0.84 | 0.79 | 0.91 1/ | 3.38 | 0.85 | |
| | Total | 5.45 | 5.15 | 4.71 | 5.25 1/ | 20.56 | 5.15 | 3.50 |
| Haymor | First | 2.14 | 2.33 | 2.06 | 2.56 | 9.09 | 2.27a | |
| | Second | 1.78 | 2.01 | 1.61 | 2.29 | 7.69 | 1.92 | |
| | Third | 0.93 | 0.87 | 0.83 | 1.19 | 3.82 | 0.96** | |
| | Total | 4.85 | 5.21 | 4.50 | 6.04 | 20.60 | 5.15 | 3.48 |
| BH22 | First | 2.19 | 2.72 | 2.05 | 1.73 | 8.69 | 2.17aa | |
| | Second | 1.61 | 1.72 | 1.90 | 1.44 | 6.67 | 1.67 | |
| | Third | 0.70 | 0.82 | 0.71 | 0.87 | 3.10 | 0.78 | |
| | Total | 4.50 | 5.26 | 4.66 | 4.04 | 18.46 | 4.62a | 3.79 |
| Hot One red clover | First | 2.21 | 2.57 | 2.36 | 2.54 | 9.68 | 2.42 | |
| | Second | 1.76 | 1.69 | 2.06 | 1.83 | 7.34 | 1.83 | |
| | Third | 0.57 | 0.63 | 0.69 | 0.62 | 2.51 | 0.63a | |
| | Total | 4.54 | 4.89 | 5.11 | 4.99 | 19.53 | 4.88 | 2.54a |
| Mammoth red clover | First | 3.68 | 3.60 | 3.33 | 3.55 | 14.16 | 3.54** | |
| | Second | 0.82 | 0.65 | 0.76 | 1.00 | 3.23 | 0.81aa | |
| | Third | 0.32 | 0.32 | 0.34 | 0.46 | 1.44 | 0.36aa | |
| | Total | 4.82 | 4.57 | 4.43 | 5.01 | 18.83 | 4.71a | 2.05aa |

| | First Harvest | Second Harvest | Third Harvest | Total | 1972 Total |
|---|---|---|---|---|---|
| Harvest date | 6-28 | 8-9 | 9-13 | | |
| Mean yields | 2.42T/A | 1.74T/A | 0.79T/A | 4.94T/A | 3.41T/A |
| F-value for variety yield comparison | 10.69** | 11.19** | 23.12** | 4.99** | 6.18** |
| S.E.$\bar{x}$ | 0.127T/A | 0.090T/A | 0.039T/A | 0.204T/A | 0.231T/A |
| S.E.$_{\bar{d}}$ | 0.179T/A | 0.128T/A | 0.055T/A | 0.288T/A | 0.326T/A |
| C.V.$=\frac{S\bar{x}}{\bar{x}}$ | 5.3% | 5.2% | 4.9% | 4.1% | 6.8% |
| L.S.D. at .05 | 0.362T/A | 0.257T/A | 0.111T/A | 0.580T/A | 0.657T/A |
| L.S.D. at .01 | 0.483T/A | 0.343T/A | 0.148T/A | 0.775T/A | 0.878T/A |

1/ Yield calculated by missing plot formula.

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

* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

a Indicates a significantly lower yield than the check at .05 for that cutting or for the season total.

aa Indicates a significantly lower yield than the check at .01 for that cutting or for the season total.

Table 2. Yields obtained from a dryland alfalfa nursery at Kalispell, 1973.

| Variety | Harvest | Tons per acre at 12 percent moisture: Replications I | II | III | IV | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| Ranger | First | 3.82 | 2.91 | 2.93 | 2.83 | 12.49 | 3.12 | |
| | Second | 1.26 | 1.28 | 1.06 | 1.12 | 4.72 | 1.18* | |
| | Third | 0.71 | 0.60 | 0.33 | 0.54 | 2.18 | 0.55** | |
| | Total | 5.79 | 4.79 | 4.32 | 4.49 | 19.39 | 4.85 | 2.58 |
| Ladak-65 | First | 3.50 | 3.26 | 2.74 | 3.43 | 12.93 | 3.23 | |
| | Second | 0.74 | 0.85 | 0.68 | 1.12 | 3.39 | 0.85 | |
| | Third | 0.25 | 0.25 | 0.16 | 0.33 | 0.99 | 0.25 | |
| | Total | 4.49 | 4.36 | 3.58 | 4.88 | 17.31 | 4.33 | 2.64 |
| Vernal | First | 3.48 | 3.19 | 3.28 | 3.42 | 13.37 | 3.34 | |
| | Second | 0.86 | 1.08 | 1.18 | 1.36 | 4.48 | 1.12* | |
| | Third | 0.62 | 0.33 | 0.42 | 0.49 | 1.86 | 0.47** | |
| | Total | 4.96 | 4.60 | 4.88 | 5.27 | 19.71 | 4.93 | 2.62 |
| Thor | First | 3.24 | 2.80 | 2.53 | 3.29 | 11.86 | 2.97 | |
| | Second | 1.34 | 1.00 | 0.81 | 1.32 | 4.47 | 1.12* | |
| | Third | 0.73 | 0.48 | 0.24 | 0.48 | 1.93 | 0.48** | |
| | Total | 5.31 | 4.28 | 3.58 | 5.09 | 18.26 | 4.57 | 3.15 |
| Grimm | First | 3.00 | 2.80 | 2.80 | 2.74 | 11.34 | 2.84a | |
| | Second | 1.34 | 0.94 | 1.22 | 1.23 | 4.73 | 1.18* | |
| | Third | 0.63 | 0.22 | 0.26 | 0.50 | 1.61 | 0.40* | |
| | Total | 4.97 | 3.96 | 4.28 | 4.47 | 17.68 | 4.42 | 2.63 |
| NK919 | First | 3.06 | 3.22 | 3.14 | 3.02 | 12.44 | 3.11 | |
| | Second | 1.06 | 1.17 | 0.96 | 1.20 | 4.39 | 1.10 | |
| | Third | 0.57 | 0.53 | 0.45 | 0.52 | 2.07 | 0.52** | |
| | Total | 4.69 | 4.92 | 4.55 | 4.74 | 18.90 | 4.73 | 2.97 |
| Orca | First | 2.61 | 2.63 | 2.29 | 1.95 | 9.48 | 2.37aa | |
| | Second | 0.90 | 0.98 | 1.11 | 0.68 | 3.67 | 0.92 | |
| | Third | 0.60 | 0.46 | 0.54 | 0.29 | 1.89 | 0.47** | |
| | Total | 4.11 | 4.07 | 3.94 | 2.92 | 15.04 | 3.76a | 2.43 |
| Mesilla | First | 2.44 | 2.79 | 2.39 | 2.72 | 10.34 | 2.58aa | |
| | Second | 0.97 | 1.03 | 0.93 | 1.24 | 4.17 | 1.04 | |
| | Third | 0.90 | 0.70 | 0.45 | 0.65 | 2.70 | 0.68** | |
| | Total | 4.31 | 4.52 | 3.77 | 4.61 | 17.21 | 4.30 | 2.43 |
| Ladak | First | 3.56 | 3.03 | 3.25 | 3.45 | 13.29 | 3.32 | |
| | Second | 1.12 | 0.69 | 0.85 | 1.06 | 3.72 | 0.93 | |
| | Third | 0.63 | 0.31 | 0.33 | 0.37 | 1.64 | 0.41* | |
| | Total | 5.31 | 4.03 | 4.43 | 4.88 | 18.65 | 4.66 | 2.84 |
| 502 | First | 2.90 | 2.79 | 3.30 | 2.94 | 11.93 | 2.98 | |
| | Second | 1.73 | 1.00 | 1.31 | 1.32 | 5.36 | 1.34** | |
| | Third | 0.66 | 0.49 | 0.60 | 0.52 | 2.27 | 0.57** | |
| | Total | 5.29 | 4.28 | 5.21 | 4.78 | 19.56 | 4.89 | 1.23aa |

Table 2. (con't)

| Variety | Harvest | Tons per acre at 12 percent moisture — Replications I | II | III | IV | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| German | First | 3.09 | 2.56 | 2.97 | 3.09 | 11.71 | 2.93 | |
| | Second | 0.91 | 1.13 | 1.17 | 1.21 | 4.42 | 1.11* | |
| | Third | 0.57 | 0.54 | 0.48 | 0.58 | 2.17 | 0.54** | |
| | Total | 4.57 | 4.23 | 4.62 | 4.88 | 18.30 | 4.58 | 3.06 |
| Haymor | First | 3.03 | 2.61 | 3.09 | 2.54 | 11.27 | 2.82a | |
| | Second | 1.26 | 0.97 | 1.27 | 0.90 | 4.40 | 1.10 | |
| | Third | 0.64 | 0.49 | 0.64 | 0.27 | 2.04 | 0.51** | |
| | Total | 4.93 | 4.07 | 5.00 | 3.71 | 17.71 | 4.43 | 3.30 |
| BH22 | First | 3.21 | 2.93 | 2.52 | 3.14 | 11.80 | 2.95 | |
| | Second | 1.22 | 1.35 | 0.76 | 1.23 | 4.56 | 1.14* | |
| | Third | 0.57 | 0.47 | 0.28 | 0.57 | 1.89 | 0.47** | |
| | Total | 5.00 | 4.75 | 3.56 | 4.94 | 18.25 | 4.56 | 2.81 |
| Hot One red clover | First | 2.43 | 2.05 | 2.06 | 2.30 | 8.84 | 2.21aa | |
| | Second | 0.23 | 0.23 | 0.20 | 0.23 | 0.89 | 0.22aa | |
| | Third | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00aa | |
| | Total | 2.66 | 2.28 | 2.26 | 2.53 | 9.73 | 2.43aa | 1.97a |
| Mammoth red clover | First | 3.69 | 3.36 | 2.77 | 3.06 | 12.88 | 3.22 | |
| | Second | 0.05 | 0.09 | 0.02 | 0.05 | 0.21 | 0.05aa | |
| | Third | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00aa | |
| | Total | 3.74 | 3.45 | 2.79 | 3.11 | 13.09 | 3.27aa | 2.51 |

| | First Harvest | Second Harvest | Third Harvest | Total | 1972 Total |
|---|---|---|---|---|---|
| Harvest date | 6-27 | 8-2 | 9-12 | | |
| Mean yields | 2.93 T/A | 0.96 T/A | 0.42 T/A | 4.31 T/A | 2.61 T/A |
| F-value for variety yield comparison | 7.15** | 15.60** | 13.76** | 9.68** | 3.53** |
| S.E.$\bar{x}$ | 0.124T/A | 0.090T/A | 0.053T/A | 0.218T/A | 0.270T/A |
| S.E.$_{\bar{d}}$ | 0.176T/A | 0.128T/A | 0.074T/A | 0.308T/A | 0.381T/A |
| C.V.$= \frac{S\bar{x}}{\bar{x}}$ | 4.2% | 9.4% | 12.6% | 5.1% | 10.3% |
| L.S.D. at .05 | 0.355T/A | 0.258T/A | 0.150T/A | 0.622T/A | 0.769T/A |
| L.S.D. at .01 | 0.473T/A | 0.343T/A | 0.199T/A | 0.828T/A | 1.025T/A |

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

* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

a Indicates a significantly lower yield than the check at .05 for that cutting or for the season total.

aa Indicates a significantly lower yield than the check at .01 for that cutting or for the season total.

TITLE: Evaluation of alfalfa introductions.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: The yield trial for the introductions will be phased out in 1974. Three or four of the top yielding introductions will be placed in a polycross block to produce seed for more through testing throughout the state.

OBJECTIVES: Evaluate alfalfa introductions for forage production in northwestern Montana.

PROCEDURES: Six alfalfa introductions from the Northeastern Regional Plant Introduction Station, Geneva, New York and the check variety (Vernal) were planted on May 15, 1972 in Field Y-8. The design was a randomized complete block with three replications. Each plot consisted of a single row, 12 feet in length. Harvest area in 1973 was nine square feet per plot.

RESULTS: Three introductions P.I. 256004, P.I. 277425 and P.I. 178980 yielded approximately twice that of Vernal for total harvest (Table 1). Yields for each harvest for each of the three introductions significantly out yielded Vernal at the 0.01 probability level. First, third and total harvest yields for P.I. 174275 were significantly higher than those for Vernal.

Table 1. Yields obtained from an irrigated alfalfa introduction nursery at Kalispell, 1973.

| Variety or P.I. Number | Harvest | Tons per acre at 12 per cent moisture — Replications I | II | III | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|
| Vernal | First | 1.57 | 3.02 | 2.71 | 7.30 | 2.43 | |
| | Second | 1.35 | 2.16 | 0.86 | 4.37 | 1.46 | |
| | Third | 0.62 | 0.80 | 0.39 | 1.81 | 0.60 | |
| | Total | 3.54 | 5.98 | 3.96 | 13.48 | 4.49 | 2.78 |
| 256004 | First | 3.25 | 4.30 | 3.43 | 10.98 | 3.66** | |
| | Second | 2.90 | 3.37 | 2.68 | 8.95 | 2.98** | |
| | Third | 1.36 | 1.60 | 1.68 | 4.64 | 1.55** | |
| | Total | 7.51 | 9.27 | 7.79 | 24.57 | 8.19** | 4.80** |
| 277425 | First | 3.48 | 3.60 | 4.09 | 11.17 | 3.72** | |
| | Second | 2.68 | 2.68 | 3.15 | 8.51 | 2.84** | |
| | Third | 1.58 | 1.37 | 1.94 | 4.89 | 1.63** | |
| | Total | 7.74 | 7.65 | 9.18 | 24.57 | 8.19** | 2.47 |
| 277427 | First | 1.46 | 1.81 | 1.95 | 5.22 | 1.74a | |
| | Second | 1.63 | 1.46 | 1.59 | 4.68 | 1.56 | |
| | Third | 0.80 | 0.70 | 1.19 | 2.69 | 0.90 | |
| | Total | 3.89 | 3.97 | 4.73 | 12.59 | 4.20 | 2.33 |
| 174275 | First | 2.73 | 2.85 | 3.74 | 9.32 | 3.11* | |
| | Second | 1.97 | 2.20 | 2.12 | 6.29 | 2.10 | |
| | Third | 0.95 | 0.95 | 1.52 | 3.42 | 1.14* | |
| | Total | 5.65 | 6.00 | 7.38 | 19.03 | 6.35* | 4.11* |
| 178980 | First | 3.95 | 3.95 | 4.12 | 12.02 | 4.01** | |
| | Second | 3.40 | 2.72 | 3.43 | 9.55 | 3.18** | |
| | Third | 1.72 | 1.07 | 1.92 | 4.71 | 1.57** | |
| | Total | 9.07 | 7.74 | 9.47 | 26.28 | 8.76** | 3.23 |
| 236606 | First | 2.24 | 2.18 | 2.76 | 7.18 | 2.39 | |
| | Second | 1.17 | 1.02 | 1.33 | 3.52 | 1.17 | |
| | Third | 0.58 | 0.52 | 0.76 | 1.86 | 0.62 | |
| | Total | 3.99 | 3.72 | 4.85 | 12.56 | 4.18 | 2.90 |

| | 1st Harvest | 2nd Harvest | 3rd Harvest | Total | 1972 Total |
|---|---|---|---|---|---|
| Harvest date | 6-29 | 8-9 | 9-11 | | |
| Mean yields | 3.01T/A | 2.18T/A | 1.14T/A | 6.34T/A | 3.23T/A |
| F-value for variety yield comparison | 15.38** | 14.60** | 11.31** | 17.76** | 5.51** |
| S.E.$\bar{x}$ | 0.215T/A | 0.214T/A | 0.133T/A | 0.488T/A | 0.386T/A |
| S.E.$_{\bar{d}}$ $_{S\bar{x}}$ | 0.304T/A | 0.303T/A | 0.189T/A | 0.690T/A | 0.546T/A |
| C.V. | 7.1% | 9.8% | 11.7% | 7.7% | 12.0% |
| L.S.D. at .05 | 0.662T/A | 0.659T/A | 0.411T/A | 1.503T/A | 1.190T/A |
| L.S.D. at .01 | 0.928T/A | 0.924T/A | 0.576T/A | 2.107T/A | 1.669T/A |

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

* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

a Indicates a significantly lower yield than the check at .05for that cutting or for the season total.

TITLE: Irrigated Commercial Alfalfa Yield Trial

PROJECT: Forage Investigations MS755

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 feet 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 at the same time for both cuttings. Four hundred pounds of 0-45-0 were applied in the spring of 1973.

RESULTS: No significant differences were obtained between any of the commercial varieties and the two check varieties for either cutting or for total harvest (Table 1). A-73-6 and A-73-7 were the highest yielding entries in the nursery.

Table 1. Yields obtained from an irrigated alfalfa nursey at Kalispel, 1973

| Variety | Harvest | Tons per acre at 12 per cent moisture | | | | | |
|---|---|---|---|---|---|---|---|
| | | Replication | | | | | |
| | | I | II | III | IV | Total | Mean |
| A-73-4 | First | 1.90 | 1.46 | 1.73 | 1.61 | 6.70 | 1.68 |
| | Second | 1.78 | 1.63 | 2.01 | 1.88 | 7.30 | 1.82 |
| | Total | 3.68 | 3.09 | 3.74 | 3.49 | 14.00 | 3.50 |
| Haymor | First | 2.10 | 1.54 | 1.80 | 1.75 | 7.19 | 1.80 |
| | Second | 1.92 | 1.67 | 1.90 | 2.28 | 7.77 | 1.94 |
| | Total | 4.02 | 3.21 | 3.70 | 4.03 | 14.96 | 3.74 |
| A-73-6 | First | 1.87 | 1.44 | 1.82 | 1.98 | 7.11 | 1.78 |
| | Second | 2.27 | 2.00 | 1.76 | 2.18 | 8.21 | 2.05 |
| | Total | 4.14 | 3.44 | 3.58 | 4.16 | 15.32 | 3.83 |
| A-73-7 | First | 1.89 | 1.94 | 1.58 | 2.13 | 7.54 | 1.88 |
| | Second | 2.12 | 1.99 | 1.92 | 1.85 | 7.88 | 1.97 |
| | Total | 4.01 | 3.93 | 3.50 | 3.98 | 15.42 | 3.85 |
| A-73-5 | First | 1.50 | 1.94 | 1.75 | 1.73 | 6.92 | 1.73 |
| | Second | 1.74 | 1.50 | 2.31 | 2.03 | 7.58 | 1.89 |
| | Total | 3.24 | 3.44 | 4.06 | 3.76 | 14.50 | 3.62 |
| Ladak-65 | First | 1.77 | 1.81 | 1.69 | 1.77 | 7.04 | 1.76 |
| | Second | 1.73 | 2.14 | 1.81 | 1.63 | 7.31 | 1.83 |
| | Total | 3.50 | 3.95 | 3.50 | 3.40 | 14.35 | 3.59 |

| | First Harvest | Second Harvest | Total |
|---|---|---|---|
| Harvest date | 7-24 | 9-12 | |
| Mean yields | 1.77T/A | 1.92T/A | 3.69T/A |
| F-value for variety yield comparison | 0.50N.S. | 0.52N.S. | 0.77N.S. |
| S.E.$\bar{x}$ | 0.099T/A | 0.122T/A | 0.161T/A |
| S.E.$_{\bar{c}}$ | 0.141T/A | 0.173T/A | 0.228T/A |
| C.V.$= \frac{S\bar{x}}{\bar{x}}$ | 5.6% | 6.4% | 4.4% |
| L.S.D. at .05 | N.S. | N.S. | N.S. |

NOTE: Haymore and Ladak-65 are considered to be the check varieties for this nursery.

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: To 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 feet 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 each variety as they matured.

RESULTS: All of the regrowth varieties (Remont, S-73-2, and S-73-3) had significantly less yield than Eski for each cutting and total harvest at the 0.01 level of probability (Table 1). However, the regrowth varieties did have from three to four inches of growth after the second harvest. Eski and Melrose had very little regrowth after the second harvest due to the late harvest and early frost. No real differences were obtained between Eski and Melrose.

Table 1. Yields obtained from an irrigated sainfoin nursery at Kalispell, 1973.

| Variety | Harvest | Harvest Date | Tons per acre at 12 per cent moisture | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Replications | | | | | |
| | | | I | II | III | IV | Total | Mean |
| Remont | First | 7/24 | 1.20 | 1.32 | 1.42 | 1.41 | 5.35 | 1.34** |
| | Second | 8/21 | 1.05 | 0.97 | 1.16 | 1.01 | 4.19 | 1.05** |
| | Total | | 2.25 | 2.29 | 2.58 | 2.42 | 9.54 | 2.38** |
| S-73-2 | First | 7/24 | 1.08 | 1.56 | 1.45 | 1.25 | 5.34 | 1.33** |
| | Second | 8/21 | 0.91 | 0.89 | 0.96 | 0.85 | 3.61 | 0.90**a |
| | Total | | 1.99 | 2.45 | 2.41 | 2.10 | 8.95 | 2.23** |
| S-73-3 | First | 7/24 | 0.99 | 1.26 | 1.32 | 1.49 | 5.06 | 1.26** |
| | Second | 8/21 | 0.90 | 0.95 | 1.01 | 1.00 | 3.86 | 0.96** |
| | Total | | 1.89 | 2.21 | 2.33 | 2.49 | 8.92 | 2.23** |
| Eski | First | 8/ 2 | 1.17 | 1.83 | 2.17 | 1.88 | 7.05 | 1.76aa |
| | Second | 9/12 | 1.18 | 1.15 | 1.24 | 1.35 | 4.92 | 1.23aa |
| | Total | | 2.35 | 2.98 | 3.41 | 3.23 | 11.97 | 2.99aa |
| Melrose | First | 7/31 | 1.03 | 1.71 | 2.09 | 1.95 | 6.78 | 1.69a |
| | Second | 9/12 | 1.17 | 1.37 | 1.29 | 1.42 | 5.25 | 1.31aa |
| | Total | | 2.20 | 3.08 | 3.38 | 3.37 | 12.03 | 3.00aa |

| | First Harvest | Second Harvest | Total |
|---|---|---|---|
| Mean yields | 1.48T/A | 1.09T/A | 2.57T/A |
| F-value for variety yield comparison | 5.73** | 23.00** | 12.47** |
| S.E.$\bar{x}$ | 0.0965T/A | 0.0364T/A | 0.112T/A |
| S.E.$_{\bar{d}}$ | 0.137T/A | 0.051T/A | 0.159T/A |
| C.V. $= \frac{S\bar{x}}{\bar{x}}$ | 6.5% | 3.3% | 4.4% |
| L.S.D. at .05 | 0.297T/A | 0.112T/A | 0.346T/A |
| L.S.D. at .01 | 0.417T/A | 0.157T/A | 0.486T/A |

NOTE: Remont and Eski are considered to be the check varieties for this nursery.

** Indicated a significantly lower yield than Eski at .01 for that cutting or for the season total.

a Indicates a significantly higher or lower yield than Remont at .05 for that cutting or for the season total.

aa Indicates a significantly higher yield than Remont at .01 for that cutting or for the season total.

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: To 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 feet by 20 feet with one foot between rows. A randomized complete block design with four replications was utilized. All varieties were cut on a common date for the first harvest. However, the difference in regrowth necessitated different harvest dates for the second harvest. Thirty-two square feet were harvested from each plot at both harvests. Four hundred pounds of 0-45-0 were applied in the spring of 1973.

RESULTS: For first harvest yields all the varieties except Tana produced significantly more hay than Empire with Leo being the highest followed by P-15456 (Table 1). However, the second harvest yields of Leo were significantly lower than Empire. None of the varieties produced significantly more hay than Empire for the second harvest. For total harvest, P-15456, Mansfield, and Granger produced significantly more hay than Empire.

Table 1. Yields obtained from an irrigated trefoil nursery at Kalispell, 1973.

| Variety | Harvest | Per cent of plot in bloom | Tons per acre at 12 percent moisture: Replication I | II | III | IV | Total | Mean |
|---|---|---|---|---|---|---|---|---|
| P-15456 | First | 12 | 0.63 | 1.39 | 1.56 | 1.98 | 5.56 | 1.39** |
| | Second | 15 | 1.24 | 1.21 | 1.38 | 1.21 | 5.04 | 1.26 |
| | Total | | 1.87 | 2.60 | 2.94 | 3.19 | 10.60 | 2.65* |
| Leo | First | 19 | 0.65 | 1.63 | 1.82 | 2.08 | 6.18 | 1.54** |
| | Second | 15 | 0.71 | 0.99 | 0.91 | 1.16 | 3.77 | 0.94[a] |
| | Total | | 1.36 | 2.62 | 2.73 | 3.24 | 9.95 | 2.49 |
| Mansfield | First | 20 | 0.49 | 1.34 | 1.44 | 1.62 | 4.89 | 1.22* |
| | Second | 15 | 0.96 | 1.47 | 1.47 | 1.70 | 5.60 | 1.40 |
| | Total | | 1.45 | 2.81 | 2.91 | 3.32 | 10.49 | 2.62* |
| Empire | First | 5 | 0.51 | 1.05 | 1.09 | 1.42 | 4.07 | 1.02 |
| | Second | 15 | 0.98 | 1.24 | 1.41 | 1.52 | 5.15 | 1.29 |
| | Total | | 1.49 | 2.29 | 2.50 | 2.94 | 9.22 | 2.30 |
| Granger | First | 21 | 0.55 | 1.27 | 1.53 | 1.74 | 5.09 | 1.27** |
| | Second | 15 | 0.97 | 1.51 | 1.67 | 1.56 | 5.71 | 1.43 |
| | Total | | 1.52 | 2.78 | 3.20 | 3.30 | 10.80 | 2.70** |
| Tana | First | 16 | 0.49 | 1.11 | 1.22 | 1.58 | 4.40 | 1.10 |
| | Second | 15 | 0.90 | 1.41 | 1.23 | 0.85 | 4.39 | 1.10 |
| | Total | | 1.39 | 2.52 | 2.45 | 2.43 | 8.79 | 2.20 |

| | First Harvest | Second Harvest | Total |
|---|---|---|---|
| Mean yields | 1.26T/A | 1.24T/A | 2.50T/A |
| F-value for variety yield comparison | 13.79** | 4.32* | 4.82** |
| $S.E._{\bar{x}}$ | .052T/A | .089T/A | .093T/A |
| $S.E._{\bar{d}}$ | 0.073T/A | 0.126T/A | 0.131T/A |
| $C.V. = \frac{S_{\bar{x}}}{\bar{x}}$ | 4.1% | 7.2% | 3.7% |
| L.S.D. at .05 | 0.156T/A | 0.269T/A | 0.279T/A |
| L.S.D. at .01 | 0.215T/A | 0.372T/A | 0.386T/A |

NOTE: Empire is considered to be the check variety for this nursery.
Harvest dates: First - all varieties - July 21, 1973
Second - Mansfield, Granger and Tana - September 12, 1973
P-15456, Leo and Empire - September 21, 1973

* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

a Indicates a significantly lower yield than the check at .05 for that cutting or for the season total.

TITLE: Irrigated Intrastate Orchardgrass Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperators - C. S. Cooper, J. L. Krall, J. G. Scheetz

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: Through 1975

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

PROCEDURES: Eleven orchardgrass varieties were sent to Bozeman, Huntley, Bridger, Sidney and Conrad in the spring of 1972 to establish an intrastate orchardgrass nursery. Data included in the 1973 report are from Kalispell, Bozeman, Huntley and Bridger.

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 consist of four rows spaced one foot apart and were 20 feet in length. Harvest area was thirty-four square feet. For the first cutting the varieties were harvested as they matured. Since maturity differences were not great for the second cutting all varieties were harvested on a common date. Four hundred pounds of 0-45-0 were applied in the spring of 1972. Nitrogen applications in 1973 were made in early spring (94 lbs N/A) and in midsummer (48 lbs N/A).

RESULTS: NK-1 (Nordstern) and NK-4 were the only two varieties that produced significantly more total forage than Pennlate (Table 1). Several varieties produced higher yields than Pennlate for the first cutting but none were higher for the second cutting. In 1972, NK-1 and Chinook were the highest yielding entries.

No single variety was the best producer across all locations (Table 2). Kay and Dayton were the best hay producers at Huntley, NK-1 and Potomac at Bozeman and Napier and NK-2 at Bridger. The highest mean yield across all locations and years was NK-1 followed by Dayton.

Table 1. Yields obtained from an irrigated orchardgrass nursery at Kalispell, 1973.

| Variety | Harvest | Harvest Date | Tons per acre at 12 per cent moisture | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Replications | | | | | |
| | | | I | II | III | IV | Total | Mean |
| Chinook | First | 6- 1 | 3.11 | 2.27 | 2.54 | 2.42 | 10.34 | 2.59* |
| | Second | 9-11 | 2.29 | 1.79 | 1.33 | 1.72 | 7.13 | 1.78 |
| | Total | | 5.40 | 4.06 | 3.87 | 4.14 | 17.47 | 4.37 |
| Napier | First | 6- 1 | 2.51 | 1.99 | 2.20 | 2.14 | 8.84 | 2.21 |
| | Second | 9-11 | 1.95 | 1.74 | 2.33 | 1.97 | 7.99 | 2.00 |
| | Total | | 4.46 | 3.73 | 4.53 | 4.11 | 16.83 | 4.21 |
| NK-1 | First | 6- 7 | 3.62 | 2.89 | 3.00 | 2.70 | 12.21 | 3.05** |
| | Second | 9-11 | 1.74 | 2.10 | 2.26 | 1.55 | 7.65 | 1.91 |
| | Total | | 5.36 | 4.99 | 5.26 | 4.25 | 19.86 | 4.96* |
| NK-4 | First | 6- 7 | 2.90 | 2.58 | 3.19 | 2.66 | 11.33 | 2.83** |
| | Second | 9-11 | 2.28 | 1.94 | 2.29 | 1.71 | 8.22 | 2.06 |
| | Total | | 5.18 | 4.52 | 5.48 | 4.37 | 19.55 | 4.89* |
| Kay | First | 6- 7 | 2.67 | 2.47 | 2.95 | 2.66 | 10.75 | 2.69** |
| | Second | 9-11 | 2.13 | 2.08 | 1.88 | 1.65 | 7.74 | 1.94 |
| | Total | | 4.80 | 4.55 | 4.83 | 4.31 | 18.49 | 4.63 |
| Latar | First | 6- 7 | 3.43 | 2.36 | 2.66 | 2.33 | 10.78 | 2.70** |
| | Second | 9-11 | 2.59 | 2.41 | 1.52 | 1.47 | 7.99 | 2.00 |
| | Total | | 6.02 | 4.77 | 4.18 | 3.80 | 18.77 | 4.70 |
| Dayton | First | 6- 1 | 2.58 | 1.88 | 2.35 | 2.24 | 9.05 | 2.26 |
| | Second | 9-11 | 2.71 | 2.28 | 2.48 | 1.69 | 9.16 | 2.29 |
| | Total | | 5.29 | 4.16 | 4.83 | 3.93 | 18.21 | 4.55 |
| NK-2 | First | 6- 1 | 2.28 | 2.33 | 2.22 | 2.23 | 9.06 | 2.27 |
| | Second | 9-11 | 2.34 | 2.47 | 2.18 | 2.02 | 9.01 | 2.25 |
| | Total | | 4.62 | 4.80 | 4.40 | 4.25 | 18.07 | 4.52 |
| Pennlate | First | 6- 7 | 2.40 | 2.24 | 2.26 | 2.12 | 9.02 | 2.26 |
| | Second | 9-11 | 2.15 | 2.18 | 2.00 | 1.67 | 8.00 | 2.00 |
| | Total | | 4.55 | 4.42 | 4.26 | 3.79 | 17.02 | 4.26 |
| NK-3 | First | 6- 7 | 2.93 | 2.94 | 2.94 | 2.46 | 11.27 | 2.82** |
| | Second | 9-11 | 2.30 | 1.98 | 1.52 | 1.67 | 7.47 | 1.87 |
| | Total | | 5.23 | 4.92 | 4.46 | 4.13 | 18.74 | 4.69 |
| Potomac | First | 6- 1 | 2.09 | 2.16 | 2.30 | 2.25 | 8.80 | 2.20 |
| | Second | 9-11 | 2.27 | 1.67 | 2.01 | 1.94 | 7.89 | 1.97 |
| | Total | | 4.36 | 3.83 | 4.31 | 4.19 | 16.69 | 4.17 |

Table 1. (con't)

| | First Harvest | Second Harvest | Total |
|---|---|---|---|
| Mean yields | 2.53T/A | 2.01T/A | 4.54T/A |
| F-value for variety yield comparisons | 7.80** | 1.22N.S. | 1.98N.S. |
| S.E.$\bar{x}$ | 0.109T/A | 0.137T/A | 0.189T/A |
| S.E.$\bar{d}$ | 0.155T/A | 0.194T/A | 0.268T/A |
| C.V. = $\frac{S\bar{x}}{\bar{x}}$ | 4.3% | 6.8% | 4.2% |
| L.S.D. at .05 | 0.316T/A | 0.396T/A | 0.547T/A |
| L.S.D. at .01 | 0.425T/A | 0.533T/A | 0.736T/A |

NOTE: Pennlate is considered to be the check variety for this nursery.
* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.
** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

Table 2. Yields obtained from an irrigated orchardgrass nursery at four locations in Montana.

| Variety | Tons per acre at 12 per cent moisture | | | | | |
|---|---|---|---|---|---|---|
| | Location | | | | | |
| | Kalispell (1972) | Kalispell (1973) | Huntley | Bozeman | Bridger | Mean |
| Chinook | 2.68 | 4.37 | 3.52 | 3.11 | 1.38 | 3.01 |
| Napier | 1.71 | 4.21 | 3.47 | 3.08 | 2.55 | 3.00 |
| NK-1 | 2.23 | 4.96 | 3.47 | 3.26 | 1.91 | 3.17 |
| NK-4 | 1.61 | 4.89 | 3.20 | 3.01 | 1.59 | 2.86 |
| Kay | 1.72 | 4.63 | 4.03 | 2.93 | 1.67 | 3.00 |
| Latar | 1.91 | 4.70 | 3.02 | 2.98 | 2.12 | 2.95 |
| Dayton | 1.73 | 4.55 | 4.06 | 2.93 | 2.23 | 3.10 |
| NK-2 | 1.48 | 4.52 | 3.64 | 3.07 | 2.37 | 3.02 |
| Pennlate | 1.75 | 4.26 | 3.62 | 3.01 | 1.90 | 2.91 |
| NK-3 | 1.61 | 4.69 | 3.25 | 2.70 | 1.51 | 2.75 |
| Potomac | 1.53 | 4.17 | 3.66 | 3.13 | 1.89 | 2.88 |
| Nordstern | ---- | ---- | ---- | ---- | 1.29 | 1.29 |
| Mean yield | 1.82T/A | 4.54T/A | 3.54T/A | 3.02T/A | 1.87T/A | |
| F-value for variety yield comparison | 2.93* | 1.98N.S. | 1.94N.S. | 1.06N.S. | 4.81** | |
| S.E.$\bar{x}$ | 0.206T/A | 0.189T/A | 0.229T/A | 0.141T/A | 0.180T/A | |
| S.E.$_{\bar{d}}$ | 0.291T/A | 0.268T/A | 0.324T/A | 0.199T/A | 0.255T/A | |
| C.V. = $\frac{S\bar{x}}{\bar{x}}$ | 11.3% | 4.2% | 6.5% | 4.6% | 9.7% | |
| L.S.D. at .05 | 0.594T/A | 0.547T/A | 0.661T/A | 0.406T/A | 0.539T/A | |
| L.S.D. at .01 | 0.800T/A | 0.736T/A | 0.891T/A | 0.547T/A | 0.719T/A | |

TITLE: Irrigated Orchardgrass Introduction Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1974

OBJECTIVE: Evaluate orchardgrass introductions for forage production in northwestern Montana.

PROCEDURES: The nursery was planted on May 12, 1972 in Field Y-8, in a randomized complete block design with three replications. Each plot consisted of one row, 12 feet in length. The introductions were harvested twice in 1973 on uniform dates. Harvest area was nine square feet. Four hundred pounds of 0-45-0 were applied in the spring of 1972. Nitrogen applications in 1973 were made in early spring (94 lbs N/A) and in midsummer (48 lbs N/A).

RESULTS: Only one orchardgrass introduction was significantly higher than the check variety, Pennlate (Table 1). This introduction, 200319, was 1.34 tons per acre larger than Pennlate for the second harvest and 2.80 tons per acre larger for total harvest yields. The CV's for this experiment were very high due to the small plot size and low number of replications.

Table 1. Yields obtained from an orchardgrass introduction nursery at Kalispell, 1973.

| Variety or P.I. Number | Harvest | Tons per acre at 12 per cent moisture — Replications I | II | III | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|
| Pennlate | First | 4.89 | 2.75 | 2.87 | 10.51 | 3.50 | |
| | Second | 3.37 | 1.97 | 2.32 | 7.66 | 2.55 | |
| | Total | 8.26 | 4.72 | 5.19 | 18.17 | 6.05 | 3.43 |
| Potomac | First | 3.68 | 2.01 | 2.80 | 8.49 | 2.83 | |
| | Second | 2.70 | 2.30 | 2.13 | 7.13 | 2.38 | |
| | Total | 6.38 | 4.31 | 4.93 | 15.62 | 5.21 | 3.35 |
| 174773 | First | 3.88 | 4.87 | 3.15 | 11.90 | 3.97 | |
| | Second | 2.80 | 1.81 1/ | 2.27 | 6.88 | 2.29 | |
| | Total | 6.68 | 6.68 | 5.42 | 18.78 | 6.26 | 3.26 |
| 174774 | First | 4.99 | 2.95 | 2.19 | 10.13 | 3.38 | |
| | Second | 2.43 | 1.40 | 2.35 | 6.18 | 2.06 | |
| | Total | 7.42 | 4.35 | 4.54 | 16.31 | 5.44 | 2.83 |
| 172417 | First | 3.49 | 4.86 | 3.73 | 12.08 | 4.03 | |
| | Second | 1.67 | 2.19 | 1.54 | 5.40 | 1.80 | |
| | Total | 5.16 | 7.05 | 5.27 | 17.48 | 5.83 | 3.13 |
| 173696 | First | 3.00 | 1.79 | 1.12 | 5.91 | 1.97 | |
| | Second | 2.59 | 1.57 | 1.57 | 5.73 | 1.91 | |
| | Total | 5.59 | 3.36 | 2.69 | 11.64 | 3.88 | 2.35 |
| 176555 | First | 2.58 | 5.69 | 3.00 | 11.27 | 3.76 | |
| | Second | 2.66 | 2.87 | 3.14 | 8.67 | 2.89 | |
| | Total | 5.24 | 8.56 | 6.14 | 19.94 | 6.65 | 3.27 |
| 184040 | First | 2.12 | 2.46 | 3.53 | 8.11 | 2.70 | |
| | Second | 2.32 | 1.67 | 2.68 | 6.67 | 2.22 | |
| | Total | 4.44 | 4.13 | 6.21 | 14.78 | 4.93 | 3.33 |
| 189142 | First | 2.06 | 1.91 | 3.18 | 7.15 | 2.38 | |
| | Second | 2.59 | 1.47 | 2.24 | 6.30 | 2.10 | |
| | Total | 4.65 | 3.38 | 5.42 | 13.45 | 4.48 | 2.69 |
| 199245 | First | 3.01 | 3.06 | 3.14 | 9.21 | 3.07 | |
| | Second | 3.06 | 3.77 | 3.08 | 9.91 | 3.30 | |
| | Total | 6.07 | 6.83 | 6.22 | 19.12 | 6.37 | 3.33 |
| 200319 | First | 6.04 | 3.10 | 5.74 | 14.88 | 4.96 | |
| | Second | 4.15 | 2.19 | 5.33 | 11.67 | 3.89* | |
| | Total | 10.19 | 5.29 | 11.07 | 26.55 | 8.85* | 3.36 |

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 1975

OBJECTIVES: 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 feet by 20 feet. One hundred and fifty pounds of 34-0-0 were applied in the spring of 1973. All plots were harvested on July 11, 1973.

RESULTS: At all spacings, Pennlate out yielded Potomac by a good margin (Table 1). Over all spacings, the mean seed yield of Pennlate was about 66 percent greater than Potomac. The optimum row spacing for each variety was 12 inches. The interaction between variety and row spacing was not significant.

Table 1. Effect of row spacing and variety on orchardgrass seed production (pounds per acre) at Kalispell, 1973.

| Variety | Replication | Row Spacing (inches) 6 | 12 | 24 | 36 | Mean 1/ |
|---|---|---|---|---|---|---|
| Pennlate | I | 729.2 | 796.4 | 796.4 | 818.8 | |
| | II | 551.7 | 590.1 | 650.0 | 655.6 | |
| | III | 527.7 | 892.3 | 630.9 | 380.6 | |
| | IV | 503.7 | 748.4 | 748.4 | 393.4 | |
| | Mean | 578.1 | 756.8 | 706.4 | 562.1 | 650.9a |
| Potomac | I | 551.7 | 546.9 | 518.1 | 329.4 | |
| | II | 451.0 | 441.4 | 429.4 | 345.4 | |
| | III | 422.2 | 522.9 | 160.7 | 175.9 | |
| | IV | 254.3 | 522.9 | 338.2 | 252.7 | |
| | Mean | 419.8 | 508.5 | 361.6 | 275.9 | 391.5b |
| | Mean 2/ | 499.0bc | 632.7a | 534.0ab | 419.0c | |

Mean Yield: 521.2 lbs/a
$S^2$ = 10580.95 lbs/a
S = 102.87 lbs/a
Harvest date: 7-11-73
Harvest area: 6" and 12" row spacing = 20 square feet, 24" row spacing = 40 square feet and 36" row spacing = 30 square feet.
F-value, S.E.$\bar{x}$, C.V. $\left(\frac{S.E.\bar{x}}{(\bar{x})}\right)$ for variety yield comparison: 50.88**, 25.72 lbs/a, 4.9%
F-value, S.E.$\bar{x}$, C. V. $\left(\frac{S.E.\bar{x}}{(\bar{x})}\right)$ for row spacing yield comparison: 5.93**, 36.35 lbs/a, 7.0%
F- value, S.E.$\bar{x}$, C.V. $\left(\frac{S.E.\bar{x}}{(\bar{x})}\right)$ for row spacing x variety interaction: 1.16 N.S., 51.44 lbs/a, 9.9%

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

TITLE: Dryland Sainfoin Progeny Yield Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: This experiment will be phased out in 1974. Selections may be taken out of these progenies and the seed increased for more through testing.

OBJECTIVE: Evaluate the progenies of sainfoin selections for forage production in northwestern Montana.

PROCEDURES: This experiment was planted in a randomized complete block design with three replications on May 11, 1971, in Field F-1. Plots consist of four rows spaced one foot apart, 12 feet in length. Harvest area was 20 square feet. Harvest dates varied for the first cutting and were the same for the second cutting.

RESULTS: None of the sainfoin progenies yielded as much as Vernal alfalfa (Table 1). Total season yields for C-70-13 were significantly higher than registered Eski yields. The highest yielding entries in 1972 were not the same as those in 1973 which would indicate a year x variety interaction.

Table 1. Yields obtained from a dryland sainfoin progeny nursery at Kalispell, 1973

| Clone number or source | Harvest | Harvest date | Tons per acre at 12 percent moisture | | | | | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| | | | Replications | | | | | |
| | | | I | II | III | Total | Mean | |
| C-70-1 | First | 6-14 | 3.71 | 3.24 | 2.53 | 9.48 | 3.16 | |
| | Second | 7-23 | 1.05 | 0.74 | 1.24 | 3.03 | 1.01 | |
| | Total | | 4.76 | 3.98 | 3.77 | 12.51 | 4.17 | 6.03 |
| C-70-2 | First | 6-12 | 3.48 | 3.38 | 3.66 | 10.52 | 3.51 | |
| | Second | 7-23 | 0.89 | 0.69 | 0.81 | 2.39 | 0.80 | |
| | Total | | 4.37 | 4.07 | 4.47 | 12.91 | 4.30 | 5.12 |
| C-70-3 | First | 6-14 | 3.26 | 2.71 | 3.05 | 9.02 | 3.01 | |
| | Second | 7-23 | 0.95 | 0.87 | 0.57 | 2.39 | 0.80 | |
| | Total | | 4.21 | 3.58 | 3.62 | 11.41 | 3.80 | 5.67 |
| Vernal alfalfa | First | 6-16 | 3.38 | 2.66 | 4.67 | 10.71 | 3.57* | |
| | Second | 7-23 | 1.20 | 1.87 | 1.75 | 4.82 | 1.61** | |
| | Total | | 4.58 | 4.53 | 6.42 | 15.53 | 5.18** | 6.21* |
| C-70-7 | First | 6-11 | 4.00 | 2.97 | 2.84 | 9.81 | 3.27 | |
| | Second | 7-23 | 1.17 | 0.51 | 0.68 | 2.36 | 0.79 | |
| | Total | | 5.17 | 3.48 | 3.52 | 12.17 | 4.06 | 4.77 |
| C-70-8 | First | 6-14 | 3.91 | 3.09 | 3.22 | 10.22 | 3.41 | |
| | Second | 7-23 | 0.87 | 0.87 | 0.86 | 2.60 | 0.87 | |
| | Total | | 4.78 | 3.96 | 4.08 | 12.82 | 4.27 | 5.86 |
| C-70-11 | First | 6-19 | 4.28 | 3.38 | 3.28 | 10.94 | 3.65* | |
| | Second | 7-23 | 1.00 | 0.61 | 0.78 | 2.39 | 0.80 | |
| | Total | | 5.28 | 3.99 | 4.06 | 13.33 | 4.44* | 5.28 |
| C-70-13 | First | 6-11 | 3.38 | 3.07 | 3.68 | 10.63 | 3.54 | |
| | Second | 7-23 | 0.95 | 0.75 | 1.08 | 2.78 | 0.93 | |
| | Total | | 4.83 | 3.82 | 4.76 | 13.41 | 4.47* | 4.12 |
| C-70-17 | First | 6-11 | 2.96 | 2.72 | 2.83 | 8.51 | 2.84 | |
| | Second | 7-23 | 0.92 | 0.67 | 0.82 | 2.41 | 0.80 | |
| | Total | | 3.88 | 3.39 | 3.65 | 10.92 | 3.64 | 4.80 |
| C-70-26 | First | 6-19 | 3.53 | 3.03 | 3.34 | 9.90 | 3.30 | |
| | Second | 7-23 | 1.03 | 0.64 | 0.95 | 2.62 | 0.87 | |
| | Total | | 4.56 | 3.67 | 4.29 | 12.52 | 4.17 | 4.13 |
| C-70-29 | First | 6-12 | 3.28 | 2.65 | 2.83 | 8.76 | 2.92 | |
| | Second | 7-23 | 0.90 | 1.18 | 0.90 | 2.98 | 0.99 | |
| | Total | | 4.18 | 3.83 | 3.73 | 11.74 | 3.91 | 6.16* |
| C-70-30 | First | 6-12 | 3.66 | 3.57 | 2.76 | 9.99 | 3.33 | |
| | Second | 7-23 | 0.97 | 0.90 | 1.03 | 2.90 | 0.97 | |
| | Total | | 4.63 | 4.47 | 3.79 | 12.89 | 4.30 | 4.17 |
| C-70-35 | First | 6-12 | 3.06 | 2.86 | 2.57 | 8.49 | 2.83 | |
| | Second | 7-23 | 0.83 | 0.65 | 0.65 | 2.13 | 0.71 | |
| | Total | | 3.89 | 3.51 | 3.22 | 10.62 | 3.54 | 6.13* |

Table 1. (con't)

| Clone number or source | Harvest | Harvest date | Tons per acre at 12 percent moisture Replications I | II | III | Total | Mean | 1972 Total Yield |
|---|---|---|---|---|---|---|---|---|
| Registered Eski | First | 6-11 | 2.98 | 3.14 | 2.41 | 8.53 | 2.84 | |
| | Second | 7-23 | 0.86 | 0.75 | 0.73 | 2.34 | 0.78 | |
| | Total | | 3.84 | 3.89 | 3.14 | 10.87 | 3.62 | 4.59 |
| Eski (original source) | First | 6-11 | 3.27 | 3.12 | 2.86 | 9.25 | 3.08 | |
| | Second | 7-23 | 1.22 | 1.09 | 1.21 | 3.52 | 1.17* | |
| | Total | | 4.49 | 4.21 | 4.07 | 12.77 | 4.26 | 4.01 |

| | First Harvest | Second Harvest | Total | 1972 Total |
|---|---|---|---|---|
| Mean yields | 3.22 T/A | 0.93 T/A | 4.14 T/A | 5.14 T/A |
| F-value for variety yield comparison | 1.52 NS | 4.50** | 2.46* | 2.64* |
| S.E.$\bar{x}$ | 0.232T/A | 0.105T/A | 0.264T/A | 0.510T/A |
| S.E.$_{\bar{d}}$ | 0.329T/A | 0.149T/A | 0.374T/A | 0.721T/A |
| C.V.$= \frac{S\bar{x}}{\bar{x}}$ | 7.2% | 11.4% | 6.4% | 9.9% |
| L.S.D. at .05 | 0.706T/A | 0.319T/A | 0.802T/A | 1.456T/A |
| L.S.D. at .01 | 0.979T/A | 0.443T/A | 1.113T/A | 1.939T/A |

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

* Indicates a significantly higher yield than the check at .05 for that cutting or for the season total.

** Indicates a significantly higher yield than the check at .01 for that cutting or for the season total.

TITLE: Agropyron Hybrid Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1975

OBJECTIVE: To compare the forage production of three Agropyron hybrids to that of the standard crested variety under dryland conditions.

PROCEDURES: All entries were planted in 4 feet 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.

RESULTS: Several mistakes were noted in the planting plan early in 1973 so the data reported in the 1972 annual report is not correct. Mean yields for all entries for 1972 are reported in Table 1 along with the 1973 data.

In 1972, only the Cristatum x Desertorum hybrid yielded significantly more than the standard crested variety. The two hybrids that had quackgrass as a parent yielded less than standard crested.

In 1973, all the entries in the nursery yielded more than the standard crested variety. However, only the Repens x Desertorum hybrid yielded significantly more. The Repens x Cristatum hybrid had a much greater degree of rhizomatous growth than did the Repens x Desertorum hybrid.

Table 1. Yields obtained from an Agropyron Hybrid Nursery at Kalispell, 1973.

| Entry | Harvest Date | Tons per acre at 12 percent moisture: Replication I | II | III | IV | Total | Mean | 1972 Yields |
|---|---|---|---|---|---|---|---|---|
| Cristatum x Desertorum | 6-13 | 3.06 | 3.22 | 2.79 | 2.54 | 11.61 | 2.90 | 1.39* |
| Ladak 65 alfalfa | 6-26 | 3.16 | 4.30 | 3.85 | 3.17 | 14.48 | 3.62** | 2.48** |
| Repens x Cristatum | 6-26 | 3.03 | 3.45 | 2.54 | 2.73 | 11.75 | 2.94 | 0.42 |
| Standard Crested | 6-13 | 2.87 | 2.44 | 2.61 1/ | 2.09 | 10.01 | 2.50 | 0.71 |
| Ohoe intermediate wheatgrass | 6-26 | 5.87 | 4.57 | 5.69 | 5.02 | 21.15 | 5.29** | 0.38 |
| Repens x Desertorum | 6-26 | 3.39 | 3.14 | 3.70 | 2.93 | 13.16 | 3.29* | 0.89 |

| | 1973 | 1972 |
|---|---|---|
| Mean yields | 3.42T/A | 1.05T/A |
| F-value for variety yield comparison | 22.24** | 16.85** |
| S.E.$\bar{x}$ | 0.210T/A | 0.194T/A |
| S.E.$_{\bar{d}}$ | 0.296T/A | 0.274T/A |
| C.V. = $\frac{\text{S.E.}\bar{x}}{\bar{x}}$ | 6.1% | 18.5% |
| L.S.D. at .05 | 0.636T/A | 0.588T/A |
| L.S.D. at .01 | 0.882T/A | 0.816T/A |

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 .05 probability level.

** Indicates a significantly higher yield than the check at the .01 probability level.

TITLE: The effect of nitrogen and phosphorous on the forage yields of Eski sainfoin and Vernal alfalfa when harvested under three regimes.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Through 1975

OBJECTIVE: To determine the influence of fertility level on sainfoin and alfalfa forage yields when harvested as hay, simulated pasture and hay-stockpile.

PROCEDURES: Eski sainfoin and Vernal alfalfa were seeded on May 30, 1972 in Field Y-10. Plot size was 4 feet by 20 feet with one foot between rows. Different rates of nitrogen and phosphorous were applied to both legumes under three harvest management regimes. These harvest management regimes were (1) simulated pasture harvest where the legumes were harvested when they reached an approximate height of 12 inches and then were clipped every six weeks; (2) hay harvest where the legumes were cut as hay, and (3) hay-stockpile harvest where the legumes were first harvested as hay and then all regrowth was allowed to accumulate till fall when they were harvested a second time. The experimental design was randomized split plot with four replications. Harvest management regimes were assigned to main plots and the species and fertilizer treatments were assigned to the subplots. Harvest area for each plot was 34 square feet. Yield data was not obtained the seeding year. The nursery was irrigated three times in 1973 with two inches being applied at each irrigation.

RESULTS: Data showing the effect of nitrogen and phosphorous on the forage yields of sainfoin and alfalfa when harvested under the simulated pasture regime for first, second and third cuttings are presented in Table 1. Generally, first cutting yields of alfalfa regardless of fertilizer rates were lower than yields for most sainfoin treatments. However, second and third cutting yields of alfalfa were usually greater than those for sainfoin. There were essentially no differences between the alfala varieties that had different nitrogen rates for any of the cuttings.

The influence of nitrogen and phosphorous on the forage yields of sainfoin and alfalfa when harvested as hay for first, second and third cuttings is shown in Table 2. First cutting yields of the alfalfa treatments were lower than any of the sainfoin treatments. First cutting yields of sainfoin were the greatest at the 50 pounds per acre nitrogen and 0 pounds per acre phosphorous rates.

Sainfoin first cutting yields were approximately 1.2 tons per acre higher than those for alfalfa under the hay-stockpile regime (Table 3). However, for the "stockpile" harvest alfalfa yields were consistantly higher than sainfoin yields regardless of fertility levels. Differences in yields within species for each harvest were minimal.

Mean yields for each cutting at each harvest regime across species and fertilizer treatments are presented in Table 4. First cutting yields were the greatest under the hay and hay-stockpile regimes. Yields for second cutting of the simulated pasture were greater than those harvested under the hay regime. Second cutting yields of the hay-stockpile harvest regime were far greater than for either of the other two harvest regimes.

The effects of nitrogen and phosphorous rates, species, and harvest regime on the total forage yields of Eski sainfoin and Vernal alfalfa are presented in Table 5. The mean yields of the simulated pasture regime across all other treatments were significantly less than those for hay and hay-stockpile regimes. The yield difference for total harvest between the hay and hay-stockpile regime approached significance at the 0.05 probability level. For every fertilizer and species treatment the hay-stockpile regime out yielded the hay regime. Alfalfa showed a slight response to nitrogen across all harvest regimes. Sainfoin yields across all harvest regimes were not increased significantly by adding fertilizers although slight increases were noted. The nitrogen rate of 300 pounds per acre even decreased yields although this decrease was not significant.

Table 1. The effect of fertilizers on sainfoin and alfalfa forage yields when harvested under the simulated pasture regime.

| Species | Nitrogen (lbs/a) | Phosphorous (lbs/a) | Harvest | Tons per acre at 12 per cent moisture Replications I | II | III | IV | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Sainfoin | 0 | 0 | First | 2.60 | 2.58 | 2.52 | 2.61 | 10.31 | 2.58 |
| | | | Second | 1.18 | 1.20 | 1.28 | 1.13 | 4.79 | 1.20 |
| | | | Third | 1.12 | 1.04 | 0.97 | 1.02 | 4.15 | 1.04 |
| | | | Total | 4.90 | 4.82 | 4.77 | 4.76 | 19.25 | 4.82 |
| Sainfoin | 50 | 0 | First | 2.53 | 2.45 | 2.53 | 2.28 | 9.79 | 2.45 |
| | | | Second | 1.29 | 1.08 | 0.95 | 1.00 | 4.32 | 1.08 |
| | | | Third | 1.36 | 1.15 | 1.12 | 0.97 | 4.60 | 1.15 |
| | | | Total | 5.18 | 4.68 | 4.60 | 4.25 | 18.71 | 4.68 |
| Sainfoin | 100 | 0 | First | 2.38 | 2.04 | 2.21 | 2.43 | 9.06 | 2.27 |
| | | | Second | 1.16 | 0.97 | 1.09 | 0.90 | 4.12 | 1.03 |
| | | | Third | 0.99 | 1.03 | 1.06 | 0.84 | 3.92 | 0.98 |
| | | | Total | 4.53 | 4.04 | 4.36 | 4.17 | 17.10 | 4.28 |
| Sainfoin | 200 | 0 | First | 2.24 | 2.38 | 2.70 | 2.20 | 9.52 | 2.38 |
| | | | Second | 1.19 | 1.17 | 1.19 | 1.14 | 4.69 | 1.17 |
| | | | Third | 1.24 | 1.21 | 1.35 | 1.03 | 4.83 | 1.21 |
| | | | Total | 4.67 | 4.76 | 5.24 | 4.37 | 19.04 | 4.76 |
| Sainfoin | 300 | 0 | First | 2.24 | 2.12 | 2.06 | 2.06 | 8.48 | 2.12 |
| | | | Second | 1.23 | 0.93 | 0.78 | 0.77 | 3.71 | 0.93 |
| | | | Third | 1.26 | 0.98 | 0.89 | 0.79 | 3.92 | 0.98 |
| | | | Total | 4.73 | 4.03 | 3.73 | 3.62 | 16.11 | 4.03 |
| Sainfoin | 200 | 100 | First | 2.18 | 2.15 | 2.24 | 2.02 | 8.59 | 2.15 |
| | | | Second | 1.02 | 1.10 | 1.37 | 0.90 | 4.39 | 1.10 |
| | | | Third | 1.04 | 1.13 | 1.30 | 1.06 | 4.53 | 1.13 |
| | | | Total | 4.24 | 4.38 | 4.91 | 3.98 | 17.51 | 4.38 |
| Sainfoin | 200 | 200 | First | 2.24 | 2.39 | 2.55 | 2.38 | 9.56 | 2.39 |
| | | | Second | 1.30 | 1.33 | 1.40 | 1.28 | 5.31 | 1.33 |
| | | | Third | 1.32 | 1.34 | 1.39 | 1.32 | 5.37 | 1.34 |
| | | | Total | 4.86 | 5.06 | 5.34 | 4.98 | 20.24 | 5.06 |
| Alfalfa | 0 | 200 | First | 1.83 | 2.63 | 2.28 | 1.97 | 8.71 | 2.18 |
| | | | Second | 1.59 | 1.30 | 1.46 | 1.45 | 5.80 | 1.45 |
| | | | Third | 1.95 | 1.76 | 2.19 | 1.78 | 7.68 | 1.92 |
| | | | Total | 5.37 | 5.69 | 5.93 | 5.20 | 22.19 | 5.55 |
| Alfalfa | 100 | 200 | First | 1.99 | 1.75 | 2.40 | 2.10 | 8.24 | 2.06 |
| | | | Second | 1.67 | 1.22 | 1.28 | 1.54 | 5.71 | 1.43 |
| | | | Third | 2.01 | 1.96 | 2.16 | 2.28 | 8.41 | 2.10 |
| | | | Total | 5.67 | 4.93 | 5.84 | 5.92 | 22.36 | 5.59 |

Table 2. The effect of fertilizers on sainfoin and alfalfa forage yields when harvested under the hay regime.

| Species | Nitrogen (lbs/a) | Phosphorous (lbs/a) | Harvest | Tons per acre at 12 per cent moisture: Replications I | II | III | IV | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Sainfoin | 0 | 0 | First | 3.92 | 4.34 | 4.21 | 4.44 | 16.91 | 4.23 |
| | | | Second | 1.02 | 1.01 | 0.68 | 0.88 | 3.59 | 0.90 |
| | | | Third | 1.03 | 0.96 | 0.85 | 1.22 | 4.06 | 1.02 |
| | | | Total | 5.97 | 6.31 | 5.74 | 6.54 | 24.56 | 6.15 |
| Sainfoin | 50 | 0 | First | 4.74 | 4.60 | 4.32 | 4.84 | 18.50 | 4.63 |
| | | | Second | 0.97 | 1.05 | 0.69 | 0.83 | 3.54 | 0.89 |
| | | | Third | 1.14 | 1.11 | 0.80 | 1.11 | 4.16 | 1.04 |
| | | | Total | 6.85 | 6.76 | 5.81 | 6.78 | 26.20 | 6.56 |
| Sainfoin | 100 | 0 | First | 4.33 | 4.79 | 4.16 | 4.74 | 18.02 | 4.51 |
| | | | Second | 1.00 | 1.16 | 0.87 | 0.91 | 3.94 | 0.99 |
| | | | Third | 1.00 | 0.95 | 0.75 | 1.39 | 4.09 | 1.02 |
| | | | Total | 6.33 | 6.90 | 5.78 | 7.04 | 26.05 | 6.52 |
| Sainfoin | 200 | 0 | First | 4.75 | 4.66 | 3.31 | 4.83 | 17.55 | 4.39 |
| | | | Second | 0.92 | 1.25 | 0.45 | 1.14 | 3.76 | 0.94 |
| | | | Third | 1.06 | 0.94 | 0.61 | 1.37 | 3.98 | 1.00 |
| | | | Total | 6.73 | 6.85 | 4.37 | 7.34 | 25.29 | 6.33 |
| Sainfoin | 300 | 0 | First | 4.51 | 4.04 | 3.41 | 4.57 | 16.53 | 4.13 |
| | | | Second | 0.69 | 0.68 | 0.68 | 0.97 | 3.02 | 0.76 |
| | | | Third | 0.95 | 0.85 | 0.58 | 1.39 | 3.77 | 0.94 |
| | | | Total | 6.15 | 5.57 | 4.67 | 6.93 | 23.32 | 5.83 |
| Sainfoin | 200 | 100 | First | 3.28 | 4.38 | 4.09 | 4.61 | 16.36 | 4.09 |
| | | | Second | 0.74 | 0.64 | 0.45 | 0.91 | 2.74 | 0.69 |
| | | | Third | 0.99 | 0.79 | 0.59 | 1.26 | 3.63 | 0.91 |
| | | | Total | 5.01 | 5.81 | 5.13 | 6.78 | 22.73 | 5.69 |
| Sainfoin | 200 | 200 | First | 4.49 | 4.13 | 3.52 | 4.80 | 16.94 | 4.24 |
| | | | Second | 0.85 | 0.91 | 0.56 | 0.93 | 3.25 | 0.81 |
| | | | Third | 1.12 | 0.94 | 0.56 | 1.13 | 3.75 | 0.94 |
| | | | Total | 6.46 | 5.98 | 4.64 | 6.86 | 23.94 | 5.99 |
| Alfalfa | 0 | 200 | First | 2.61 | 3.19 | 3.36 | 3.07 | 12.23 | 3.06 |
| | | | Second | 1.74 | 1.70 | 1.66 | 1.65 | 6.75 | 1.69 |
| | | | Third | 1.91 | 1.81 | 2.01 | 1.88 | 7.61 | 1.90 |
| | | | Total | 6.26 | 6.70 | 7.03 | 6.60 | 26.59 | 6.65 |
| Alfalfa | 100 | 200 | First | 3.57 | 3.19 | 3.52 | 3.01 | 13.29 | 3.32 |
| | | | Second | 1.73 | 1.92 | 1.49 | 1.57 | 6.71 | 1.68 |
| | | | Third | 1.84 | 2.08 | 1.91 | 1.90 | 7.73 | 1.93 |
| | | | Total | 7.14 | 7.19 | 6.92 | 6.48 | 27.73 | 6.93 |

Table 3. The effect of fertilizers on sainfoin and alfalfa forage yields when harvested under the stockpiling regime.

| Species | Nitrogen (lbs/a) | Phosphorous (lbs/a) | Harvest | Tons per acre at 12 per cent moisture Replications I | II | III | IV | Total | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Sainfoin | 0 | 0 | First | 3.80 | 4.54 | 4.87 | 4.53 | 17.74 | 4.44 |
| | | | Second | 2.16 | 2.59 | 2.50 | 2.37 | 9.62 | 2.41 |
| | | | Total | 5.96 | 7.13 | 7.37 | 6.90 | 27.36 | 6.85 |
| Sainfoin | 50 | 0 | First | 3.83 | 4.55 | 4.74 | 4.55 | 17.67 | 4.42 |
| | | | Second | 2.36 | 2.33 | 2.35 | 2.51 | 9.55 | 2.39 |
| | | | Total | 6.19 | 6.88 | 7.09 | 7.06 | 27.22 | 6.81 |
| Sainfoin | 100 | 0 | First | 3.19 | 4.42 | 5.67 | 4.52 | 17.80 | 4.45 |
| | | | Second | 2.03 | 2.80 | 2.72 | 2.41 | 9.96 | 2.49 |
| | | | Total | 5.22 | 7.22 | 8.39 | 6.93 | 27.76 | 6.94 |
| Sainfoin | 200 | 0 | First | 3.88 | 4.52 | 5.05 | 4.80 | 18.25 | 4.56 |
| | | | Second | 2.55 | 2.55 | 2.54 | 2.90 | 10.54 | 2.64 |
| | | | Total | 6.43 | 7.07 | 7.59 | 7.70 | 28.79 | 7.20 |
| Sainfoin | 300 | 0 | First | 3.42 | 4.06 | 5.06 | 4.98 | 17.52 | 4.38 |
| | | | Second | 2.64 | 2.47 | 2.75 | 2.89 | 10.75 | 2.69 |
| | | | Total | 6.06 | 6.53 | 7.81 | 7.87 | 28.27 | 7.07 |
| Sainfoin | 200 | 100 | First | 4.11 | 4.99 | 4.69 | 5.11 | 18.90 | 4.73 |
| | | | Second | 2.46 | 2.85 | 2.82 | 2.61 | 10.74 | 2.69 |
| | | | Total | 6.57 | 7.84 | 7.51 | 7.72 | 29.64 | 7.42 |
| Sainfoin | 200 | 200 | First | 3.70 | 5.01 | 4.98 | 4.40 | 18.09 | 4.52 |
| | | | Second | 2.55 | 3.34 | 2.52 | 2.75 | 11.16 | 2.79 |
| | | | Total | 6.25 | 8.35 | 7.50 | 7.15 | 29.25 | 7.31 |
| Alfalfa | 0 | 200 | First | 3.26 | 2.61 | 2.76 | 3.70 | 12.33 | 3.08 |
| | | | Second | 3.81 | 3.57 | 3.83 | 4.11 | 15.32 | 3.83 |
| | | | Total | 7.07 | 6.18 | 6.59 | 7.81 | 27.65 | 6.91 |
| Alfalfa | 100 | 200 | First | 3.14 | 3.15 | 3.35 | 3.61 | 13.25 | 3.31 |
| | | | Second | 3.83 | 3.90 | 3.46 | 3.77 | 14.96 | 3.74 |
| | | | Total | 6.97 | 7.05 | 6.81 | 7.38 | 28.21 | 7.05 |

Table 4. Mean yields for each cutting for each harvest regime.

| Harvest Regime | Tons per acre at 12 per cent moisture Harvest Date 5-29 | 6-20 | 7-12 | 7-25 | 8-28 | 9-10 | Total |
|---|---|---|---|---|---|---|---|
| Simulated pasture | 2.29 | ---- | 1.19 | ---- | 1.32 | ---- | 4.79 |
| Hay | ---- | 4.07 | ---- | 1.04 | ---- | 1.19 | 6.29 |
| Stockpile | ---- | 4.21 | ---- | ---- | ---- | 2.85 | 7.06 |

Table 5. Effect of varying fertilizer rates and harvest regime on the total forage yields* of Eski sainfoin and Vernal alfalfa.

| Species | Nitrogen (lbs/a) | Phosphorous (lbs/a) | Tons per acre at 12 percent moisture — Harvest Regime: Simulated Pasture | Hay | Hay Stockpile | Mean |
|---|---|---|---|---|---|---|
| Sainfoin | 0 | 0 | 4.82abcd | 6.15abcd | 6.85a | 5.94bcd |
| Sainfoin | 50 | 0 | 4.68cd | 6.56abc | 6.81a | 6.02bcd |
| Sainfoin | 100 | 0 | 4.28cd | 6.52abc | 6.94a | 5.91bcd |
| Sainfoin | 200 | 0 | 4.76bcd | 6.33abcd | 7.20a | 6.10abcd |
| Sainfoin | 300 | 0 | 4.03d | 5.83cd | 7.07a | 5.64d |
| Sainfoin | 200 | 100 | 4.38cd | 5.69d | 7.42a | 5.83cd |
| Sainfoin | 200 | 200 | 5.06abc | 5.99bcd | 7.31a | 6.12abc |
| Alfalfa | 0 | 200 | 5.55ab | 6.65ab | 6.91a | 6.37ab |
| Alfalfa | 100 | 200 | 5.59a | 6.93a | 7.05a | 6.52a |
| Mean | | | 4.79a | 6.29b | 7.06b | |

* Species and fertilizer means, harvest regime means, and species and fertilizer means within each harvest regime not followed by the same letter are significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

| | Species and fertilizer | Harvest regime | Species and fertilizer within each harvest regime |
|---|---|---|---|
| F-value for variety yield comparison | 3.45** | 22.05** | 2.22** |
| S.E. $\bar{x}$ | 0.146T/A | 0.246T/A | 0.253T/A |
| S.E. $\bar{d}$ | 0.206T/A | 0.347T/A | 0.357T/A |
| C.V. = $\frac{S.E.\bar{x}}{\bar{x}}$ | 2.4% | 4.1% | 4.2% |

TITLE: Evaluation of two irrigated pasture mixtures 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, forage utilization, carrying capacity, and beef gain per acre of two irrigated pasture mixtures (Eski sainfoin-Empire birdsfoot trefoil and Ladino clover-Potomac orchardgrass) when grazed by yearling steers.

DURATION: The evaluation of these two pasture mixtures was discontinued in 1973. Three new pastures will be evaluated in 1974, 1975 and 1976. They are (1) Melrose sainfoin-Empire birdsfoot trefoil - Manchar smooth bromegrass; (2) Ladino clover - Chinook orchardgrass; and (3) a pure stand of Thor alfalfa.

PROCEDURES: A non bloating pasture mixture (Eski sainfoin-Empire birdsfoot trefoil) and a bloating mixture (Ladino clover-Potomac orchardgrass) were seeded in late summer of 1971 at Kalispell, Montana. Each pasture treatment consisted of two acres plus a one-half acre holding pasture. The two acres for each treatment were divided into four sub-pastures to allow rotational grazing. The pastures were fertilized with 200 pounds per acre of 16-20-0 at time of seeding and 150 pounds per acre of 34-0-0 in the spring of 1972. In the spring of 1973, 280 pounds per acre of 16-20-0 were applied to the clover-orchardgrass mixture and 120 pounds per acre of 0-45-0 were applied to the sainfoin-trefoil mixture. Six irrigations with two inches per irrigation were applied throughout the 1973 growing season.

No forage data was obtained in the fourth rotation which essentially was a fall grazing rotation. Three samples of 3 by 10 feet each were obtained from each sub-pasture before and after grazing for the first three rotations to evaluate each species mixture for forage yield and forage consumption. In paddock number two for the first three rotations, three samples were hand separated to determine the species composition by weight throughout the growing season. In 1973 the sainfoin-trefoil pasture was heavily invaded by bluegrass, so essentially the mixture consisted of three species rather than two.

The cattle used to graze the pastures were hereford and hereford-angus yearling steers which were obtained from the Tutvedt brothers northwest of Kalispell. Each steer was implanted with 36 milligrams of D.E.S. The steers were recieved in early May of 1973 and weighed prior to assignment to the pastures. The weights ranged from 400 to 550 pounds. The very light and heavy steers were not included in the study. Three steers that weighed 500$^{+}$ 11 pounds were assigned to each pasture treatment as "tester" steers (Table 1). These steers remained on the study throughout the season to evaluate the quality of the forage. In addition, steers with equivalent 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 put on the pasture. The "testers" steers were weighed after grazing each sub-pasture in the same manner. No concentrates were given to either group of steers throughout the growing season. A mineral supplement (block form) was provided for the sainfoin-trefoil-bluegrass steers and Bloat Guard which contained poloxalene (block form) was provided for the clover-orchardgrass steers. The latter steers were fed Bloat Guard for three days prior to putting them on the bloating mixture. None of the steers grazing the clover-orchardgrass mixture showed signs of bloat in 1973.

RESULTS AND DISCUSSION:

Initial weights, final weights, and total weight gains for the yearling "tester" steers when grazing each of the pasture mixtures for 146 days are presented in Table 1. Each pasture treatment was assigned two hereford steers and one black-whiteface steer. Total weight gains for each steer on the sainfoin-trefoil-bluegrass mixture exceeded those of the clover-orchardgrass mixture by an average of 26 pounds. Statistics for the average daily gains for the "tester" steers are included in Table 2.

The total production in pounds per acre of the clover-orchardgrass steers ("tester" and "put and take") was 121.5 pounds greater than that of the sainfoin-trefoil-bluegrass steers (Table 2). As could be expected, beef production was greater in the first rotation for both pasture mixtures and dropped off in each succeeding rotation. In every rotation except the second, beef production was greater for clover-orchardgrass pastures. One possible reason for the reverse in the second rotation could be due to an infestation of flies. The clover-orchardgrass steers seemed to be more affected even though steers in both pastures had access to an insecticide. Also, the clover-orchardgrass steers did have some diarrhea which could have increased the fly problem.

Average daily gains across all rotations for the tester steers was greater for those steers on the sainfoin-trefoil-bluegrass mixture than it was for the clover-orchardgrass steers, although this difference was not significant. In the fourth rotation, the sainfoin-trefoil-bluegrass mixture consisted mostly of bluegrass and with the absence of a legume in the mixture, the average daily gains dropped. The average daily gain for the clover-orchardgrass animals in the second rotation was very low. Again, I would attribute this to the fly problem.

The number of AUM's was greater for the clover-orchardgrass pasture than for the sainfoin-trefoil-bluegrass pasture. On the average each steer consumed more forage per pound of gain for the clover-orchardgrass pasture than for the sainfoin-trefoil-bluegrass pasture. The carrying capacity of the clover-orchardgrass pasture was significantly greater than the sainfoin-trefoil-bluegrass pasture.

The total forage yield (tons/acre at 12 percent moisture) was 0.5 tons/acre greater for the clover-orchardgrass pasture mixture (Table 3). For both pastures, yields were greatest for the first rotation and decreased in each succeeding rotation. The difference in total production for the two pastures came in the second and third rotations due to the greater regrowth of the clover-orchardgrass. Percent consumption was greater in the second and third rotation than in the first rotation, especially for the sainfoin-trefoil-bluegrass mixture. Sainfoin comprised the greater part of the sainfoin-trefoil-bluegrass mixture in the first rotation and decreased markedly in the following rotations. Trefoil, however showed an exact reverse in its

contribution to the mixture. The clover-orchardgrass mixture consisted mostly of orchardgrass early in the season and gradually declined through midsummer and increased slightly in the fall. The clover increased in its contribution to the total forage yield of the mixture as the season progressed. In both pastures, weed invasions were the greatest during the second rotation and markedly decreased in the third rotation. Shepherd's purse was the predominate weed in both pastures.

SUMMARY:

Two irrigated pasture mixtures (1) Eski sainfoin-Empire birdsfoot trefoil (non bloating mixture) and (2) Ladino clover-Potomac orchardgrass (bloating mixture) were grazed by yearling steers for 146 days in 1973 at Kalispell, Montana. Total beef production was 977 and 855.5 pounds per acre for the clover-orchardgrass and sainfoin-trefoil pastures, respectively. It is questionable whether this difference was great enough to off set the cost of feeding Bloat Guard to the clover-orchardgrass steers. There were no signs of bloat in 1973. Average daily gains were greater for those steers grazing the sainfoin-trefoil mixture, although this difference was not significant. The average carrying capacity of the clover-orchardgrass and sainfoin-trefoil mixtures was 3.69 and 3.10 steers per acre, respectively. This difference was significant at the 0.05 level of probability.

Table 1. Initial weights, final weights, and total weight gains for yearling tester steers when grazing two irrigated pasture mixtures for 146 days.

| Animal Number | Animal Type | Initial Weight | Final Weight | Total Gain | ADG |
|---|---|---|---|---|---|
| | | Sainfoin - Trefoil - Bluegrass | | | |
| 7 | Hereford | 496 | 733 | 237 | 1.62 |
| 12 | Hereford | 511 | 833 | 322 | 2.21 |
| 18 | Black, whiteface | 497 | 809 | 312 | 2.14 |
| $\bar{x}$ | | 501.3 | 791.7 | 290.3 | 1.99 |
| | | Clover - Orchardgrass | | | |
| 3 | Hereford | 499 | 759 | 260 | 1.78 |
| 15 | Hereford | 506 | 782 | 276 | 1.89 |
| 32 | Black, whiteface | 505 | 761 | 256 | 1.75 |
| $\bar{x}$ | | 503.3 | 767.3 | 264.0 | 1.81 |

Table 2. Performance of yearling steers by rotation when grazing two irrigated pasture mixtures.

| | First Rotation 5/17-6/17 32 days | Second Rotation 6/18-7/27 40 days | Third Rotation 7/28-9/7 42 days | Fourth Rotation 9/8-10/9 32 days | Total | Mean |
|---|---|---|---|---|---|---|
| Sainfoin-trefoil-bluegrass | | | | | | |
| Gain/a (lbs) | 298.5 | 251.0 | 204.5 | 101.5 | 855.5 | --- |
| ADG-testers (lbs) | 2.02 | 2.09 | 2.14 | 1.71 | --- | 1.99 1/ |
| Steer days/a | 165.0 | 110.5 | 104.5 | 64.0 | 444.0 | --- |
| Animal days/a* | 110.6 | 74.0 | 70.0 | 42.9 | 297.5 | --- |
| Steer months/a | --- | --- | --- | --- | 14.80 | --- |
| Animal months/a* | --- | --- | --- | --- | 9.92 | --- |
| 12% hay intake/steer/ day (lbs) | 14.18 | 14.67 | 13.01 | --- | --- | 13.95 |
| 12% hay/lb of beef | 7.84 | 6.45 | 6.65 | --- | --- | 6.98 |
| Carrying capacity | | | | | | |
| Steers/a | 5.16 | 2.76 | 2.49 | 2.00 | --- | 3.10 2/ |
| AU/a | 3.45 | 1.85 | 1.67 | 1.34 | --- | 2.08 |
| Clover-orchardgrass | | | | | | |
| Gain/a (lbs) | 344.0 | 199.5 | 273.0 | 160.5 | 977.0 | --- |
| ADG-testers (lbs) | 1.87 | 1.49 | 1.93 | 1.95 | --- | 1.81 1/ |
| Steer days/a | 183.0 | 137.0 | 130.0 | 80.0 | 530.0 | --- |
| Animal days/a* | 122.6 | 91.8 | 87.1 | 53.6 | 355.1 | --- |
| Steer months/a | --- | --- | --- | --- | 17.67 | --- |
| Animal months/a* | --- | --- | --- | --- | 11.84 | --- |
| 12% hay intake/steer/ day (lbs) | 12.90 | 15.18 | 14.46 | --- | --- | 14.18 |
| 12% hay/lb of beef | 6.86 | 10.43 | 6.89 | --- | --- | 8.06 |
| Carrying capacity | | | | | | |
| Steers/a | 5.72 | 3.43 | 3.10 | 2.50 | --- | 3.69 2/ |
| AU/a | 3.83 | 2.30 | 2.07 | 1.67 | --- | 2.47 |

* Animal days/a and animal months/a were calculated from steer days/a and steer months/a by multiplying by the factor 0.67.

1/ L.S.D. at 0.05 = 0.40 lbs/day and C.V. $\left(\frac{S.E.\bar{x}}{\bar{x}}\right)$ = 6.0%

2/ L.S.D. at 0.01 = 0.34 steers/a and C.V. $\left(\frac{S.E.\bar{x}}{\bar{x}}\right)$ = 1.2%

Table 3. Forage yields, species composition and percent consumption by rotation and paddock for two irrigated pasture mixtures.

| | First Rotation 5/17-6/17 32 days | | | | | Second Rotation 6/18-7/27 40 days | | | | | Third Rotation 7/28-9/7 42 days | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of days/paddock | | | | | Number of days/paddock | | | | | Number of days/paddock | | | | | |
| | 10 | 6* | 7 | 9 | Total | 10 | 10 | 10 | 10 | Total | 9 | 9 | 10 | 14 | Total | |
| Sainfoin-trefoil-bluegrass | | | | | | | | | | | | | | | | |
| Forage yield (tons/a at 12% moisture) | .43 | .06 | .28 | .40 | 1.17 | .25 | .13 | .21 | .24 | .81 | .18 | .18 | .18 | .15 | .68 | 2.66 |
| Percent consumption | 79.6 | 85.2 | 74.4 | 78.9 | | 82.7 | 72.6 | 85.6 | 93.5 | | 68.6 | 86.0 | 88.2 | 87.3 | | |
| Species composition % | | | | | | | | | | | | | | | | |
| sainfoin | | 60.5 | | | | | 28.1 | | | | | 12.1 | | | | |
| trefoil | | 1.9 | | | | | 33.7 | | | | | 73.1 | | | | |
| bluegrass | | 12.2 | | | | | 5.8 | | | | | 7.3 | | | | |
| weeds | | 25.5 | | | | | 32.4 | | | | | 7.5 | | | | |
| Clover-orchardgrass | | | | | | | | | | | | | | | | |
| Forage yield (tons/a at 12% moisture) | .38 | .05 | .38 | .38 | 1.18 | .25 | .15 | .33 | .31 | 1.04 | .27 | .18 | .25 | .25 | .94 | 3.16 |
| Percent consumption | 80.9 | 93.8 | 88.5 | 81.0 | | 89.8 | 88.9 | 91.9 | 91.5 | | 94.3 | 87.7 | 95.2 | 90.3 | | |
| Species composition % | | | | | | | | | | | | | | | | |
| clover | | 23.9 | | | | | 28.1 | | | | | 62.9 | | | | |
| orchardgrass | | 54.3 | | | | | 31.9 | | | | | 33.8 | | | | |
| weeds | | 21.9 | | | | | 40.0 | | | | | 13.4 | | | | |

* First paddock grazed in 1973.

TITLE: Spring Barley.

PROJECT: Small Grains Investigations 756

YEAR: 1973

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

1973 EXPERIMENTS:

1. Dryland Intrastate Yield Nursery
2. Irrigated Intrastate Yield Nursery
3. Off Station Yield Nurseries
   - Missoula County
   - Ravalli County
   - Lake County
   - Sanders County
4. Irrigated Unitan 2-6 Row Isogenic Yield Nursery
5. Dryland Awnless Yield Nursery
6. Dryland Hooded Yield Nursery

SUMMARY OF 1973 RESULTS:

Dryland Intrastate Yield Nursery: Below normal rainfall during the growing season accounted in part for the low dryland yield. Steptoe is the highest yielding variety with 69.05 bu/a, however it is not significantly greater in yield than Piroline at the .05 level of probability. Table 1.

A summary of dryland varieties is found in Table 2. Many varieties exceeded Piroline in yield, with Steptoe being 30% higher in yield over a 3 year period. Centennial 12%, 6 years; ID143411, 22%, 2 years and Zepher, 16%, 7 years.

Irrigated Intrastate Yield Nursery: Yields ranged from 54.0 bu/a to 109.2 bu/a. No varieties were found to be significantly (.05) higher in yield than Ingrid. The highest yielding entry was ID681241. Complete tabulated data is found in Table 3.

Yields of varieties grown in the Irrigated Intrastate Nursery for the past ten years and comparisons are found in Table 4.

Off Station Locations:

Missoula County - A large weed population early in the growing season may have had some effect on yields; however, they are near average for this location. Water shortage was a factor in total yield. MT729 was the highest yielding entry in the nursery and was significantly higher in yield than Ingrid. Test weights were very high for all varieties. Table 5.

Ravalli County - This nursery was grown on land which had been in sugar beets in 1972. Water was adequate during the growing season. Yields are very high and plumpness was high for most entries. There was good differintial in lodging data. The mean yield for the nursery was 110.72 bu/a. ID6821241 was the highest in yield. Table 6.

Results (con't)

Lake County - The seed bed contained considerable straw at seeding time (stubbled in wheat land). This resulted in some planting shoes plugging, causing missing plots. This could in part account for the rather high C.V. Yields were quite high in this location. Hector was the highest yielding entry, but yields were found to be statistically non-significant. Table 7.

Sanders County - Good seed bed at planting time and adequate moisture during the growing season are responsible for the high yields and large plump kernels. Yields ranged from 95.63 bu/a to 137.17 bu/a. Steptoe was significantly higher in yield than Ingrid in this location. Table 8.

Tables 9, 10 and 11 are summaries of barley data obtained from 20 lines and varieties tested in western Montana in 1973. The highest mean yield was obtained in Sanders County, the highest yielding variety was ID681241, Steptoe was third in yield for all locations.

Several breeding nurseries were grown in 1973. These are included in the overall Feed Crops Research Committee Report.

Table 1. Agronomic data from **dryland** intrastate barley yield nursery grown at the Northwestern Agricultural Research Center, Route 4, Kalispell. Field A-2.

Date seeded: April 18, 1973 Date harvested: August 17, 1973
Size of plot: 16 square feet

| C.I. or St. No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Heading Date | Plant Height | Lodging % Prev. | Lodging Sev. | % Plump 1/ |
|---|---|---|---|---|---|---|---|---|
| CI 15229 | Steptoe | 69.05 | 42.8 | 172.25b | 31.50 | .00b | .00 | 80.0 |
| ID143411 | Pir/Vance Smyrna | 67.27 | 48.0 | 171.75b | 27.75 | 74.25a | 4.00a | 67.0 |
| MT 722 | | 64.11 | 47.2 | 179.50a | 29.25 | .00b | .00 | 73.0 |
| CI 3351 | Dekap | 63.86 | 45.8 | 174.75 | 28.25 | 99.00a | 7.00a | 46.0 |
| ID681241 | Steveland x Unitan | 63.46 | 42.4 | 171.75b | 30.75 | 99.00a | 2.75a | 72.0 |
| CI 13667 | Zephyr | 63.05 | 45.8 | 179.00a | 27.75 | .00b | .00 | 79.0 |
| MT 729 | | 62.90 | 48.5 | 179.25a | 28.50 | .00b | .00 | 72.0 |
| CI 13826 | Erbet | 62.30 | 49.6 | 170.25 | 27.75 | 99.00a | 5.25a | 51.0 |
| ID 18101 | Klages | 62.08 | 44.3 | 181.25a | 30.25 | .00b | .00 | 64.0 |
| CI 10421 | Unitan | 62.05 | 42.2 | 172.75b | 35.75a | 99.00a | 1.75a | 73.0 |
| CI 9558 | Piroline 2/ | 61.77 | 49.6 | 176.00 | 28.50 | 24.75 | .25 | 66.0 |
| MT 724 | | 61.61 | 44.6 | 182.00a | 26.25b | .00b | .00 | 72.0 |
| CI 13827 | Shabet | 61.36 | 45.3 | 179.00a | 29.75 | 99.00a | 1.50a | 42.0 |
| CI 6398 | Betzes | 60.61 | 45.6 | 178.75a | 31.25a | 49.50 | 1.00 | 50.0 |
| MT 72132 | Hector | 59.43 | 46.1 | 177.25 | 31.50a | 24.75 | .25 | 76.0 |
| MT 728 | | 59.33 | 46.5 | 177.75a | 27.00 | .00b | .00 | 57.0 |
| WA692566 | Marie/Pir// Heines Hanna | 59.30 | 46.2 | 175.75a | 29.25 | 24.75 | .25 | 54.0 |
| CD 5914 | Centennial | 58.89 | 45.6 | 181.25a | 28.25 | .00b | .00 | 83.0 |
| MT 7211 | Merio | 58.58 | 44.8 | 180.25a | 26.50b | .00b | .00 | 55.0 |
| MT 723 | | 58.14 | 43.7 | 179.00a | 25.25 | .00b | .00 | 75.0 |
| MT 727 | | 57.93 | 45.6 | 181.50a | 27.00 | .00b | .00 | 50.0 |
| MT 13682 | Briggs | 57.02 | 42.6 | 166.25b | 24.50b | .00b | .00 | 85.0 |
| MT 726 | | 56.71 | 46.5 | 179.00a | 28.00 | .00b | .00 | 85.0 |
| MT 7212 | Signat | 56.58 | 48.0 | 179.25a | 28.00 | .00b | .00 | 77.0 |
| MT 7213 | | 55.33 | 45.9 | 184.50a | 23.00b | .00b | .00 | 50.0 |
| MT 7210 | | 54.46 | 45.3 | 179.75a | 25.75b | .00b | .00 | 64.0 |
| CI 10083 | Ingrid | 53.61 | 47.7 | 181.75a | 28.75 | 24.75 | .25 | 71.0 |
| MT 725 | | 52.74 | 46.2 | 180.75a | 30.00 | .00b | .00 | 67.0 |
| MT 7214 | | 52.17 | 46.1 | 179.50a | 26.50b | .00b | .00 | 39.0 |
| MT 87148 | Betzes Double Erectoides | 50.64b | 47.2 | 177.25 | 24.25b | .00b | .00 | 61.0 |
| CI 5438 | Compana | 50.30b | 43.0 | 174.00b | 29.75 | 99.00a | 7.00a | 88.0 |
| MT 721 | | 44.20b | 43.7 | 180.00a | 25.25b | .00b | .00 | 60.0 |
| MT294318 | Waxy Compana | 41.73b | 41.2 | 173.75b | 27.75 | 99.00a | 7.00a | 79.0 |
| MT 72811 | Wiebe 8 Chr Late | 41.20b | 44.0 | 183.50a | 26.75 | .00b | .00 | 40.0 |
| MT 7285 | Wiebe 8 Chr Early | 32.07b | 47.2 | 172.75b | 25.25b | 24.75 | .25 | 40.0 |
| | $\bar{x}$ | 57.0 | 45.6 | 177.5 | 28.0 | 26.9 | 1.1 | 64.7 |
| | F 3/ | 4.69** | .0 | 72.05** | 13.29** | 12.29** | 43.44** | .0 |
| | S.E.$\bar{x}$ | 3.59 | .0 | .49 | .69 | 11.40 | .33 | .0 |
| | L.S.D. (.05) | 10.07 | .0 | 1.36 | 1.92 | 31.97 | .93 | .0 |
| | C.V. % | 6.30 | .0 | .27 | 2.45 | 42.44 | 30.14 | .0 |

1/ On top 6/64 seive
2/ Check variety
3/ Value for variety comparison
a/ Values significantly greater than the check.
b/ Values significantly less than the check.
*/ Indicates statistical significance .05 level.
**/Indicates statistical significance .01 level.

Table 2. Summary of yields for dryland intrastate and station yield nurseries grown on the Northwestern Agricultural Research Center, Kalispell, Montana from 1964 thru 1973.

| C.I. or State # | Variety | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | Ave. | Sta Yrs | % Piroline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CI 10421 | Unitan | 65.5 | 80.4 | 72.6 | 60.7 | 90.1 | 64.5 | 86.2 | 78.5 | 88.9 | 62.1 | 74.9 | 10 | 108 |
| CI 6398 | Betzes | 61.7 | 73.5 | 69.9 | 56.5 | 90.4 | 76.4 | 72.0 | 72.5 | 83.8 | 60.6 | 71.7 | 10 | 103 |
| CI 9558 | Piroline | 75.3 | 80.8 | 69.1 | 58.3 | 96.5 | 50.4 | 78.7 | 67.7 | 57.1 | 61.8 | 69.6 | 10 | 100 |
| CI 3351 | Dekap | 56.8 | 72.5 | 56.5 | 52.4 | 86.7 | 53.8 | 74.8 | 73.4 | 69.8 | 63.9 | 65.9 | 10 | 95 |
| CI 5438 | Compana | 57.1 | 79.8 | 62.9 | 58.2 | 89.1 | 44.9 | 66.2 | 58.6 | 44.2 | 50.3 | 61.1 | 10 | 88 |
| CI 13667 | Zephyr | | | | 60.9 | 94.8 | 60.5 | 93.7 | 82.2 | 89.6 | 63.1 | 77.8 | 7 | 116 |
| CI 13826 | Erbet | | | | 53.3 | 85.1 | 66.3 | 66.9 | 59.8 | 40.1 | 62.3 | 62.0 | 7 | 92 |
| CD 5914 | Centennial | | | | | 101.4 | 64.3 | 94.9 | 83.7 | 57.1 | 58.9 | 76.7 | 6 | 112 |
| CI 13827 | Shabet | | | | | | 57.8 | 73.4 | 68.4 | 62.6 | 61.4 | 64.7 | 5 | 103 |
| MT 72132 | Hector | | | | | | 43.1 | 74.0 | 77.5 | 68.1 | 59.4 | 64.4 | 5 | 102 |
| CI 15229 | Steptoe | | | | | | | | 97.9 | 75.9 | 69.1 | 81.0 | 3 | 130 |
| ID143411 | Pir/Vance Sm | | | | | | | | | 78.2 | 67.3 | 72.7 | 2 | 122 |
| MT 7212 | | | | | | | | | | 82.1 | 56.6 | 69.4 | 2 | 117 |
| WA692566 | Marie/Pir//Heines Hanna | | | | | | | | | 75.1 | 59.3 | 67.2 | 2 | 113 |
| MT 729 | | | | | | | | | | 70.0 | 62.9 | 66.4 | 2 | 112 |
| ID681241 | Steveland x Unitan | | | | | | | | | 63.8 | 63.5 | 63.7 | 2 | 107 |
| MT 7210 | | | | | | | | | | 71.0 | 54.5 | 62.7 | 2 | 106 |
| MT 723 | | | | | | | | | | 63.1 | 58.1 | 60.6 | 2 | 102 |
| MT 725 | | | | | | | | | | 65.6 | 52.7 | 59.2 | 2 | 100 |
| MT 87148 | Betzes Double Erectoides | | | | | | | | | 57.5 | 50.6 | 54.1 | 2 | 91 |
| MT 721 | | | | | | | | | | 58.4 | 44.2 | 51.3 | 2 | 86 |
| MT 722 | | | | | | | | | | | 64.1 | 64.1 | 1 | 104 |
| ID 18101 | Klages | | | | | | | | | | 62.1 | 62.1 | 1 | 100 |
| MT 724 | | | | | | | | | | | 61.6 | 61.6 | 1 | 100 |
| MT 728 | | | | | | | | | | | 59.3 | 59.3 | 1 | 96 |
| MT 7211 | (Vireo) | | | | | | | | | | 58.6 | 58.6 | 1 | 95 |
| MT 727 | | | | | | | | | | | 57.9 | 57.9 | 1 | 94 |
| CI 13682 | Briggs | | | | | | | | | | 57.0 | 57.0 | 1 | 92 |
| MT 726 | | | | | | | | | | | 56.7 | 56.7 | 1 | 92 |
| MT 7213 | | | | | | | | | | | 55.3 | 55.3 | 1 | 90 |
| CI10083 | Ingrid | | | | | | | | | | 53.6 | 53.6 | 1 | 87 |
| MT 7214 | | | | | | | | | | | 52.2 | 52.2 | 1 | 85 |
| MT294318 | Waxy Compana | | | | | | | | | | 41.7 | 41.7 | 1 | 68 |
| MT 72811 | Wiebe 8 Chr Late | | | | | | | | | | 41.2 | 41.2 | 1 | 67 |
| MT 7285 | Wiebe 8 Chr Early | | | | | | | | | | 32.1 | 32.1 | 1 | 52 |

Table 3. Agronomic data from the irrigated intrastate barley yield nursery grown at the Northwestern Agricultural Research Center, Route 4, Kalispell. Field Y-2.

Date seeded: April 24, 1973 Date harvested: August 23, 1973
Size of plot: 16 square feet

| C.I. or St. No. | Variety | Yield Bu/A | Test Wt Lbs/Bu. | Heading Date | Plant Height | Lodging % Prev. | Lodging Sev. | %[1] Plump |
|---|---|---|---|---|---|---|---|---|
| ID681241 | Steveland x Unitan | 109.21 | 42.5 | 172.60b | 36.80 | 99.0 | 7.40 | 82.0 |
| MT 13682 | Briggs | 102.96 | 45.0 | 168.20b | 30.80 | 99.0 | 6.00 | 89.0 |
| MT 7211 | | 102.13 | 47.0 | 180.00 | 34.40 | 99.0 | 9.00 | 73.0 |
| MT 72132 | Hector | 100.93 | 50.2 | 175.60b | 38.00 | 99.0 | 9.00 | 86.4 |
| MT 723 | | 100.43 | 47.2 | 177.80b | 35.80 | 95.2 | 9.00 | 75.8 |
| MT 7210 | | 100.08 | 51.2 | 178.60b | 32.20b | 99.0 | 3.40 | 86.2 |
| CI 15229 | Steptoe | 97.41 | 45.5 | 172.40b | 40.80a | 99.0 | 8.60 | 83.8 |
| MT 7213 | | 97.31 | 44.7 | 183.00a | 30.40b | .0b | .00b | 65.2 |
| MT 729 | | 96.53 | 50.5 | 178.80b | 35.40 | 79.2 | 3.20 | 77.0 |
| MT 728 | | 95.06 | 51.2 | 178.00b | 35.00 | 85.4 | 6.00 | 76.2 |
| MT 724 | | 95.06 | 51.0 | 179.40b | 34.00 | 75.4 | 4.00b | 85.4 |
| CD 5914 | Centennial | 94.23 | 48.5 | 180.20 | 35.00 | 99.0 | 5.40 | 85.8 |
| WA692566 | Marie/Pir// Heines Hanna | 93.98 | 48.0 | 176.80b | 38.60 | 99.0 | 9.00 | 75.2 |
| MT 721 | | 92.06 | 47.5 | 179.80 | 31.80b | 79.2 | 3.00b | 66.2 |
| CI 10421 | Unitan | 91.88 | 45.5 | 173.20b | 43.80 | 99.0 | 8.20 | 73.6 |
| MT 7214 | | 91.86 | 50.5 | 180.20 | 36.00 | 75.4 | 5.40 | 85.0 |
| MT 87148 | Betzes Double Erectoides | 91.48 | 50.0 | 177.00b | 31.00b | 39.6b | 2.20b | 64.8 |
| CI 10083 | Ingrid[2] | 91.23 | 50.6 | 181.00 | 35.60 | 99.0 | 7.60 | 81.0 |
| MT 727 | | 90.95 | 51.0 | 180.00 | 36.00 | 69.4 | 7.00 | 86.6 |
| CI 6398 | Betzes | 89.05 | 49.5 | 176.80b | 36.20 | 99.0 | 8.20 | 72.0 |
| MT 726 | | 88.93 | 52.0 | 179.80 | 33.60 | 79.2 | 1.80b | 83.0 |
| MT 7212 | | 88.48 | 50.2 | 179.80 | 37.40 | 99.0 | 7.20 | 81.4 |
| CI 5438 | Compana | 87.88 | 50.0 | 174.60b | 36.40 | 99.0 | 9.00 | 90.2 |
| ID 18101 | Klages | 87.0 | 51.3 | 180.40 | 35.80 | 79.2 | 6.00 | 88.0 |
| CI 13667 | Zephyr | 85.53 | 46.7 | 178.20b | 34.80 | 79.2 | 7.20 | 60.2b |
| ID143411 | Pir/Vance Smyrna | 85.18 | 45.2 | 173.20b | 35.80 | 99.0 | 7.40 | 64.4 |
| CI 13827 | Shabet | 81.78 | 50.3 | 178.20b | 37.40 | 99.0 | 8.00 | 69.8 |
| CI 3351 | Dekap | 80.43 | 48.5 | 176.20b | 36.00 | 99.0 | 9.00 | 74.8 |
| MT 722 | | 79.25 | 50.5 | 179.80 | 36.60 | 99.0 | 7.80 | 82.8 |
| CI 13826 | Erbet | 78.83 | 50.8 | 168.80b | 35.20 | 99.0 | 8.20 | 79.8 |
| MT 725 | | 78.73 | 48.0 | 179.20b | 36.40 | 85.4 | 8.00 | 75.8 |
| MT294318 | Waxy Compana | 75.70 | 44.0 | 174.00b | 36.40 | 99.0 | 9.00 | 79.4 |
| CI 9558 | Piroline | 71.75b | 47.5 | 175.60 | 36.00 | 99.0 | 7.20 | 51.8b |
| MT 72811 | Wiebe 8 Chr Late | 54.29b | 45.2 | 183.00a | 31.80b | 99.0 | 3.40b | 48.2b |
| MT 7285 | Wiebe 8 Chr Early | 54.04b | 47.1 | 172.40 | 34.60 | 79.2 | 3.00b | 72.0b |
| | $\bar{x}$ | 88.62 | 48.41 | 177.22 | 35.48 | 88.0 | 6.39 | 76.34 |
| | F[3] | 3.03** | .00 | 67.95** | 5.99** | 3.33** | 4.61** | 2.89** |
| | S.E.$\bar{x}$ | 6.89 | .00 | .44 | 1.09 | 11.05 | 1.17 | 6.01 |
| | L.S.D.(.05) | 19.11 | .00 | 1.21 | 3.03 | 30.63 | 3.24 | 16.65 |
| | C.V.% | 7.78 | .00 | .25 | 3.08 | 12.56 | 18.27 | 7.87 |

1/ On top 6/64 seive
2/ Check variety
*/ Indicates statistical significance at .05 level.
**/Indicates statistical significance at .01 level.
a/ Values significantly greater than the check.
b/ Values significantly less than the check.

Table 4. Summary yields for irrigated intrastate and station yield nursery grown on the Northwestern Agricultural Research Center, Kalispell, Montana from 1962 thru 1973.

| C.I. or State # | Variety | 1962 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | Ave. | Yr | % Ingrid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CI 10421 | Unitan | 76.4 | 84.4 | 90.8 | 128.4 | 98.4 | 92.1 | 80.0 | 102.9 | 92.6 | 91.9 | 93.8 | 10 | 103.1 |
| CI 10083 | Ingrid | 70.8 | 92.0 | 88.9 | 111.7 | 80.6 | 109.3 | 75.0 | 114.8 | 75.3 | 91.2 | 91.0 | 10 | 100.0 |
| CI 9558 | Piroline | 72.0 | 95.9 | 87.3 | 108.8 | 93.3 | 85.3 | 64.8 | 88.5 | 73.6 | 71.7 | 84.1 | 10 | 92.4 |
| CI 6398 | Betzes | 73.0 | 88.5 | 67.6 | 104.7 | 63.2 | 82.7 | 66.1 | 89.2 | 56.5 | 89.1 | 78.1 | 10 | 85.8 |
| CI 5438 | Compana | 71.2 | 70.7 | 60.0 | 85.5 | 63.4 | 72.3 | 59.9 | 71.6 | 53.1 | 87.9 | 69.6 | 10 | 76.5 |
| CI 13667 | Zephyr | | | | 120.5 | 95.0 | 110.8 | 68.7 | 114.6 | 77.5 | 85.5 | 96.1 | 7 | 102.2 |
| CI 13826 | Erbet | | | | 91.4 | 73.3 | 76.4 | 71.1 | 88.6 | 73.7 | 78.8 | 79.0 | 7 | 84.0 |
| CD 5914 | Centennial | | | | | 106.6 | 106.9 | 76.0 | 111.6 | 78.0 | 94.2 | 95.6 | 6 | 105.1 |
| MT 72132 | Hector | | | | | | 82.1 | 62.4 | 101.6 | 70.2 | 100.9 | 83.4 | 5 | 89.6 |
| CI 13827 | Shabet | | | | | | 80.4 | 67.7 | 93.6 | 69.6 | 81.8 | 78.6 | 5 | 84.4 |
| CI 15229 | Steptoe | | | | | | | | 116.0 | 111.3 | 97.4 | 108.2 | 3 | 115.4 |
| ID681241 | Steveland x Unitan | | | | | | | | | 86.5 | 109.2 | 97.9 | 2 | 117.5 |
| MT 7210 | | | | | | | | | | 83.3 | 100.1 | 91.7 | 2 | 110.1 |
| MT 723 | | | | | | | | | | 76.8 | 100.4 | 88.6 | 2 | 106.4 |
| WA692566 | Marie/Pir//H | | | | | | | | | 81.8 | 94.0 | 87.9 | 2 | 105.5 |
| MT 7212 | | | | | | | | | | 82.8 | 88.5 | 85.7 | 2 | 102.9 |
| MT 87148 | Betzes Doubl | | | | | | | | | 76.1 | 91.5 | 83.8 | 2 | 100.6 |
| MT 721 | | | | | | | | | | 74.1 | 92.1 | 83.1 | 2 | 99.8 |
| MT 7211 | | | | | | | | | | 56.7 | 102.1 | 79.4 | 2 | 95.3 |
| MT 725 | | | | | | | | | | 68.2 | 78.7 | 73.4 | 2 | 88.1 |
| MT 13682 | Briggs | | | | | | | | | | 103.0 | 103.0 | 1 | 112.9 |
| MT 7213 | | | | | | | | | | | 97.3 | 97.3 | 1 | 106.7 |
| MT 729 | | | | | | | | | | | 96.5 | 96.5 | 1 | 105.8 |
| MT 724 | | | | | | | | | | | 95.1 | 95.1 | 1 | 104.3 |
| MT 728 | | | | | | | | | | | 95.1 | 95.1 | 1 | 104.3 |
| MT 7214 | | | | | | | | | | | 91.9 | 91.9 | 1 | 100.8 |
| MT 727 | | | | | | | | | | | 91.0 | 91.0 | 1 | 99.8 |
| MT 726 | | | | | | | | | | | 88.9 | 88.9 | 1 | 97.5 |
| ID 18101 | Klages | | | | | | | | | | 87.0 | 87.0 | 1 | 95.4 |
| ID143411 | Pir/Vance Sm | | | | | | | | | | 85.2 | 85.2 | 1 | 93.4 |
| CI 3351 | Dekap | | | | | | | | | | 80.4 | 80.4 | 1 | 88.2 |
| MT 722 | | | | | | | | | | | 79.3 | 79.3 | 1 | 87.0 |
| MT294318 | Waxy Compana | | | | | | | | | | 75.7 | 75.7 | 1 | 83.0 |
| MT 72811 | Wiebe 8 Chr | | | | | | | | | | 54.3 | 54.3 | 1 | 59.5 |
| MT 7285 | Wiebe 8 Chr | | | | | | | | | | 54.0 | 54.0 | 1 | 59.2 |

Table 5. Agronomic data from irrigated off station spring barley nursery grown in Missoula County on the Gerald Tucker farm, Lolo, MT. in 1973. Random block design, four replications.

Date seeded: April 25, 1973 Date harvested: August 21, 1973
Size of plot: 16 square feet

| C. I. or St. No. | Variety | Yield Bu/A | Test Wt Lbs/Bu | Plant Height | Lodging % Prev. | Lodging Sev. | %[1] Plump | Diastate Power |
|---|---|---|---|---|---|---|---|---|
| MT 729 | | 94.06a | 55.1 | 27.25 | .00 | .00 | 95.75b | 100.00 |
| MT 7211 | | 90.40 | 54.0 | 23.25 | .00 | .00 | 94.50b | 100.00 |
| CI 13667 | Zephyr | 88.25 | 54.2 | 23.50 | .00 | .00 | 95.00b | 100.00 |
| CD 5914 | Centennial | 85.18 | 52.2 | 24.50 | .00 | .00 | 97.25b | 100.00 |
| MT 725 | | 82.71 | 54.0 | 26.75 | .00 | .00 | 96.50b | 100.00 |
| WA692566 | Marie/Pir// Heines Hanna | 82.40 | 53.7 | 26.50 | 74.25a | .75 | 97.25 | 98.75 |
| MT 72132 | Hector | 81.84 | 53.5 | 28.25 | 99.00a | 1.25a | 97.00b | 98.75 |
| CI 15229 | Steptoe | 81.00 | 49.2 | 27.25 | 99.00a | 2.00a | 96.75b | 90.00b |
| MT 7210 | | 79.81 | 53.6 | 22.75 | 49.50a | .50a | 97.50b | 100.00 |
| CI 10083 | Ingrid[2] | 79.03 | 54.1 | 26.25 | .00 | .00 | 98.00 | 100.00 |
| CI 13827 | Shabet | 75.74 | 52.8 | 29.00 | 99.00a | 3.00a | 95.50b | 92.50b |
| MT 7212 | | 73.74 | 54.5 | 24.50 | .00 | .00 | 98.25 | 100.00 |
| MT 723 | | 72.59 | 52.7 | 22.50 | 24.75a | .25 | 94.75b | 98.75 |
| MT 721 | | 72.56 | 53.3 | 24.50 | .00 | .00 | 89.50b | 98.75 |
| CI 10421 | Unitan | 72.21 | 49.5 | 30.25 | 99.00a | 3.00a | 93.75b | 80.00b |
| CI 9558 | Piroline | 70.77 | 54.0 | 28.00 | 99.00a | 1.00a | 97.25 | 95.00 |
| ID681241 | Steveland x Unitan | 69.09 | 48.5 | 25.50 | 99.00a | 1.25a | 96.25b | 86.25b |
| ID 18101 | Klages | 66.99b | 53.0 | 26.25 | .00 | .00 | 96.75b | 100.00 |
| MT 13682 | Briggs | 62.02b | 45.0 | 22.25b | 49.50a | .50a | 94.25b | 96.25 |
| MT 87148 | Betzes Double Erectoides | 56.11b | 51.8 | 24.25 | .00 | .00 | 84.50b | 98.75 |
| | $\bar{x}$ | 76.83 | 52.44 | 25.66 | 39.60 | .67 | 95.31 | 96.69 |
| | F[3] | 4.40** | .00 | 3.88** | 13.85** | 33.74** | 21.70** | 9.64** |
| | S.E.$\bar{x}$ | 4.53 | .00 | 1.16 | 12.09 | .17 | .69 | 1.77 |
| | L.S.D.(.05) | 12.84 | .00 | 3.28 | 34.26 | .48 | 1.96 | 5.01 |
| | C.V. % | 5.90 | .00 | 4.51 | 30.53 | 24.92 | .72 | 1.83 |

1/ On top of 6/64 seive.
2/Check variety.
3/ 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.

Table 6. Agronomic data from the irrigated off station spring barley nursery grown in Ravalli County on the Homer Bailey farm, Corvallis, MT. in 1973. Random block design, four replications.

Date seeded: April 25, 1973 Date harvested: August 21, 1973
Size of plot: 16 square feet

| C.I. or St. No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Plant Height | Lodging % Prev. | Lodging Sev. | %[1] Plump |
|---|---|---|---|---|---|---|---|
| ID681241 | Steveland x Unitan | 128.70 | 46.8 | 29.50b | 74.25 | 3.00 | 93.75 |
| CI 15229 | Steptoe | 122.29 | 47.0 | 29.00b | 74.25 | 3.50 | 88.00 |
| MT 729 | | 120.85 | 54.0 | 30.25 | 57.25 | 4.25 | 83.75 |
| MT 723 | | 120.76 | 51.7 | 29.75b | 49.50 | 3.00 | 91.25 |
| MT 87148 | Betzes Double Erectoides | 120.70 | 52.2 | 29.50b | .00b | .00b | 80.25b |
| MT 721 | | 118.01 | 52.3 | 29.75b | 74.25 | 3.50 | 84.50b |
| CI 10421 | Unitan | 115.98 | 49.0 | 32.00 | 99.00 | 4.75 | 90.00 |
| CI 13667 | Zephyr | 114.23 | 52.50 | 29.50b | 74.25 | 4.50 | 85.75 |
| MT 13682 | Briggs | 112.32 | 44.5 | 27.50b | .00b | .00b | 93.75 |
| CI 10083 | Ingrid[2] | 111.04 | 52.5 | 33.50 | 99.00 | 5.75 | 91.75 |
| MT 7211 | | 110.97 | 51.9 | 30.75 | 49.50 | 3.00 | 88.00 |
| CD 5914 | Centennial | 109.75 | 51.0 | 30.50 | 86.75 | 4.50 | 96.50 |
| MT 7212 | | 108.22 | 54.5 | 29.75b | 49.50 | 2.75 | 96.75 |
| MT 7210 | | 106.85 | 53.5 | 30.25 | 76.75 | 3.25 | 95.75 |
| MT 72132 | Hector | 105.41 | 52.0 | 32.50 | 99.00 | 5.25 | 91.00 |
| ID 18101 | Klages | 103.41 | 53.0 | 32.25 | 62.00 | 3.75 | 93.25 |
| WA692566 | Marie/Pir//Heines Hanna | 100.06 | 52.5 | 33.50 | 99.00 | 5.25 | 88.00 |
| CI 9558 | Piroline | 98.75 | 52.5 | 31.50 | 86.75 | 5.25 | 83.00b |
| MT 725 | | 95.56 | 51.0 | 31.75 | 99.00 | 4.50 | 85.50 |
| CI 13827 | Shabet | 90.56b | 49.0 | 34.00 | 99.00 | 5.75 | 81.50 |
| | $\bar{x}$ | 110.72 | 51.17 | 30.85 | 70.45 | 3.77 | 89.10 |
| | F[3] | 2.22** | .00 | 2.81** | 2.90** | 2.72** | 4.37** |
| | S.E.$\bar{x}$ | 6.63 | .00 | 1.02 | 17.58 | .97 | 2.42 |
| | L.S.D.(.05) | 18.80 | .00 | 2.90 | 49.82 | 2.76 | 6.85 |
| | C.V. % | 5.99 | .00 | 3.31 | 24.95 | 25.78 | 2.71 |

1/ On top 6/64 seive
2/ Check variety
3/ 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.

Table 7. Agronomic data from the irrigated off station barley nursery grown in Lake County on the Art Mangles farm, Polson, MT. in 1973. Random block design, four replications.

Date seeded: April 26, 1973 Date harvested: August 23, 1973
Size of plot; 16 square feet

| C.I. or St. No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Plant Height | Lodging % Prev. | Lodging Sev. | % Plump 1/ |
|---|---|---|---|---|---|---|---|
| MT 72132 | Hector | 117.63 | 50.5 | 39.00a | 96.75 | 5.25 | 96.00 |
| CI 13667 | Zephyr | 113.60 | 52.7 | 35.75 | 57.00 | 3.25 | 94.00 |
| MT 7211 | | 112.63 | 51.0 | 33.50 | 17.50b | 2.75 | 88.25 |
| WA692566 | Marie/Pir//Heines Hanna | 109.91 | 51.7 | 36.75 | 43.50 | 2.50 | 96.75 |
| MT 729 | | 109.79 | 54.3 | 37.00 | 2.50b | .50 | 89.50 |
| CI 15229 | Steptoe | 106.88 | 43.9 | 37.00 | 99.00 | 2.75 | 95.25 |
| CD 5914 | Centennial | 105.50 | 50.0 | 35.25 | 52.00 | 1.75 | 99.00a |
| MT 7212 | | 103.78 | 51.2 | 36.5 | 23.75b | 2.00 | 98.50a |
| MT 7210 | | 103.35 | 48.6 | 29.75b | .00b | .00 | 92.25 |
| ID681241 | Steveland x Unitan | 101.63 | 43.0 | 36.00 | 69.50 | 5.00 | 94.00 |
| CI 10083 | Ingrid 2/ | 100.91 | 51.4 | 34.00 | 84.50 | 3.50 | 91.00 |
| MT 721 | | 100.35 | 51.4 | 29.50b | .00b | .00 | 88.00 |
| CI 13827 | Shabet | 99.69 | 48.2 | 35.25 | 99.00 | 4.25 | 88.25 |
| CI 10421 | Unitan | 98.13 | 45.0 | 39.75a | 99.00 | 6.25 | 93.25 |
| MT 87148 | Betzes Double Erectoides | 97.75 | 52.2 | 30.50b | 24.75b | .25 | 90.50 |
| MT 723 | | 95.91 | 51.5 | 30.00b | .00b | .00 | 96.75 |
| MT 13682 | Briggs | 92.56 | 45.5 | 29.00b | 49.50 | 1.50 | 94.00 |
| ID 18101 | Klages | 92.37 | 49.5 | 34.50 | 24.75b | 1.25 | 91.00 |
| CI 9558 | Piroline | 91.37 | 52.7 | 37.50a | 99.00 | 4.00 | 93.75 |
| MT 725 | | 86.43 | 51.2 | 32.50 | 86.75 | 3.00 | 93.25 |
| | $\bar{x}$ | 102.0 | 49.8 | 34.4 | 51.4 | 2.5 | 93.2 |
| | F 3/ | 1.28NS | .00 | 7.08* | 5.13* | 2.19* | 1.78* |
| | S.E.$\bar{x}$ | 7.24 | .00 | 1.23 | 16.80 | 1.26 | 2.48 |
| | L.S.D.(.05) | 20.51 | .00 | 3.48 | 47.62 | 3.58 | 7.04 |

1/ On top 6/64 seive.
2/ Check variety
3/ Values 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 8. Agronomic data from the irrigated off station barley nursery grown in Sanders County on the Robert Stonebrook farm, Plains, MT. in 1973. Random block design, four replications.

Date seeded: April 25, 1973 Date harvested: August 22, 1973
Size of plot: 16 square feet

| C.I. or St. No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Plant Height | Lodging % Prev. | Lodging Sev. | %[1] Plump |
|---|---|---|---|---|---|---|---|
| ID681241 | Steveland x Unitan | 137.17a | 47.5 | 39.75 | 99.00 | 3.50 | 90.00 |
| CI 15229 | Steptoe | 133.70a | 46.5 | 38.00 | 99.00 | 3.00 | 84.75 |
| MT 13682 | Briggs | 126.17 | 45.1 | 31.25 | .00b | .00b | 84.00 |
| MT 729 | | 124.42 | 53.0 | 36.75 | 74.25 | .75 | 74.75 |
| CI 10421 | Unitan | 123.85 | 44.5 | 39.25 | 99.00 | 4.25a | 77.75 |
| MT 723 | | 116.23 | 52.2 | 32.50 | 74.25 | 1.25 | 78.25 |
| MT 721 | | 115.63 | 41.7 | 33.25b | 37.25b | 1.75 | 58.00b |
| MT 7210 | | 115.35 | 48.2 | 34.0 | 99.00 | 2.50 | 83.25 |
| MT 87148 | Betzes Double Erectoides | 114.16 | 53.0 | 31.50b | .00b | .00b | 62.00b |
| CI 9558 | Piroline | 113.94 | 49.0 | 38.25 | 99.00 | 4.00a | 68.75 |
| MT 72132 | Hector | 113.88 | 52.5 | 38.50 | 99.00 | 3.25 | 84.25 |
| MT 7211 | | 113.63 | 51.5 | 35.00 | 99.00 | 1.25 | 73.25 |
| WA692566 | Marie/Pir//Heines Hanna | 112.10 | 49.3 | 37.00 | 99.00 | 4.00 | 80.50 |
| CI 10083 | Ingrid[2] | 112.04 | 52.0 | 37.75 | 99.00 | 2.00 | 79.50 |
| MT 7212 | | 111.79 | 54.2 | 36.00 | .00 | .00 | 94.00 |
| CI 13667 | Zephyr | 110.91 | 51.6 | 31.50b | 74.25 | 2.00 | 71.00 |
| CD 5914 | Centennial | 108.25 | 50.5 | 35.25 | 74.25 | 1.50 | 92.75 |
| ID 18101 | Klages | 102.31b | 46.8 | 37.00 | 24.75b | .25b | 72.25 |
| MT 725 | | 96.25b | 52.1 | 36.25 | 49.50b | .50b | 79.25 |
| CI 13827 | Shabet | 95.63b | 44.7 | 36.50 | 99.00 | 3.00 | 64.00b |
| | $\bar{x}$[3] | 114.87 | 49.30 | 35.76 | 69.92 | 1.94 | 77.61 |
| | F | 3.18* | .00 | 5.69* | 6.92* | 8.28* | 4.26* |
| | S.E.$\bar{x}$ | 5.92 | .00 | 1.11 | 14.26 | .50 | 4.75 |
| | L.S.D.(.05) | 16.77 | .00 | 3.15 | 40.41 | 1.42 | 13.47 |
| | C.V. % | 5.15 | .00 | 3.10 | 20.39 | 25.81 | 6.12 |

1/ On top 6/64 seive.
2/ Check variety
3/ 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.

Table 9. Summary of agronomic data from nurseries grown in western Montana, 1973.

| C.I. or State # | Variety | NWARC | Missoula | Ravalli | Lake | Sanders | $\bar{x}$ | Rank |
|---|---|---|---|---|---|---|---|---|
| | | | | Yield Bushel/Acre | | | | |
| ID681241 | Steveland x Unitan | 109.21 | 69.09 | 128.70 | 101.63 | 137.17* | 109.16 | 1 |
| 15229 | Steptoe | 97.41 | 81.00 | 122.29 | 106.88 | 133.70* | 108.26 | 3 |
| MT 729 | | 96.53 | 94.06* | 120.85 | 109.79 | 124.42 | 109.13 | 2 |
| MT 723 | | 100.43 | 72.59 | 120.76 | 95.91 | 116.23 | 101.18 | 7 |
| MT 87148 | Betzes Double Erectodies | 91.48 | 56.11 | 120.70 | 97.75 | 114.16 | 96.04 | 16 |
| MT 721 | | 92.06 | 72.56 | 118.01 | 100.35 | 115.63 | 99.72 | 11 |
| 10421 | Unitan | 91.88 | 72.21 | 115.98 | 98.13 | 123.85 | 100.41 | 10 |
| 13667 | Zephyr | 85.53 | 88.25 | 114.23 | 113.60 | 110.91 | 102.50 | 6 |
| 13682 | Briggs | 102.96 | 62.02 | 112.32 | 92.56 | 126.17 | 99.21 | 13 |
| 10083 | Ingrid | 91.23 | 79.03 | 111.04 | 100.91 | 112.04 | 98.85 | 14 |
| MT 7211 | | 102.13 | 90.40 | 110.97 | 112.63 | 113.63 | 105.95 | 4 |
| CD 5914 | Centennial | 94.23 | 85.18 | 109.75 | 105.50 | 108.25 | 100.57 | 9 |
| MT 7212 | | 88.48 | 73.74 | 108.22 | 103.78 | 111.79 | 97.20 | 15 |
| MT 7210 | | 100.08 | 79.81 | 106.85 | 103.35 | 115.35 | 101.09 | 8 |
| MT 72132 | Hector | 100.93 | 81.84 | 105.41 | 117.63 | 113.88 | 103.94 | 5 |
| ID 18101 | Klages | 87.00 | 66.99 | 103.41 | 92.37 | 102.31 | 90.42 | 17 |
| WA692566 | Marie/Pir// Heines Hanna | 93.98 | 82.40 | 100.06 | 109.91 | 112.10 | 99.69 | 12 |
| 9558 | Piroline | 71.75 | 70.77 | 98.75 | 91.37 | 113.94 | 89.32 | 18 |
| MT 725 | | 78.73 | 82.71 | 95.56 | 86.43 | 96.25 | 87.94 | 20 |
| 13827 | Shabet | 81.78 | 75.74 | 90.56 | 99.69 | 95.63 | 88.65 | 19 |
| | $\bar{x}$ | | 76.83 | 110.72 | 102.00 | 114.87 | | |
| | F 1/ | | 4.40** | 2.22** | 1.28NS | 3.18** | | |
| | S.E.$\bar{x}$ | | 4.53 | 6.63 | 7.24 | 5.92 | | |
| | L.S.D.(.05) | | 12.84 | 18.80 | 20.51 | 16.77 | | |
| | C.V.% | | 5.90 | 5.99 | 7.10 | 5.15 | | |

1/ Value for variety comparison
* Significantly higher in yield than Ingrid .05

Table 10 . Summary of agronomic data from nurseries grown in western Montana, 1973.

| C.I. or St. No. | Variety | NWARC | Missoula | Ravalli | Lake | Sanders | $\bar{x}$ | Rank |
|---|---|---|---|---|---|---|---|---|
| | | Test Weight Lbs/Bu. | | | | | | |
| ID681241 | Steveland x Unitan | 42.5 | 48.5 | 46.8 | 43.0 | 47.5 | 45.66 | 17 |
| CI 15229 | Steptoe | 45.5 | 49.2 | 47.0 | 43.9 | 46.5 | 46.42 | 16 |
| MT 729 | | 50.5 | 55.1 | 54.0 | 54.3 | 53.0 | 53.38 | 1 |
| MT 723 | | 47.2 | 52.7 | 51.7 | 51.5 | 52.2 | 51.06 | 9 |
| MT 87148 | Betzes Double Erectoides | 50.0 | 51.8 | 52.2 | 52.2 | 53.0 | 51.84 | 4 |
| MT 721 | | 47.5 | 53.3 | 52.3 | 51.4 | 41.7 | 49.24 | 14 |
| CI 10421 | Unitan | 45.5 | 49.5 | 49.0 | 45.0 | 44.5 | 38.70 | 20 |
| CI 13667 | Zephyr | 46.7 | 54.2 | 52.5 | 52.7 | 51.6 | 51.54 | 6 |
| MT 13682 | Briggs | 45.0 | 45.0 | 44.5 | 45.5 | 45.1 | 45.02 | 18 |
| CI 10083 | Ingrid | 50.6 | 54.1 | 52.50 | 51.4 | 52.0 | 52.08 | 3 |
| MT 7211 | | 47.0 | 54.0 | 51.9 | 51.0 | 51.5 | 51.08 | 8 |
| CD 5914 | Centennial | 48.5 | 52.2 | 51.0 | 50.0 | 50.5 | 50.44 | 13 |
| MT 7212 | | 50.2 | 54.5 | 54.5 | 51.2 | 54.2 | 52.92 | 2 |
| MT 7210 | | 51.2 | 53.6 | 53.5 | 48.6 | 48.2 | 51.02 | 11 |
| MT 72132 | Hector | 50.2 | 53.5 | 52.0 | 50.5 | 52.5 | 51.74 | 5 |
| ID 18101 | Klages | 51.3 | 53.0 | 53.0 | 49.5 | 46.8 | 50.72 | 12 |
| WA692566 | Marie/Pir//Heines Hanna | 48.0 | 53.7 | 52.5 | 51.7 | 49.3 | 51.04 | 10 |
| CI 9558 | Piroline | 47.5 | 54.0 | 52.5 | 52.7 | 49.0 | 51.14 | 7 |
| MT 725 | | 48.0 | 54.0 | 51.0 | 51.2 | 52.1 | 41.46 | 19 |
| CI 13827 | Shabet | 50.3 | 52.8 | 49.0 | 48.2 | 44.7 | 49.00 | 15 |

Table 11. Summary of agronomic data from nurseries grown in western Montana, 1973.

| C.I. or St. No. | Variety | NWARC | Missoula | Ravalli | Lake | Sanders | $\bar{x}$ | Rank |
|---|---|---|---|---|---|---|---|---|
| | | Plant Height in Inches | | | | | | |
| ID681241 | Steveland x Unitan | 36.8 | 25.50 | 29.50 | 36.00 | 39.75 | 33.51 | 7 |
| CI 15229 | Steptoe | 40.8* | 27.25 | 29.00 | 37.00 | 38.00 | 34.41 | 5 |
| MT 729 | | 35.4 | 27.25 | 30.25 | 37.00 | 36.75 | 33.33 | 9 |
| MT 723 | | 35.8 | 22.50 | 29.75 | 30.00 | 32.50 | 30.11 | 16 |
| MT 87148 | Betzes Double Erectoides | 31.0 | 24.25 | 29.50 | 30.50 | 31.50 | 29.35 | 19 |
| MT 721 | | 31.8 | 24.50 | 29.75 | 29.50 | 33.25 | 29.76 | 18 |
| CI 10421 | Unitan | 43.8 | 30.25 | 32.00 | 39.75* | 39.25 | 37.01 | 1 |
| CI 13667 | Zephyr | 34.8 | 23.50 | 29.50 | 35.75 | 31.50 | 31.01 | 15 |
| CI 13682 | Briggs | 30.8 | 22.25 | 27.50 | 29.00 | 31.25 | 28.16 | 20 |
| CI 10083 | Ingrid | 35.6 | 26.25 | 33.50 | 34.00 | 37.75 | 33.42 | 8 |
| MT 7211 | | 34.4 | 23.25 | 30.75 | 33.50 | 35.00 | 31.38 | 14 |
| CD 5914 | Centennial | 35.0 | 24.50 | 30.50 | 35.25 | 35.25 | 32.10 | 13 |
| MT 7212 | | 37.4 | 24.50 | 29.75 | 36.50 | 36.00 | 32.75 | 11 |
| MT 7210 | | 32.2 | 22.75 | 30.25 | 29.75 | 34.00 | 29.79 | 17 |
| MT 72132 | Hector | 38.0 | 28.25 | 32.50 | 39.00* | 38.50 | 35.25 | 2 |
| ID 18101 | Klages | 35.8 | 26.25 | 32.25 | 34.50 | 37.00 | 33.16 | 10 |
| WA692566 | Marie/Pir// Heines Hanna | 38.6 | 26.50 | 33.50 | 36.75 | 37.00 | 34.47 | 3 |
| CI 9558 | Piroline | 36.0 | 28.00 | 31.50 | 37.50* | 38.25 | 34.25 | 6 |
| MT 725 | | 36.4 | 26.75 | 31.75 | 32.50 | 36.25 | 32.73 | 12 |
| CI 13827 | Shabet | 37.4 | 29.00 | 34.00 | 35.25 | 36.50 | 34.43 | 4 |
| | $\bar{x}$ | 35.48 | 25.66 | 30.85 | 34.40 | 35.76 | | |
| | F 1/ | 5.99** | 3.88** | 2.81** | 7.08* | 5.69* | | |
| | S.E.$\bar{x}$ | 1.09 | 1.16 | 1.02 | 1.23 | 1.11 | | |
| | L.S.D.(.05) | 3.03 | 3.28 | 2.90 | 3.48 | 3.15 | | |
| | C.V. % | 3.08 | 4.51 | 3.31 | 3.56 | 3.10 | | |

1/ Value for variety comparison
*/ Significantly higher plant height than Ingrid .05.

TITLE: Spring Oats

PROJECT: Small Grains Investigations 756

YEAR: 1973

PERSONNEL: Leader - Vern R. Stewart
Cooperators - Feed Crops Committee, MSU

LOCATION: Northwestern Agricultural Research Center

DURATION: Indefinite

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

1973 EXPERIMENTS:

1. Uniform Northwestern States Oat Nursery

SUMMARY OF 1973 RESULTS:

The outstanding variety in the nursery was ID635280 with a yield of 127.60 bu/a and a test weight of 39 lbs/bu. This variety has excellent straw strength.

Forage yields were secured from each entry. No significant differences between varieties were found when analyzed statistically. Complete tabulation of data is found in Table 1.

A ten year summary is found in Table 2, in which Park is used as the check.

Table 1. Agronomic data from uniform northwestern states oat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana in Y-2, 1973.

Date seeded: April 24, 1973 Date harvested: August 3, 1973
Size of plot: 16 sq. ft.

| C.I. or State # | Variety | Yield Bu/A | Test Weight lbs/bu | Heading Date | Plant Height | Lodging Prev % | Lodging Sev. 0-9 | Forage T/A | Straw Grain Ratio |
|---|---|---|---|---|---|---|---|---|---|
| ID635280 | CI5345xZanster | 127.60 | 39.00 | 182.67b | 45.67a | .00 | .00 | 4.54 | 1.23 |
| ID 71694 | 71Ab694 | 125.85 | 35.60 | 184.67 | 39.67 | .33 | 1.67 | 4.48 | 1.23 |
| ID683975 | Cayuse x Glen | 124.85 | 35.80 | 184.00 | 39.33 | .33 | 1.67 | 4.37 | 1.20 |
| ID 68644 | Cayuse x Orbit | 123.48 | 32.20 | 189.33a | 40.67 | 1.00 | 5.00 | 4.79 | 1.42 |
| OT 714 | Pendak x Glen | 122.23 | 35.50 | 180.00 | 40.33 | .00 | .00 | 4.22 | 1.16 |
| WA 6014 | | 118.29 | 34.60 | 186.33a | 41.00 | .00 | .00 | 4.34 | 1.32 |
| ID 71716 | 71Ab716 | 118.16 | 34.50 | 188.00a | 41.67a | .67 | 3.33 | 4.31 | 1.30 |
| ID 71748 | 71Ab748 | 116.60 | 35.20 | 184.00 | 39.67 | .00 | .00 | 4.17 | 1.27 |
| CI 9081 | Random | 116.54 | 33.00 | 180.00 | 40.00 | .33 | 1.67 | 4.34 | 1.33 |
| ID701034 | 70Ab1034 | 116.23 | 33.40 | 187.00a | 41.00 | .67 | 3.33 | 4.31 | 1.33 |
| ID 69450 | Cayuse x Orbit | 116.10 | 30.20 | 190.00a | 39.67 | .33 | 3.33 | 4.65 | 1.50 |
| CI 8171 | Kelsey | 115.73 | 36.80 | 182.00b | 45.00a | .67 | 5.00 | 4.37 | 1.37 |
| ID 68710 | Cayuse x Orbit | 115.35 | 34.20 | 186.67a | 39.33 | .00 | .00 | 4.31 | 1.34 |
| ID 71718 | 71Ab718 | 115.23 | 34.50 | 186.33a | 41.00 | 1.33 | 8.33 | 4.03 | 1.17 |
| CI 6611 | Park | 115.10 | 38.30 | 186.00a | 42.00a | .33 | 3.33 | 4.08 | 1.24 |
| CI 5346 | Basin | 114.35 | 37.80 | 187.33a | 43.33a | .33 | 1.67 | 4.39 | 1.49 |
| CI 8263 | Cayuse 1/ | 113.60 | 35.00 | 184.33 | 37.33 | .00 | .00 | 4.03 | 1.23 |
| ID 71692 | 71Ab692 | 113.10 | 36.60 | 186.00 | 42.00a | 1.00 | 5.00 | 4.25 | 1.37 |
| ID635100 | Cx202xSxS | 112.47 | 35.20 | 185.00 | 42.33a | .00 | .00 | 4.17 | 1.34 |
| ID 71670 | 71Ab670 | 110.72 | 34.00 | 186.00a | 37.33 | .67 | 3.33 | 4.22 | 1.40 |
| WA 6013 | | 108.66 | 28.50 | 190.33a | 38.00 | 1.00 | 6.67 | 4.59 | 1.70 |
| WA 6012 | | 105.85 | 30.30 | 185.33 | 43.00a | .00 | .00 | 4.22 | 1.49 |
| WA 6015 | | 104.16 | 29.50 | 188.00 | 40.00 | .00 | .00 | 4.11 | 1.48 |
| WA 6031 | | 104.16 | 30.00 | 189.33a | 38.00 | .67 | 5.00 | 4.71 | 1.83 |
| CI 6661 | Rodney | 104.03 | 38.00 | 185.67 | 45.00a | .67 | 3.33 | 4.31 | 1.65 |
| WA 6016 | | 99.10 | 31.20 | 190.67a | 39.67 | 1.00 | 5.00 | 4.14 | 1.68 |
| CI 2027 | Gopher | 99.03 | 37.00 | 180.00b | 45.00a | 1.33 | 8.33 | 4.03 | 1.60 |
| CI 2053 | Markton | 87.09b | 37.50 | 181.33b | 46.33a | 1.33 | 8.33 | 3.66 | 1.59 |
| | $\bar{x}$ 2/ | 112.99 | 34.41 | 185.62 | 41.19 | .50 | 2.92 | 4.29 | 1.40 |
| | F 2/ | 1.52* | .00 | 30.36** | 2.72** | 2.06* | 2.00** | .79 | 2.33 |
| | S.E.$\bar{x}$ | 7.33 | .00 | .56 | 1.53 | .32 | 1.97 | .27 | .12 |
| | L.S.D.(.05) | 20.77 | .00 | 1.59 | 4.32 | .90 | 5.57 | .76 | .33 |
| | C.V.% | 6.49 | .00 | .30 | 3.70 | 63.83 | 67.37 | 6.24 | 8.21 |

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

Table 2. Summary of oat yield data from the uniform oat nursery, Northwestern Agricultural Research Center, 1964-73.

| C.I. or State # | Variety | 1964 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | Sta Yrs | Ave | % Park |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CI 5346 | Basin | 120.7 | 120.2 | 149.1 | 151.5 | 148.7 | 177.0 | 144.2 | 114.4 | 8 | 140.7 | 115 |
| CI 6611 | Park | 80.5 | 108.3 | 120.3 | 171.4 | 127.1 | 190.6 | 67.8 | 115.1 | 8 | 122.6 | 100 |
| CI 6661 | Rodney | 73.0 | 126.2 | 121.4 | 126.2 | 132.2 | 169.9 | 87.9 | 104.0 | 8 | 122.6 | 100 |
| CI 2027 | Gopher | 46.2 | 116.8 | 101.0 | 134.9 | 127.4 | 168.9 | 76.7 | 99.0 | 8 | 108.9 | 89 |
| CI 2053 | Markton | 89.1 | 89.9 | 101.7 | 120.2 | 120.5 | 175.1 | 77.5 | 87.1 | 8 | 107.6 | 88 |
| CI 8263 | Cayuse | | 142.6 | 130.0 | 138.1 | 158.7 | 195.9 | 140.7 | 113.6 | 7 | 145.7 | 113 |
| ID635100 | Cx202xSxS | | | 123.9 | 133.7 | 150.8 | 198.5 | 135.1 | 112.5 | 6 | 142.6 | 108 |
| CI 8171 | Kelsey | | | | 142.5 | 127.6 | 195.3 | 89.3 | 115.7 | 5 | 134.1 | 100 |
| OT 714 | Pendak x Glen | | | | | 167.7 | 183.6 | 107.4 | 122.2 | 4 | 145.2 | 116 |
| ID 68710 | Cayuse x Orbit | | | | | | 208.7 | 91.5 | 115.4 | 3 | 138.5 | 111 |
| ID 68644 | Cayuse x Orbit | | | | | | 195.4 | 104.9 | 123.5 | 3 | 141.3 | 113 |
| ID683975 | Cayuse x Glen | | | | | | 183.6 | 103.2 | 124.9 | 3 | 137.2 | 110 |
| CI 9081 | Random | | | | | | 197.7 | 106.9 | 116.5 | 3 | 140.4 | 113 |
| ID635280 | CI5345 x Zanst | | | | | | | 142.9 | 127.6 | 2 | 135.3 | 148 |
| ID 69450 | Cayuse x Orbit | | | | | | | 129.2 | 116.1 | 2 | 122.7 | 134 |
| ID 71694 | 71Ab694 | | | | | | | | 125.9 | 1 | 125.9 | 109 |
| WA 6014 | | | | | | | | | 118.3 | 1 | 118.3 | 103 |
| ID 71716 | 71Ab716 | | | | | | | | 118.2 | 1 | 118.2 | 103 |
| ID 71748 | 71Ab748 | | | | | | | | 116.6 | 1 | 116.6 | 101 |
| ID701034 | 70Ab1034 | | | | | | | | 116.2 | 1 | 116.2 | 101 |
| ID 71692 | 71Ab692 | | | | | | | | 113.1 | 1 | 113.1 | 98 |
| ID 71670 | 71Ab670 | | | | | | | | 110.7 | 1 | 110.7 | 96 |
| WA 6013 | | | | | | | | | 108.7 | 1 | 108.7 | 94 |
| WA 6012 | | | | | | | | | 105.8 | 1 | 105.8 | 92 |
| WA 6031 | | | | | | | | | 104.2 | 1 | 104.2 | 91 |
| WA 6015 | | | | | | | | | 104.2 | 1 | 104.2 | 91 |
| WA 6016 | | | | | | | | | 99.1 | 1 | 99.1 | 86 |
| ID 71718 | 71Ab718 | | | | | | | | 115.2 | 1 | 115.2 | 100 |

TITLE: Spring Wheat

PROJECT: Small Grains Investigations 756

YEAR: 1973

PERSONNEL: Vern R. Stewart
Cooperators - F. H. McNeal and M. A. Berg

COOPERATING AGENCIES:

Montana Agricultural Experiment Station
Field Crops Branch, ARS, USDA
Montana Wheat Research and 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.

1973 EXPERIMENTS:

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

SUMMARY OF 1973 RESULTS:

Spring Wheat (1) The hard red semi-dwarf out yielded the taller standard wheats. Norana, a semi-dwarf type, is a new release for western Montana. Era is the highest yielding semi-dwarf type over a five year period in western Montana, but is somewhat weak in baking quality. ID 43 needs further evaluation, because of its high yield and earliness. (2) The soft white wheats were 2 to 3 bushels higher in yield on the average than the hard red types. ID 46 was the highest yielding variety in 1973, but not significantly higher than Twin, a recommended variety for western Montana. ID 46 is 4 days earlier in heading which could be a valuable asset in western Montana. (3) There were no real significant differences found between commercial varieties tested and Norana (HR) which was used as the check variety. Twin (SW) was superior in yield to all private lines tested.

1973 RESULTS BY NURSERY:

Advance Yield Nursery - The mean for this nursery was 62.0 bu/a down 12.8 bu/a from the 1972 nursery. This is due to lower rain fall during the 1973 crop year. Norana, a new release, is used as the check variety. Era is equal to Norana, MT 738 is the highest yielding entry, however no entry was significantly higher in yield than the check.

The semi-dwarf lines out yielded and are superior agronomically to the tall standard varieties.

ID 43 is the earliest heading entry in the nursery, 4 days ahead of Norana. Its earliness could be a real asset for spring wheat production in western Montana. Table 1

Table 2 gives a summary of yield data of spring wheat varieties grown from 1964-1973. Thatcher is used as a base of 100%. Era and Norana out yield Thatcher by 36% and 26% respectively. There are other entries that exceed these percentages but are for a very short term. Comparing the yield of Norana and Era 1971-73, they yield 82.7 bu/a and 85.2 bu/a respectively. Era, a semi-dwarf, continues to out preform all other semi-dwarf types agronomically.

Results (con't)

Western Regional Spring Wheat - Thirty-two entries are included in the nursery. There are 17 soft whites, 2 hard whites and 13 reds. Twin, a soft white variety, which is currently recommended for western Montana averaged 95.5 bu/a and no other entry was found to be significantly higher in yield. Anza, a hard red entry was the highest yielding entry at 98.7 bu/a.

The hard red varieties yielded 81.3 bu/a and the soft white varieties 83.6 bu/a.

Lodging data was obtained, but is not made a part of this record because the differences were not found to be statistically significant. Table 3.

Private Variety Nursery - This nursery contains lines and varieties developed by commercial companies and public varieties for comparison. Twin is the highest yielding entry at 94.41 bu/a followed by Era at 90.68 bu/a. Norana is used as a check for comparison. Twin was found to be significantly higher in yield statistically than Norana. None of the commercial lines were significantly lower in yield than Norana. Triticales varieties in this test were quite low in yield and very late in maturity.

SPRING WHEAT VARIETIES

## 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 Variety

1. Twin - non irrigated and 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

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 Variety

1. Twin
   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

Table 1. Agronomic data from the advanced yield spring wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana in 1973. Field No. Y-2

Planting Date: April 24, 1973 Harvest Date: August 30, 1973
Size of Plot: 16 sq. ft.

| C.I. or State No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Heading Date | Plant Height |
|---|---|---|---|---|---|
| MT 738 | Nrn10/Bvr14//6*Cnt/3/SI | 75.05 | 60.20 | 180.50 | 34.75a |
| MT 7156 | SI/3/Nrn10/Bvr14//5*Cnt | 72.72 | 60.70 | 181.00 | 31.50 |
| CI 15927 | Norana (MT 7042)1/ | 69.67 | 59.40 | 180.50 | 32.25 |
| CI 13986 | Era | 69.57 | 61.00 | 181.00 | 32.00 |
| ID 43 | 58/TC//TC/KF/3/Ftn/3*TC | 69.50 | 59.30 | 176.00b | 31.00 |
| MT 7150 | JT/3/Nrn10/Bvr14//4*Cnt | 68.85 | 59.10 | 179.25b | 36.00a |
| CI 14588 | Twin - ID0015 | 68.60 | 56.00 | 182.50a | 34.00 |
| MT 711 | Fortuna/62-85 | 67.25 | 61.50 | 180.75 | 41.00a |
| S 6914 | S6579/S659 | 66.35 | 60.50 | 177.50b | 41.50a |
| MT 7028 | SK/3/Nrn10/Bvr14//Cnt | 63.35 | 58.40 | 180.00 | 34.75a |
| MT 7145 | Weibulls 7327/Cnt | 63.15 | 61.00 | 181.00 | 41.75a |
| MT 7031 | JT/3/Nrn10/Bvr14//4*Cnt | 62.75 | 58.60 | 178.50b | 34.50a |
| S 6921 | 34-359/61-107 | 62.50 | 62.00 | 176.75b | 41.00a |
| ND 683 | Fortuna*2/57-134 | 62.27 | 60.60 | 178.50b | 38.75a |
| MN 6433 | II-55-14/II-60-105 | 61.47 | 58.50 | 180.25 | 32.25 |
| CI 13596 | Fortuna | 60.52 | 61.10 | 178.50b | 42.00a |
| MT 722 | 64-129/Fta | 60.47 | 60.00 | 178.75b | 42.25a |
| ND 491 | ND140/ND363 | 59.64 | 58.00 | 175.75b | 40.50a |
| CI 15233 | Shortana | 59.34 | 58.50 | 181.00 | 33.50 |
| RL 4238 | Manitou*2/RL4124*1 | 58.67b | 59.10 | 178.75b | 42.50a |
| MT 7318 | Nrn10/Bvr14//6*Cnt/3/SI | 58.64b | 59.20 | 182.50a | 31.75 |
| ND 6662 | Fta/62-85,S6662 | 58.57b | 60.50 | 180.25 | 41.25a |
| ND 497 | North Dakota 497 | 58.02b | 58.50 | 177.00b | 34.00 |
| MT 7111 | Fta/Tzpp//Son 64A | 57.87b | 59.50 | 178.75b | 40.50a |
| MT 727 | 61-107//Tzpp/Son64A | 57.04b | 60.90 | 176.75b | 38.50a |
| CI 12974 | Centana | 55.57b | 60.60 | 182.00a | 47.25a |
| CI 10003 | Thatcher | 55.02b | 59.70 | 178.50b | 41.25a |
| MT 7152 | SI/3/Nrn10/Bvr14//4*Cnt | 54.12b | 57.00 | 180.50 | 33.75 |
| CI 13775 | Manitou, R.L. 4159 | 53.82b | 58.90 | 179.00b | 43.00a |
| CI 13333 | Wells | 49.94b | 61.00 | 180.50 | 44.75a |
| | $\bar{x}$ 2/ | 62.0 | 59.6 | 179.4 | 37.8 |
| | F 2/ | 2.78 | .00 | 21.92 | 44.16 |
| | S.E.$\bar{x}$ | 3.64 | .00 | .39 | .70 |
| | L.D.S.(.05) | 10.24 | .00 | 1.10 | 1.97 |
| | C.V.% | 5.88 | .00 | .22 | 1.85 |

1/ Check variety
2/ Value for variety comparison
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, Route 4, Kalispell, Montana, 1964 thru 1973.

| C.I. or State # | Variety | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | Ave. | Sta. Yrs. | % of Thatcher |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CI10003 | Thatcher | 46.7 | 65.4 | 62.2 | 60.6 | 63.4 | 69.5 | 55.5 | 72.5 | 64.7 | 55.0 | 61.6 | 10 | 100 |
| CI13333 | Wells | 57.1 | 58.4 | 67.9 | 62.8 | 63.1 | 64.8 | 53.7 | 66.8 | 54.1 | 49.9 | 59.9 | 10 | 97 |
| CI12974 | Centana | 47.8 | 61.1 | 50.4 | 54.5 | 66.1 | 61.9 | 52.8 | 71.1 | 57.0 | 55.6 | 57.8 | 10 | 94 |
| CI13775 | Manitou | 50.8 | 62.2 | 67.5 | 57.5 | 57.6 | 70.7 | 66.9 | 67.1 | 61.5 | 53.8 | 61.4 | 10 | 100 |
| CI13596 | Fortuna | 62.9 | | 66.2 | 56.4 | 74.7 | 88.9 | 41.9 | 76.8 | 56.2 | 60.5 | 64.9 | 8 | 106 |
| CI15233 | Shortana | | | | | 71.8 | 71.9 | 80.2 | 70.6 | 87.4 | 59.3 | 73.5 | 6 | 116 |
| CI13986 | Era | | | | | | 93.1 | 82.2 | 90.0 | 96.1 | 69.6 | 86.2 | 5 | 136 |
| CI15927 | Norana (MT 7042) | | | | | | | | 90.8 | 87.6 | 69.7 | 82.7 | 3 | 126 |
| CI14588 | Twin - ID0015 | | | | | | | | | 93.4 | 68.6 | 81.0 | 2 | 135 |
| MT 7150 | UT/3/Nrn10/Bvr14//4*Cnt | | | | | | | | | 86.7 | 68.9 | 77.8 | 2 | 130 |
| MT 7156 | SI/3/Nrn10/Bvr14//5*Cnt | | | | | | | | | 83.9 | 72.7 | 78.3 | 2 | 131 |
| MT 7031 | UT/3/Nrn10/Bvr14//4*Cnt | | | | | | | | | 80.1 | 62.8 | 71.5 | 2 | 119 |
| MT 711 | Fortuna/62-85 | | | | | | | | | 71.9 | 67.3 | 69.6 | 2 | 116 |
| ND 6662 | Fta/62-85,S6662 | | | | | | | | | 62.7 | 58.6 | 60.7 | 2 | 101 |
| MT 738 | Nrn10/Bvr14//6*Cnt/3/SI | | | | | | | | | | 75.1 | 75.1 | 1 | 137 |
| ID 43 | 58/TC//TC/KF/3/Ftn/3*TC | | | | | | | | | | 69.5 | 69.5 | 1 | 126 |
| S 6914 | S6579/S659 | | | | | | | | | | 66.4 | 66.4 | 1 | 121 |
| MT 7028 | Sk/3/Nrn10/Bvr14//Cnt | | | | | | | | | | 63.4 | 63.4 | 1 | 115 |
| MT 7145 | Weibulls 7327/Cnt | | | | | | | | | | 63.2 | 63.2 | 1 | 115 |
| S 6921 | 34-359/61-107 | | | | | | | | | | 62.5 | 62.5 | 1 | 114 |
| ND 683 | Fortuna *2/57-134 | | | | | | | | | | 62.3 | 62.3 | 1 | 113 |
| MN 6433 | II-55-14/II-60-105 | | | | | | | | | | 61.5 | 61.5 | 1 | 112 |
| MT 722 | 64-129/Fta | | | | | | | | | | 60.5 | 60.5 | 1 | 110 |
| ND 491 | Nd140/ND363 | | | | | | | | | | 59.6 | 59.6 | 1 | 108 |
| RL 4238 | Manitou*2/RL4124.1 | | | | | | | | | | 58.7 | 58.7 | 1 | 107 |
| MT 7138 | Nrn10/Bvr14//6*Cnt/3/SI | | | | | | | | | | 58.6 | 58.6 | 1 | 107 |
| ND 497 | North Dakota 497 | | | | | | | | | | 58.0 | 58.0 | 1 | 105 |
| MT 7111 | Fta/Tzpp//Son64A | | | | | | | | | | 57.9 | 57.9 | 1 | 105 |
| MT 727 | 61-107//Tzpp/Son64A | | | | | | | | | | 57.0 | 57.0 | 1 | 104 |
| MT 7152 | SI/3/Nrn10/Bvr14//4*Cnt | | | | | | | | | | 54.1 | 54.1 | 1 | 98 |

Table 3. Agronomic data from the western regional spring wheat nursery grown at Kalispell in 1973. Field No. Y-2

Planting date: April 24, 1973 Harvest date: August 29, 1973
Size of Plot: 16 square feet

| C. I. or State No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Heading Date | Plant Height |
|---|---|---|---|---|---|
| CI 15284 | Anza | 98.68 | 61.00 | 178.00b | 28.25 |
| ID 67 | Twin/CI 13977 | 98.56 | 60.20 | 180.50b | 34.50 |
| ID 46 | YT54A*4//N10/B/3/A63166S | 96.48 | 59.40 | 178.25b | 32.25 |
| CI 14588 | Twin - ID 0015 1/ | 95.53 | 58.50 | 182.75 | 34.00 |
| ID 44 | Aberdeen 6535S-128-6-1 | 94.78 | 61.00 | 180.25b | 33.75 |
| ID 47 | Sonora 64/Winalta | 94.06 | 60.80 | 179.50b | 33.25 |
| ID 43 | 58/TC//TC/KF/3/Ftn/3*TC | 93.11 | 59.20 | 176.00b | 30.50b |
| WA 6019 | NS 3880-227/13438//13735 | 92.63 | 59.30 | 181.50 | 37.25 |
| ID 65 | L66/3/YT54A*4//Nrn10/Bvr | 92.31 | 60.50 | 185.25 | 34.25 |
| WA 5936 | NS3880-227/13438//WA4468 | 91.73 | 59.50 | 180.00b | 32.00 |
| UT 498263 | UT256-7-21-4/Pilot | 91.38 | 55.90 | 182.00 | 31.25 |
| ID 725073 | N10/ST//ID/3/Id59/4/LM66 | 89.73 | 60.40 | 181.00b | 38.00a |
| UT 498327 | UT256-7-21-4/Pilot | 89.55 | 59.60 | 176.75b | 29.50 |
| MN 206264 | Era Sib2 | 89.30 | 60.70 | 181.00b | 33.25 |
| UT 498259 | UT256-7-21-4/Pilot | 88.40 | 58.00 | 177.75b | 31.25b |
| ID 64 | Burt/MQ//Tzpp/3/AN | 87.23 | 60.70 | 178.00b | 32.75 |
| WA 5876 | Gaines/Marfed, S68-3 | 86.10b | 61.40 | 185.50a | 34.25 |
| ID 725075 | Idaed 59/4*Lemhi 62 | 85.40b | 59.30 | 182.00 | 44.00a |
| CI 15927 | Norana (MT 7042) | 85.38b | 60.50 | 180.75b | 33.25 |
| WA 6018 | NS 3880-227/13438//13735 | 85.28b | 60.00 | 183.50 | 38.25a |
| WA 6020 | CI 13438/Marfed | 84.78b | 60.30 | 183.25 | 32.75 |
| CA 4411 | May054//N10/Bvr/3/Nain60 | 83.10b | 54.70 | 177.00b | 24.00b |
| UT 49813 | UT256-7-21-4/Pilot | 83.05b | 59.00 | 181.75 | 30.00b |
| WA 5938 | NS3880-227/CI13438 | 82.05b | 62.00 | 178.00b | 36.25a |
| ID 725078 | Idaed 59/4*Lemhi 62 | 80.85b | 59.20 | 182.50 | 43.75a |
| ID 725076 | Idaed 59/4*Lemhi 62 | 78.15b | 60.10 | 183.75 | 45.75a |
| ID 725077 | Idaed 59/4*Lemhi 62 | 77.68b | 60.60 | 183.50 | 46.50a |
| ID 725072 | 178383/Idd//3*1mb/3/LM66 | 75.90b | 61.00 | 179.75b | 45.00a |
| OR 696 | Idd 59/Idd/Burt | 75.62b | 61.50 | 175.75b | 38.25a |
| ID 725071 | Nrn10/ST//Idd/3/Idd59 | 74.10b | 60.90 | 179.75b | 44.25a |
| CI 4734 | Federation | 69.35b | 60.00 | 184.75a | 42.50a |
| ID 725074 | N10/ST//ID/3/Id59/4/LM66 | 66.05b | 59.20 | 178.50b | 42.00a |
| | $\bar{x}$ 2/ | 86.1 | 59.8 | 180.6 | 35.8 |
| | F 2/ | 6.21** | .00 | 43.17** | 83.29** |
| | S.E.$\bar{x}$ | 3.32 | .00 | .41 | .63 |
| | L.S.D. .05 | 9.33 | .00 | 1.15 | 1.77 |
| | C.V. % | 3.86 | .00 | .23 | 1.75 |

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

Table 4. Agronomic data from private variety spring wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell in 1973. Field No. Y-2

Planting date: April 24, 1973 Harvest date: August 30, 1973
Size of Plot: 16 sq. ft.

| C.I. or State No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Heading Date | Plant Height | Sheaf Wt. Grams |
|---|---|---|---|---|---|---|
| CI 14588 | Twin - ID 0015 | 94.41a | 57.60 | 181.50 | 35.50 | 1928.00 |
| CI 13986 | Era | 90.68 | 59.50 | 180.75 | 35.25 | 1793.25 |
| MT 25 | Promora | 85.00 | 58.50 | 175.75b | 33.50 | 1750.50 |
| CI 15927 | Norana (MT 7042)1/ | 79.90 | 58.50 | 181.00 | 37.50 | 1722.50 |
| MT 31 | 1809 | 78.25 | 58.90 | 176.00b | 30.75b | 1601.75 |
| MT 33 | Bounty 208 | 75.42 | 57.10 | 175.50b | 30.50b | 1687.00 |
| MT 24 | Protor | 75.17 | 58.50 | 176.25b | 31.25 | 1615.75 |
| MT 29 | MP-6B | 72.22 | 52.80 | 177.50b | 30.75b | 1623.25 |
| MT 28 | Sicco | 71.82 | 58.20 | 186.25a | 37.25 | 1828.75 |
| MT 30 | Lark | 70.00 | 54.10 | 177.00b | 30.50b | 1566.50 |
| CI 13596 | Fortuna | 68.62 | 61.20 | 177.50b | 38.75 | 1637.25 |
| MT 23 | Trailblazer (Triticales)2/ | 63.62b | 49.00 | 182.50a | 46.25a | 1807.50 |
| MT 32 | Armadillo-105,Triticale2/ | 61.10b | 49.40 | 175.00b | 40.50 | 1729.50 |
| CI 10003 | Thatcher | 61.00b | 59.00 | 178.25b | 39.50 | 1559.50 |
| MT 27 | A004, 1996 | 53.22b | 61.30 | 177.25b | 27.00b | 1134.00 |
| | $\bar{x}$ | 73.4 | 56.9 | 178.5 | 35.0 | 1665.7 |
| | F3/ | 6.02** | .00 | 115.17** | 4.92** | 5.67** |
| | S.E.$\bar{x}$ | 4.61 | .00 | .30 | 2.28 | 76.11 |
| | L.S.D. .05 | 13.19 | .00 | .85 | 6.53 | 217.52 |
| | C.V. % | 6.29 | .00 | .17 | 6.53 | 4.57 |

1/ Check variety
2/ Late in maturity, this harvested several days later.
3/ Value used for variety comparison.
* Indicates statistical significance .05 level.
** Indicates statistical significance .01 level.
a Values significantly greater than the check .05.
b Values significantly less than the check .05.

TITLE: Winter Wheat

PROJECT: Small Grains Investigations 756

PERSONNEL: Leader - Vern R. Stewart
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.

1973 EXPERIMENTS:

1. Western Regional Hard Red Nursery
2. Western Regional White Nursery
3. Intrastate Nursery
4. Elite Stripe Rust Nursery
5. Off Station Nurseries

SUMMARY OF 1973 RESULTS:

Western Regional Hard Red Nursery -

Kalispell - ID70401 was the highest yielding entry in the nursery. Mean for all varieties was 45.6 bu/a. Real differences were found in winter survival of entries. ID33 has a survival reading of 29%, WA5985 and UT80702 had survival readings of 66% and 65% respectively. All other entries exceeded 80%. No dwarf smut was found in this nursery. Table 1.

Stillwater - Stand loss was very high and dwarf bunt infestation low in this nursery due to the extremely low temperatures and no snow cover. No percentage estimates were made on smut. Itana, a very susceptible variety, was smut free in this location. Table 2.

Summary of the data from these two nurseries is found in Table 3. UT755090 is the highest yielding entry, no evidence of dwarf smut, good test weight, fair straw, and somewhat later than Itana, but a little taller.

Western Regional Soft White Nursery:

In 1973 WA5987 and Paha were slightly higher, but not significantly higher, in yield than Nugaines, the check variety, however they are 2 to 3 days later in heading. Three entries were found to be significantly lower in yield. Test weights averaged 60.9 lbs/bu with Nugaines having a test weight of 63.2 lbs/bu, which was the highest in the nursery. WA5987 and Paha had less dwarf smut than Nugaines, however light smut has been found in Paha other seasons. Paha was 5 inches taller than Nugaines in this study. Table 4.

Using Nugaines as a check variety over a ten year period, eight varieties were found to exceed the check. Of these varieties only Luke has satisfactory dwarf smut and stripe rust resistance. Table 5.

Results (con't)

Intrastate Nursery -

The highest yielding entry in this nursery was McCall, however it was not significantly higher than Crest, the check variety. McCall, Wanser and Centurk are usually higher in yield but all 3 are susceptible to dwarf smut in this location. Table 6.

A summary of selected winter wheat varieties grown at the Northwestern Agricultural Research Center 1962-1973 are found in Table 7.

Elite Stripe Rust Nursery -

In this nursery lines from the breeding lines in advance stages are evaluated. Many lines were not harvested this year because of milling quality evaluation received after seeding indicated no need to continue their evaluation. The data obtained from this nursery are recorded in the wheat research committee report.

Off Station -

Three nurseries were seeded in the fall of 1972 in Lake, Sanders, Ravalli and Missoula Counties. The nursery in Missoula county was not harvested because of poor stands and high weed population.

Lake County - Because of the very dry conditions yields were low in this location. Yields were not statistically significant, however Hyslop was the highest yielding entry. Table 8.

Sanders County - Stands and yields were average in this location. McCall is the highest yielding variety in the nursery and is significantly higher in yield than Crest. Table 9.

Table 1. Agronomic data from the western regional hard red winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana, 1973 in Field R-8a.

Date Seeded: September 20, 1972 Date Harvested: August 10, 1973 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. | % Stand | Smut at Stillwater |
|---|---|---|---|---|---|---|---|---|---|
| ID 71040 | Moscow 71040 | 53.87a | 57.80 | 168.25a | 32.00 | .00b | .00b | 97.50 | |
| ID 725055 | ID 5011/ID 5006 | 53.17a | 61.20 | 167.50a | 32.50 | .00b | .00b | 100.00a | |
| UT 819116 | DM/CLM//Burt/PI 178383 | 52.92a | 61.40 | 163.75 | 40.25a | .00b | .00b | 91.25 | |
| WA 5835 | Bez-1//Bnk1205/CI13438 | 52.84a | 60.60 | 169.00a | 32.25 | .00b | .00b | 97.50 | x |
| ID 725058 | ID 5011/WA 4765, Sel. 3 | 51.94a | 60.60 | 171.00a | 40.25a | .00b | .00b | 97.50 | |
| UT 755090 | DM/178383/CLM | 51.02a | 61.40 | 165.00a | 37.00a | 24.75b | .25b | 93.75 | |
| ID 725056 | ID 5011/WA 4765, Sel, 1 | 50.97a | 58.50 | 171.25a | 31.75 | .00b | .00b | 100.00a | x |
| CI 13844 | Wanser | 50.47a | 62.50 | 163.50 | 36.25a | .00b | .00b | 97.50 | x |
| UT 755204 | DM/178383/Clm | 49.89a | 62.90 | 164.75a | 40.25a | 99.00 | 1.00 | 96.25 | |
| ID 37 | IT//KO/PI 178383 | 49.54a | 63.40 | 164.75a | 38.75a | 99.00 | 2.50 | 96.25 | x |
| CI 15317 | Franklin | 48.97a | 60.80 | 167.50a | 40.50a | 49.50b | .50b | 96.25 | |
| UT 84557 | DM/173438//CLM/3/DM/4/CO | 48.52a | 60.80 | 166.00a | 40.25a | 99.00 | 2.50 | 96.25 | |
| MT 6829 | Burt/PI 178383 101-1200 | 47.09 | 60.40 | 163.75 | 34.75a | 24.75b | .25b | 97.50 | |
| UT 821252 | Warrior//Burt/PI 178383 | 47.02 | 59.10 | 166.50a | 37.00a | 24.75b | .25b | 97.50 | |
| WA 5836 | Bez-1//CI 13438/Burt | 46.92 | 61.40 | 163.50 | 25.25b | .00b | .00b | 100.00a | x |
| ID 72 | Cnn*2/PI 187383 | 46.52 | 61.20 | 166.00a | 40.50a | 74.25 | 1.00 | 100.00a | |
| WA 5984 | BNK 1205/Burt//14/53-1 | 46.42 | 59.00 | 164.25a | 31.50 | 24.75b | .25b | 86.25 | |
| CI 15286 | Ark | 45.54 | 62.60 | 164.50a | 38.25a | 49.50b | .50b | 98.75a | x |
| CI 15316 | Ranger | 44.94 | 62.50 | 160.75 | 36.00a | 99.00 | 1.00 | 97.50 | |
| CI 1442 | Kharkof | 42.94 | 59.50 | 168.75a | 42.25a | 99.00 | 1.50 | 100.00a | x |
| ID 75 | CI 14106/CLM//McCall | 40.86 | 61.90 | 166.75a | 35.75a | 74.25b | 2.25 | 92.50 | |
| MT 6827 | Burt/PI 178383 14-1202 | 40.76 | 58.70 | 168.50a | 33.75a | .00b | .00b | 91.25 | |
| MT 6828 | Burt/PI 178383 13-1201 | 39.74 | 59.10 | 166.00a | 34.00a | .00b | .00b | 90.00 | |
| CI 12933 | Itana 1/ | 37.29 | 60.90 | 162.25 | 31.50 | 99.00 | 1.75 | 82.50 | |
| WA 5985 | BNK 1205/Burt//14/53-1 | 36.76 | 58.50 | 166.50a | 31.00 | .00b | .00b | 66.25b | x |
| UT 80702 | DM/173438//CLM/3/DM | 32.74 | 62.60 | 165.00a | 38.00a | 24.75b | 1.00 | 65.00b | |
| ID 33 | MN60157/McCall//Moran | 22.21b | 58.40 | 166.75a | 35.75a | 24.75b | .50b | 28.75b | |
| | $\bar{x}$ | 45.6 | 60.7 | 166.0 | 35.8 | 36.7 | .6 | 90.9 | |
| | F 2/ | 3.90** | .0 | 8.44** | 26.75** | 6.50** | 4.35** | 7.72** | |
| | S.E.$\bar{x}$ | 3.67 | .0 | .86 | .78 | 15.78 | .39 | 5.53 | |
| | L.S.D.(.05) | 10.31 | .0 | 2.41 | 2.19 | 44.38 | 1.10 | 15.56 | |
| | C.V.% | 8.04 | .0 | .52 | 2.17 | 43.03 | 61.85 | 6.09 | |

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

Table 2. Agronomic data from the western regional hard red winter wheat nursery grown on the Lance Claridge farm, Kalispell, Montana in 1973. Random block design, four replications.

Date Seeded: September 20, 1972
Date Harvested: August 14, 1973
Size of Plot: 16 sq. ft.

| C.I. or State No. | Variety | Yield Bu/A. | Test Wt. Lbs/Bu. | Plant Height | % Stand | Smut |
|---|---|---|---|---|---|---|
| WA 5836 | Bez-1//CI13438/Burt | 24.98 | 58.10 | 20.00 | 65.00 | x |
| WA 5984 | Bnk 1205/Burt//14/53-1 | 23.78 | 52.50 | 26.25a | 65.00 | |
| UT 755090 | DM/178383/Clm | 23.61 | 59.00 | 27.00a | 55.00 | |
| UT 755204 | DM/178383/Clm | 23.21 | .00 | 31.00 | 50.00 | |
| WA 5985 | BNK 1205/Burt//14/53-1 | 23.06 | 56.00 | 23.75 | 52.50 | x |
| ID 37 | IT//KO/PI178383 | 22.93 | 59.40 | 28.25a | 42.50 | x |
| ID 725056 | ID 5011/WA 4765, Sel.1 | 22.81 | 53.10 | 25.25 | 67.50a | x |
| CI 15316 | Ranger | 22.61 | 56.00 | 27.00a | 65.00 | |
| CI 1442 | Kharkof | 21.43 | 53.20 | 32.25a | 75.00a | x |
| ID 725058 | ID 5011/WA 4765, Sel. 3 | 21.38 | 55.20 | 30.00a | 55.00 | |
| ID 72 | CNN*2/PI 178383 | 21.16 | 56.00 | 29.75a | 60.00 | |
| ID 75 | CI 14106/Clm//McCall | 20.81 | .00 | 28.00a | 37.50 | |
| UT 84557 | DM/173438//Clm/3/DM/4/CO | 20.66 | 57.00 | 29.75a | 42.50 | |
| ID 71040 | Moscow 71040 | 19.23 | 52.70 | 26.25a | 57.50 | |
| ID 725055 | ID 5011/ID 5006 | 19.18 | .00 | 24.50 | 47.50 | |
| CI 15286 | Ark | 18.98 | .00 | 29.25a | 60.00 | x |
| UT 819116 | DM/Clm//Burt/PI 178383 | 18.66 | .00 | 30.25a | 50.00 | |
| CI 15317 | Franklin | 18.66 | .00 | 29.75a | 42.50 | |
| CI 13844 | Wanser | 18.21 | .00 | 26.75a | 57.50 | x |
| MT 6829 | Burt/PI 178383 101-1200 | 17.56 | 57.30 | 27.25a | 52.50 | |
| WA 5835 | Bez-1//Bnk1205/CI 13438 | 16.73 | .00 | 23.75 | 32.50 | x |
| CI 12933 | Itana 1/ | 16.43 | .00 | 22.25 | 42.50 | |
| UT 80702 | DM/173438//Clm/3/DM | 16.21 | .00 | 28.50a | 7.50 | |
| MT 6828 | Burt/PI 178383 13-1201 | 15.15 | .00 | 24.00 | 45.00 | x |
| ID 33 | MN60157/McCall//Moran | 15.00 | .00 | 24.00 | 22.50 | x |
| UT 821252 | Warror//Burt/PI 178383 | 14.45 | .00 | 26.50a | 43 75 | |
| MT 6827 | Burt/PI 178383 14-1202 | 12.85 | .00 | 23.50 | 45.00 | |
| | $\bar{x}$ | 19.6 | 26.9 | 26.8 | 49.6 | |
| | F 2/ | 1.19NS | .0 | 6.31** | 2.66** | |
| | S.E.$\bar{x}$ | 3.01 | .0 | 1.18 | 8.77 | |
| | L.S.D.(.05) | 8.48 | .0 | 3.32 | 24.67 | |
| | C.V.% | 15.37 | .0 | 4.40 | 17.69 | |

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

Table 3. Summary of agronomic data from the western regional hard red winter wheat nursery, grown at Northwestern Agricultural Research Center and Stillwater in 1973.

| C.I. or State No. | Variety | Yield Bu/A[1/] | Test Wt. Lbs/Bu. | Heading Date[2/] | Lodging[2/] % Prev. | Lodging[2/] Sev. | Plant Height[1/] | % Stand[1/] | Dwarf Smut[3/] |
|---|---|---|---|---|---|---|---|---|---|
| ID 71040 | Moscow 71040 | 36.55 | 55.25[1/] | 168.25a | .00 | .00 | 29.13 | 77.50 | |
| ID 725055 | ID5011/ID5006 | 36.18 | 61.20[2/] | 167.50a | .00 | .00 | 28.50 | 73.75 | |
| UT 819116 | DM/Clm//Burt/PI178383 | 35.79 | 61.40[2/] | 163.75a | .00 | .00 | 35.25 | 70.63 | |
| WA 5835 | Bez-1//Bnk1205/CI13438 | 34.79 | 60.60[2/] | 169.00a | .00 | .00 | 28.00 | 65.00 | x |
| ID 725058 | ID5011/Wa4765, Sel. 3 | 36.66 | 57.90[1/] | 171.00a | .00 | .00 | 35.13 | 76.25 | |
| UT 755090 | DM/178383/Clm | 37.32 | 60.20[1/] | 165.00a | 24.75 | .25 | 30.00 | 74.38 | |
| ID 725056 | ID5011/Wa4765, Sel. 1 | 36.89 | 55.80[1/] | 171.25a | .00 | .00 | 28.50 | 83.75 | x |
| CI 13844 | Wanser | 34.34 | 62.50[2/] | 163.50 | .00 | .00 | 31.50 | 77.50 | x |
| UT 755204 | DM/178383/Clm | 36.55 | 62.90[2/] | 164.75a | 99.00 | 1.00 | 35.63 | 73.13 | |
| ID 37 | IT//KO/PI 178383 | 36.24 | 61.40[1/] | 164.75a | 99.00 | 2.50 | 33.50 | 69.38 | x |
| CI 15317 | Franklin | 33.82 | 60.80[2/] | 167.50a | 49.50 | .50 | 35.13 | 69.38 | |
| UT 84557 | DM/173438//Clm/3/DM/4/CO | 34.59 | 58.90[1/] | 166.00a | 99.00 | 2.50 | 35.00 | 69.38 | |
| MT 6829 | Burt/PI178383 101-1200 | 32.33 | 58.85[1/] | 163.75 | 24.75 | .25 | 31.00 | 75.00 | |
| UT 821252 | Warrior//Burt/PI178383 | 30.74 | 59.10[2/] | 166.50a | 24.75 | .25 | 31.75 | 70.63 | |
| WA 5836 | Bez-1//CI13438/Burt | 35.95 | 59.75[1/] | 163.50 | .00 | .00 | 22.63 | 82.50 | x |
| ID 72 | CNN*2/PI 178383 | 33.84 | 58.60[1/] | 166.00a | 74.25 | 1.00 | 35.13 | 80.00 | |
| WA 5984 | BNK1205/Burt//14/53-1 | 35.10 | 55.75[1/] | 164.25a | 24.75 | .25 | 28.88 | 75.63 | |
| CI 15286 | Ark | 32.26 | 62.60[2/] | 164.50a | 49.50 | .50 | 33.75 | 79.38 | x |
| CI 15316 | Ranger | 33.78 | 59.25[1/] | 160.75 | 99.00 | 1.00 | 31.50 | 81.25 | |
| CI 1442 | Kharkof | 32.19 | 56.35[1/] | 168.75a | 99.00 | 1.50 | 37.25 | 87.50 | x |
| ID 75 | CI14106/Clm//McCall | 30.84 | 61.90[2/] | 166.75a | 74.25 | 2.25 | 31.88 | 65.00 | |
| MT 6827 | Burt/PI178383 14-1202 | 26.81 | 58.70[2/] | 168.50a | .00 | .00 | 28.63 | 68.13 | |
| MT 6828 | Burt/PI178383 13-1201 | 27.45 | 59.10[2/] | 166.00a | .00 | .00 | 29.00 | 67.50 | |
| CI 12933 | Itana[4/] | 26.86 | 60.90[2/] | 162.25 | 99.00 | 1.75 | 26.88 | 62.50 | |
| WA 5985 | BNK 1205/Burt//14/53-1 | 29.91 | 57.25[1/] | 166.50a | .00 | .00 | 27.38 | 59.38 | x |
| UT 80702 | DM/173438//Clm/3/DM | 24.48 | 62.60[2/] | 165.00a | 24.75 | 1.00 | 33.25 | 36.25 | |
| ID 33 | MN 60157/McCall//Moran | 18.61 | 58.40[2/] | 166.75a | 24.75 | .50 | 29.88 | 25.63 | |

1/ $\bar{x}$ for Northwestern Agricultural Research Center and Stillwater
2/ $\bar{x}$ for Northwestern Agricultural Research Center only
3/ x indicates presence of dwarf smut, no percentage estimates were taken
4/ Check variety
a/ Values significantly greater than the check (.05)

Table 4. Agronomic data from the western regional white winter wheat nursery grown at the Northwestern Agricultural Research Center at Kalispell in 1973. Field No. E-2

Date Seeded: September 15, 1972 Date Harvested: August 15, 1973
Size of Plot: 16 sq. ft.

| C. I. or State No. | Variety | Yield Bu/A | Test Wt. Lbs/Bu. | Heading Date | Plant Height | Dwarf Smut |
|---|---|---|---|---|---|---|
| WA 5987 | WA4877//Sel. 66344 | 74.10 | 61.00 | 161.75a | 29.50 | .00b |
| CI 14485 | Paha | 71.07 | 61.00 | 160.75a | 36.25a | .00b |
| WA 5988 | Gaines//178383/CI 13431 | 69.27 | 61.10 | 160.50a | 33.25a | .75b |
| WA 5986 | 4877/3/S3//178383/13431 | 69.12 | 58.50 | 163.50a | 29.50 | .75b |
| CI 13968 | Nugaines 1/ | 68.47 | 63.20 | 158.75 | 31.00 | 3.00 |
| ID 725057 | ID 5011/WA 4765, Sel.2 | 67.50 | 59.80 | 164.75a | 36.75a | 1.00b |
| OR 6734 | 178383/3*Omar | 66.92 | 62.40 | 160.25a | 43.00a | .00b |
| WA 5910 | 181268/Gaines | 66.90 | 62.30 | 159.00 | 32.75 | .75b |
| WA 5826 | OM/1834-3//178383/13431 | 66.00 | 59.10 | 162.25a | 30.50 | .50b |
| OR 6933 | Oregon Sel. 896 | 65.75 | 61.40 | 160.50a | 38.75a | .75b |
| CI 13740 | Moro | 65.57 | 60.80 | 160.00a | 39.75a | .00b |
| CI 14586 | Luke | 65.17 | 59.10 | 164.75a | 31.25 | .00b |
| WA 5989 | N98/WA4765 | 64.47 | 60.50 | 160.00a | 31.50 | 1.00b |
| ID 71041 | Gaines*2/Swedish Type | 64.02 | 62.00 | 161.00a | 38.25a | 10.00a |
| CI 14565 | Nord Desprez/2*Sel. 101 | 63.42 | 59.10 | 158.00 | 30.00 | .50b |
| OR 67205 | Cap. Desp./Sel. 101//Drv | 63.32 | 56.40 | 159.50 | 26.00b | .75b |
| CI 14564 | Hyslop | 63.12 | 59.70 | 159.50 | 29.75 | 1.00b |
| CI 14483 | Coulee | 61.62 | 60.90 | 158.50 | 29.00b | 10.00a |
| OR 65116 | Nord Desprez/Sel.101 | 61.60 | 57.50 | 158.50 | 29.25 | .75b |
| WA 5829 | S.Helvia//Suwon92/13645 | 51.94b | 60.50 | 159.00 | 29.00b | 25.00a |
| CI 11755 | Elgin | 50.89b | 62.40 | 160.00a | 41.75a | 6.25a |
| CI 1442 | Kharkof | 45.26b | 60.20 | 159.00 | 44.00a | 30.00a |
| | $\bar{x}$ | 63.9 | 60.9 | 160.4 | 33.7 | 4.2 |
| | F 2/ | 2.63** | .0 | 20.82** | 68.09** | 405.28** |
| | S.E.$\bar{x}$ | 4.15 | .0 | .42 | .63 | .40 |
| | L.S.D.(.05) | 11.72 | .0 | 1.19 | 1.79 | 1.14 |
| | C.V.% | 6.49 | .0 | .26 | 1.88 | 9.58 |

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

Table 5. Summary of western regional white winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana from 1964-73.

| C.I. or State No. | Variety | 1964 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | Sta. Yrs. | $\bar{x}$ | % Nugaines |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1442 | Kharkof | 49.2 | 52.1 | 47.4 | 58.5 | 58.9 | 56.4 | 62.1 | 59.7 | 45.3 | 9 | 54.4 | 72 |
| 11755 | Elgin | 57.3 | 52.3 | 49.6 | 80.5 | 51.2 | 74.1 | 73.0 | 70.8 | 50.9 | 9 | 62.2 | 82 |
| 13740 | Moro | 50.1 | 85.9 | 57.2 | 86.3 | 65.7 | 75.4 | 68.3 | 68.5 | 65.6 | 9 | 69.2 | 94 |
| 13968 | Nugaines | | 79.7 | 58.7 | 85.8 | 63.2 | 77.6 | 102.8 | 73.0 | 68.5 | 8 | 76.2 | 100 |
| 14485 | Paha | | | | 98.1 | 65.4 | 87.0 | 101.2 | 88.9 | 71.1 | 6 | 85.3 | 114 |
| 14564 | Hyslop | | | | 90.1 | 62.7 | 87.3 | 113.1 | 90.1 | 63.1 | 6 | 84.4 | 113 |
| 14483 | Coulee | | | | 84.5 | 55.4 | 73.1 | 100.4 | 73.8 | 61.6 | 6 | 74.8 | 100 |
| 14586 | Luke | | | | | | 93.1 | 103.1 | 73.6 | 65.2 | 4 | 83.8 | 104 |
| 14565 | Nord Desprez/2*Sel. 101 | | | | | | 88.8 | 111.9 | 95.8 | 63.4 | 4 | 89.9 | 112 |
| WA 5826 | Omar/1834-3//PI178383/CI13431 | | | | | | | | 69.4 | 66.0 | 2 | 67.7 | 96 |
| WA 5829 | Super Helvia//Suwon 92/CI13645 | | | | | | | | 88.7 | 51.9 | 2 | 70.3 | 99 |
| OR 6734 | PI 178383/3*Omar | | | | | | | | 78.3 | 66.9 | 2 | 72.6 | 103 |
| WA 5910 | PI 181268/Gaines | | | | | | | | 85.9 | 66.9 | 2 | **76.4** | 108 |
| ID 71041 | Gaines*2/Swedish Type | | | | | | | | 82.3 | 64.4 | 2 | 73.4 | 104 |
| WA 5987 | Wa4877//Sel. 66344 | | | | | | | | | 77.1 | 1 | 77.1 | 113 |
| WA 5988 | Gaines//178383/CI 13431 | | | | | | | | | 69.3 | 1 | 69.3 | 101 |
| WA 5986 | 4877/3/S 3//178383/13431 | | | | | | | | | 69.1 | 1 | 69.1 | 101 |
| ID725057 | ID5011/Wa4765, Sel. 2 | | | | | | | | | 67.5 | 1 | 67.5 | 99 |
| OR 6933 | Oregon Sel. 896 | | | | | | | | | 65.8 | 1 | 65.8 | 96 |
| WA 5989 | N98/Wa 4765 | | | | | | | | | 64.5 | 1 | 64.5 | 94 |
| OR 67205 | Cap. Desp./Sel. 101//Drv | | | | | | | | | 63.3 | 1 | 63.3 | 92 |
| OR 65116 | Nord Desprez/ Sel. 101 | | | | | | | | | 61.6 | 1 | 61.6 | 90 |

Table 6. Agronomic data from the intrastate winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, Montana in 1973. Field No. E-2. Random block design, Six replications.

Date seeded: September 15, 1972 Harvest Date: August 7, 1973 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 13842 | McCall | 62.05 | 60.30 | 158.33a | 37.83a | .00b | .00b | 2.83a |
| CI 15075 | Centurk | 59.35 | 62.60 | 154.50a | 35.50a | .00b | .00b | 2.33a |
| CI 13844 | Wanser | 59.24 | 62.20 | 157.17a | 38.33a | .00b | .00b | 1.17a |
| MT 7015 | NB55-391-64-D4/Wmt 2-1-1 | 58.65 | 60.50 | 160.67a | 39.33a | .00b | .00b | .50a |
| CI 8885 | Cheyenne | 58.52 | 62.40 | 158.17a | 41.00a | 82.50a | .83 | 1.00a |
| CI 13968 | Nugaines | 58.49 | 60.00 | 158.83a | 29.50 | .00b | .00b | .67a |
| MT 6715 | 3Yogo/Cnn 2-3-13-6 | 57.04 | 62.00 | 154.83a | 37.33a | 33.00 | .33 | 1.00a |
| CI 13880 | Crest[1/] | 55.62 | 61.40 | 152.50 | 33.00 | 33.00 | .33 | .00 |
| CI 13872 | Froid | 55.58 | 59.80 | 159.00a | 44.17a | 99.00a | 2.83a | 1.00a |
| MT 6919 | BWH1867-5/YTO-1171-3-2-1 | 55.05 | 62.00 | 157.83a | 45.50a | 99.00a | 4.00a | 5.00a |
| CI 13547 | Lancer | 54.60 | 62.00 | 154.33a | 36.83a | .00b | .00b | 1.33a |
| CI 12933 | Itana | 52.73 | 62.50 | 158.83a | 42.50a | .00b | .00b | 1.50a |
| CI 13998 | Trader | 51.85 | 61.70 | 157.17a | 42.33a | .00b | .00b | 1.17a |
| CI 15244 | Teton | 51.62 | 60.70 | 158.83a | 44.33a | 99.00a | 3.50a | .50a |
| MT 6930 | NB176/Y18181//YTO1174-3 | 51.32 | 61.60 | 159.50a | 43.83a | 82.50a | 1.83a | .83a |
| MT 6716 | 3Yogo/Cnn 2-3-17-19 | 50.23 | 61.00 | 159.00a | 43.67a | 99.00a | 3.00a | 1.00a |
| CI 14000 | Winoka | 50.03 | 61.30 | 158.67a | 40.83a | 66.00a | .67a | 1.17a |
| CI 13442 | Delmar | 49.58 | 60.00 | 160.33a | 39.67a | .00b | .00b | .50a |
| CI 8033 | Yogo | 49.05 | 61.70 | 159.00a | 46.17a | 99.00a | 3.50a | 1.00a |
| MT 7005 | Polo/Turg//Wrr 6-3-1 | 48.73 | 60.60 | 158.17a | 44.17a | 99.00a | 2.83a | .50a |
| CI 13999 | Trapper | 48.53 | 63.00 | 157.83a | 41.33a | .00b | .00b | 2.00a |
| MT 6917 | Bwh1376-8/YTO-1171-3-2-2 | 48.47 | 61.00 | 159.33a | 45.00a | 99.00a | 3.17a | 1.00a |
| CI 13181 | Rego | 48.07 | 60.90 | 158.00a | 44.67a | 99.00a | 4.33a | 1.17a |
| MT 693 | Winalta 41 | 47.60b | 61.10 | 158.33a | 39.83a | 33.00 | .33 | 1.17a |
| CI 13670 | Winalta | 46.68b | 63.00 | 158.17a | 41.17a | .00b | .00b | 1.00a |
| CI 13190 | Warrior | 46.40b | 61.50 | 156.00a | 38.83a | 33.00 | .33 | 1.17a |
| CI 15327 | Sundance | 46.27b | 59.00 | 163.33a | 44.33a | 99.00a | 3.17a | 1.00a |
| MT 6918 | BWH1376-8/YTO-1172-3-2-2 | 45.18b | 61.20 | 158.33a | 43.00a | 99.00a | 4.17a | 1.00a |
| CI 6938 | Kharkof MC22 | 45.00b | 59.00 | 161.67a | 45.17a | 99.00a | 1.83a | 1.17a |
| MT 6916 | BWH1376-8/YTO-1171-3-2-1 | 43.88b | 61.50 | 159.50a | 46.00a | 99.00a | 3.00a | 1.00a |
| MT 7010 | WHT/RY/A*E/3//WRR 14-2-1 | 43.25b | 59.70 | 157.83a | 42.50a | .00b | .00b | .83a |
| MT 6920 | BWH1867-5/YTO-1171-3-4-1 | 42.18b | 61.00 | 158.83a | 44.17a | 99.00a | 4.33a | 1.17a |
| CI 14075 | Scoutland | 41.81b | 60.80 | 150.83a | 35.83a | .00b | .00b | 1.00a |

Table 6 . (con't)

| C.I. or State No. | Variety | Yield Bu/A. | Test Wt. Lbs/Bu. | Heading Date | Plant Height | Lodging % Prev. | Lodging Sev. | Dwarf Smut % |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | 50.99 | 61.18 | 157.99 | 41.14 | 50.00 | 1.46 | 1.03 |
| | F 2/ | 4.10** | .00 | 59.89** | 33.73** | 25.00** | 44.94** | 5.7052 |
| | S.E.$\bar{x}$ | 2.75 | .00 | .32 | .69 | 9.17 | .25 | .233 |
| | L.S.D.(.05) | 7.63 | .00 | .87 | 1.90 | 25.41 | .68 | .07 |
| | C.V.% | 5.40 | .00 | .20 | 1.67 | 18.34 | 16.80 | 22.68 |

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

Table 7. Summary of selected winter wheat varieties grown at the Northwestern Agricultural Research Center, Kalispell, Montana 1964-73.

| C.I. or State No. | Variety | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | $\bar{x}$ | Sta. Yrs. | % Cheyenne |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CI 8885 | Cheyenne | 57.5 | 48.7 | 59.3 | 46.4 | 57.2 | 57.0 | 63.7 | 48.6 | 67.2 | 58.5 | 56.4 | 10 | 100.0 |
| CI 13670 | Winalta | 54.4 | 31.4 | 67.4 | 44.9 | 55.8 | 45.7 | 57.9 | 55.9 | 66.6 | 46.7 | 52.7 | 10 | 93.4 |
| CI 13181 | Rego | 49.9 | 42.5 | 62.4 | 43.6 | | 51.3 | 58.7 | 56.3 | 54.3 | 48.1 | 51.9 | 9 | 92.1 |
| CI 13442 | Delmar | 51.4 | 47.3 | 64.2 | 55.9 | 67.9 | 59.3 | | | 69.0 | 49.6 | 58.1 | 8 | 102.8 |
| CI 13844 | Wanser | | | 73.9 | 51.7 | 76.5 | 56.0 | 65.5 | 59.6 | 79.7 | 59.2 | 65.3 | 8 | 114.0 |
| CI 13880 | Crest | | | 73.4 | 53.5 | 51.6 | 43.8 | 69.0 | 54.1 | 70.9 | 55.6 | 59.0 | 8 | 103.1 |
| CI 13842 | McCall | | | 56.4 | 51.9 | 76.8 | 40.5 | 63.3 | 58.5 | 68.5 | 62.1 | 59.7 | 8 | 104.4 |
| CI 13190 | Warrior | 45.8 | 37.1 | 59.5 | 43.5 | | | 60.8 | 48.3 | 70.6 | 46.4 | 51.5 | 8 | 91.6 |
| CI 13547 | Lancer | | | 57.0 | 41.7 | 44.0 | 38.3 | 58.4 | 42.6 | 68.1 | 54.6 | 50.6 | 8 | 88.4 |
| CI 12933 | Itana | 46.8 | 38.3 | 58.2 | | | | 61.1 | 53.3 | 67.9 | 52.7 | 54.0 | 7 | 93.8 |
| CI 14000 | Winoka | | | | | | | 57.2 | 46.3 | 62.4 | 50.0 | 54.0 | 4 | 90.7 |
| CI 13998 | Trader | | | | | | | 54.7 | 38.8 | 70.2 | 51.9 | 53.9 | 4 | 90.6 |
| MT 693 | Winalta 41 | | | | | | | 56.7 | 44.7 | 61.2 | 47.6 | 52.6 | 4 | 88.3 |
| CI 13999 | Trapper | | | | | | | 56.6 | 44.6 | 58.4 | 48.5 | 52.0 | 4 | 87.4 |
| CI 13872 | Froid | | | | | | | 55.5 | 43.8 | 59.4 | 55.6 | 53.6 | 4 | 90.0 |
| CI 8033 | Yogo | | | | | | | 55.5 | 48.6 | 58.4 | 49.0 | 52.9 | 4 | 88.9 |
| CI 6938 | Kharkof Mc22 | | | | | | | 53.3 | 36.2 | 59.5 | 45.0 | 48.5 | 4 | 81.5 |
| NB 66425 | Centurk | | | | | | | | 46.8 | 78.6 | 59.4 | 61.6 | 3 | 106.0 |
| CI 15327 | Sundance | | | | | | | | | 53.5 | 46.3 | 49.9 | 2 | 79.4 |
| MT 7015 | NB55-391-64 | | | | | | | | | 65.9 | 58.7 | 62.3 | 2 | 99.1 |
| MT 6715 | 3Yogo/Cnn2- | | | | | | | | | 53.1 | 57.0 | 55.1 | 2 | 87.6 |
| MT 6919 | BWH 1867-5/YT | | | | | | | | | 51.0 | 55.1 | 53.1 | 2 | 84.4 |
| MT 6916 | BWH 1376-8/YT | | | | | | | | | 58.1 | 43.9 | 51.0 | 2 | 81.1 |
| MT 6930 | NB176/Y18181 | | | | | | | | | 50.1 | 51.3 | 50.7 | 2 | 80.7 |
| MT 7005 | Polo/Turg//W | | | | | | | | | 50.8 | 48.7 | 49.7 | 2 | 79.2 |
| MT 6716 | 3Yogo/Cnn2 | | | | | | | | | 49.2 | 50.2 | 49.7 | 2 | 79.1 |
| MT 6918 | BWH1376-8/YT | | | | | | | | | 53.2 | 45.2 | 49.2 | 2 | 78.3 |
| MT 6917 | BWH1376-8/YT | | | | | | | | | 49.1 | 48.5 | 48.8 | 2 | 77.6 |
| MT 7010 | WHT/RY/A*E/3 | | | | | | | | | 53.3 | 43.2 | 48.3 | 2 | 76.8 |
| MT 6920 | BWH1867-5/YT | | | | | | | | | 45.3 | 42.2 | 43.8 | 2 | 69.6 |
| CI 15244 | Teton | | | | | | | | | | 51.6 | 51.6 | 1 | 88.2 |
| CI 14075 | Scoutland | | | | | | | | | | 41.8 | 41.8 | 1 | 71.5 |

Table 8. Agronomic data from off station winter wheat nursery grown in Lake County on the Wolen Johnson farm, Charlo, Montana in 1973. Random block design, four replications.

Date Seeded: September 27, 1972
Date Harvested: August 1, 1973
Size of Plot: 16 sq. ft.

| C.I. or State No. | Variety | Yield Bu/A. | Test Wt. Lbs/Bu. | Plant Height | % Stand |
|---|---|---|---|---|---|
| CI 14564 | Hyslop | 37.94 | 59.50 | 22.25 | 80.0 |
| CI 14586 | Luke | 34.86 | 61.00 | 21.00 | 85.0 |
| CI 13844 | Wanser | 31.41 | 61.00 | 21.50 | 70.0 |
| CI 13842 | McCall | 31.11 | 61.00 | 23.50a | 72.5 |
| CI 14565 | Nord Desprez/2*Sel 101 | 30.99 | 58.50 | 19.00 | 76.3 |
| CI 13880 | Crest 1/ | 28.31 | 60.50 | 20.00 | 86.2 |
| CI 8885 | Cheyenne | 26.76 | 61.50 | 22.50 | 67.5 |
| CI 14485 | Paha | 26.71 | 60.50 | 17.25 | 72.5 |
| MT 6827 | Burt/PI178383 14-1202 | 26.18 | 58.50 | 22.75 | 70.0 |
| CI 13670 | Winalta | 25.68 | 60.50 | 22.25 | 77.5 |
| MT 6826 | Burt/PI 178383 4-1192 | 25.33 | 58.50 | 21.25 | 67.5 |
| MT 6829 | Burt/PI 178383 101-1200 | 24.83 | 61.00 | 23.50a | 63.8 |
| CI 13442 | Delmar | 22.78 | 59.00 | 23.75a | 65.0 |
| CI 13968 | Nugaines | 22.58 | 60.00 | 18.00 | 66.2 |
| WA 5829 | S.Helvia//Suwon92/13645 | 22.13 | 59.00 | 18.50 | 72.5 |
| CI 14483 | Coulee | 21.76 | 59.50 | 17.75 | 67.5 |
| | $\bar{x}$ | 27.5 | 60.0 | 20.9 | 72.0 |
| | F 2/ | 1.53NS | .0 | 3.32** | 1.08NS |
| | S.E.$\bar{x}$ | 7.6 | .0 | 2.4 | 1.3 |
| | L.S.D.(.05) | 10.80 | .0 | 3.46 | 18.7 |
| | C.V.% | 13.81 | .0 | 5.81 | 9.06 |

1/ Check variety
2/ Value for variety comparison
** Indicates statistical significance at .01 level
NS No statistical significance
a Values significantly greater than the check .05 level

Table 9. Agronomic data from the off station winter wheat nursery grown in Sanders County on the Jack Marrinan farm, Hot Springs, Montana in 1973. Experimental Block Design, four replications.

Date Seeded: September 17, 1972
Date Harvested: August 1, 1973
Size of Plot: 16 sq. ft.

| C.I. or State No. | Variety | Yield Bu/A. | Plant Height | % Stand |
|---|---|---|---|---|
| CI 13842 | McCall | 19.31a | 20.00a | 70.0 |
| CI 14565 | Nord Desprez/2*Sel.101 | 19.16a | 19.50 | 60.0 |
| CI 13844 | Wanser | 18.73a | 21.25 | 55.0b |
| CI 8885 | Cheyenne | 18.43a | 19.50 | 60.0 |
| MT 6827 | Burt/PI 178383 14-1202 | 18.31a | 18.50 | 57.5 |
| CI 14564 | Hyslop | 17.58a | 20.00 | 60.0 |
| MT 6829 | Burt/PI178383 101-1200 | 17.36 | 20.25 | 62.5 |
| CI 14586 | Luke | 15.68 | 19.00 | 70.0 |
| MT 6826 | Burt/PI 178383 4-1192 | 15.26 | 16.75 | 60.0 |
| WA 5829 | S.Helvia//Suwon92/13645 | 14.75 | 17.00 | 60.0 |
| CI 13670 | Winalta | 14.30 | 19.25 | 67.5 |
| CI 14485 | Paha | 13.68 | 19.00 | 62.5 |
| CI 13880 | Crest 1/ | 13.05 | 17.50 | 65.0 |
| CI 13968 | Nugaines | 12.93 | 16.00 | 60.0 |
| CI 14483 | Coulee | 12.45 | 17.50 | 52.5b |
| CI 13442 | Delmar | 11.83 | 18.75 | 57.5 |
| | $\bar{x}$ 2/ | 15.8 | 18.7 | 61.0 |
| | F 2/ | 2.86* | 3.18** | 2.05* |
| | S.E.$\bar{x}$ | 1.54 | .81 | .34 |
| | L.S.D.(.05) | 4.39 | 2.29 | 9.8 |
| | C.V.% | 9.76 | 4.30 | 5.61 |

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

YEAR: 1973

TITLE: Investigation of Cropping Sequences on Productivity and Quality of Cereal Grains.

LOCATION: Northwestern Agricultural Research Center, Agricultural Experiment Station, MSU, Route 4, Kalispell, Montana 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.

Economic evaluations are given on gross returns. After the study has continued for three years an overall economic and more meaningful report will be submitted. Commodity prices are as of November 21, 1973 for small grains and June 1973 for hay.

RESULTS AND DISCUSSION:

The factor having the most dramatic effect on production in this seasons study was precipitation. Using September 1972 thru August 31, 1973 as a crop year there was only two months where precipitation was normal or above, October and December of 1972. The total precipitation for the crop year was 12.35 inches, which was 6.66 inches below the 24 year average for the research center. There was some stand loss of winter wheat because of limited snow cover during the low temperatures recorded during December and January. It should be noted that during the author's tenure at the Northwestern Agricultural Research Center, he has never observed as much winter kill of winter wheat or perennial grasses and legumes.

In the R-2 sequence yields are still reflecting the long term effect of no fertilizers on this field for several years. Yields do not vary too much from last years yields. The gross return per acre is quite different, which probably needs no explanation. This is true of all sequences when compared to 1972.

Protein levels on barley are much higher than found in this location. This no doubt has a relationship to the rather dry conditions that existed during the growing season. Winter wheat protein levels are a little higher but not a great deal more than normally expected.

In 1973, the R-3 sequence was the most productive as related to gross income. This was followed closely by sequence R-2. The continuous cropping sequence is low in part because of the new seeding of alfalfa. Because of the extreme dry season only .15 T/A of alfalfa was harvested the seeding year.

In Table 1, are found data in detail for the 1973 cropping sequence study. Given in the table are crop, variety, plant food applied, protein levels that were sieved plus test weight, yield and economic data. These data will become more meaningful as the study continues.

Table 1. Annual data from cropping sequence study. Northwestern Agricultural Research Center, Route 4, Kalispell, Montana, 1973.

| Field No. | Crop | Variety | Pounds/Acre N | Pounds/Acre $P_2O_5$ | Pounds/Acre S | % Protein | Test Weight Lbs/Bu | Yield/ Acre | Price/ Unit Dollars | Gross Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crop Sequence - 3 years: Fallow, winter wheat, spring grain Seed legume with spring grain and plow down as green manure | | | | | | | | | |
| R-2a | Fallow | | | | | | | | | |
| R-2b | W.Wheat | Crest | 32.0 | 40.0 | 28 | 14.2 | 60.2 | 48.7bu | 4.20/bu | 204.54 |
| R-2c | S.Barley | Centennial | 58.9 | 30.6 | - | 14.6 | 48.1 | 47.8bu | 4.50/cwt | 103.46 |
| | | | | | | | | | Total | 308.00 |
| | Crop Sequence - 15 years: 5 years legume, winter grain fallow alternating | | | | | | | | | |
| R-3a | Alfalfa | Ladak | | | | | | 2.7T | 45.00/T | 121.50 |
| R-3b | W.Wheat | Nugaines | 96.3 | 40.0 | 28 | | 59.7 | 58.1bu | 4.25/bu | 246.93 |
| R-3c | Fallow | | | | | | | | Total | 368.43 |
| | Crop Sequence - 3 years: Fallow, winter wheat, spring grain | | | | | | | | | |
| R-4a | Fallow | | | | | | | | | |
| R-4b | W.Wheat | Nugaines | 96.3 | 40.0 | 28 | 14.5 | 57.5 | 48.6bu | 4.25/bu | 206.55 |
| R-4c | S.Barley | Centennial | 58.9 | 30.6 | - | 16.7 | 46.5 | 42.3bu | 4.50/cwt | 88.51 |
| | | | | | | | | | Total | 295.06 |
| | Crop Sequence - 9 years: 3 years legumes, winter grain, fallow alternating | | | | | | | | | |
| R-5a | Fallow | | | | | | | | | |
| R-5b | Alfalfa 1/ | | | 81.0 | | | | .2T | 45.00/T | 9.00 |
| R-5c | W.Wheat | Crest | 32.0 | 40.0 | 28 | 14.7 | 58.6 | 41.9bu | 4.20/bu | 175.98 |
| | | | | | | | | | Total | 184.98 |
| | Crop Sequence - Continuous cropping including a legume | | | | | | | | | |
| R-7a | Alfalfa 1/ | | | 82.0 | | | | .15T | 45.00/T | 6.75 |
| R-7b | S.Braley | Centennial | 54.8 | 28.4 | | | | 36.5 bu | 4.50/cwt | 33.84 |
| R-7c | W.Wheat | Crest | 32.0 | 40.0 | 28 | 13.3 | 59.1 | 30.8 bu | 4.20/bu | 129.36 |
| | | | | | | | | | Total | 214.95 |

1/ New seeding in 1973.

TITLE: Evaluation of Koeleria Cristata

PROJECT: Miscellaneous Crops Investigations MS 758

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

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Evaluate seven Koeleria Cristata (Junegrass) 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 consist of four rows, 12 feet long with one foot between rows and plots.

RESULTS: Seed yields were not obtained in 1973 because none of the introductions headed. However, color, emergence, growth habit and vigor differences were distinct among lines. P.I. 230256 and P.I. 206274 were the first to emerge in the spring and P.I. 229463 had above average fall vigor. Although the stands of M896 were distinctly better than the other introductions, fall vigor ratings were very low.

TITLE: Crambe Variety Trial

PROJECT: Miscellaneous Crops Investigations MS 758

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

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Evaluate three crambe varieties for seed yield under dryland and irrigated conditions in northwestern Montana.

PROCEDURES: Three crambe varieties were seeded at a rate of 15 pounds per acre under dryland and irrigated conditions on May 18, 1973 in a randomized complete block design. Plot size was 4 feet, by 12 feet with one foot between rows and plots. Sixteen square feet were harvested for yield. Both dryland and irrigated plots were harvested on August 27, 1973.

RESULTS: Under dryland, yields ranged from 454 pounds per acre to 712 pounds per acre, with Meyer being significantly the highest (Table 1). No significant differences were obtained under irrigation. Prophet at 1400 pounds per acre was the highest yielding entry (Table 2). An interaction between irrigation and variety was evident. Under both regimes, Indy matured about one week earlier than either Meyer or Prophet. Indy was significantly taller than either Prophet or Meyer under both dryland and irrigation (Tables 3 and 4).

Table 1. Yields of dryland cranbe in pounds per acre, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|
| Indy | 353.8 | 647.6 | 431.8 | 1433.2 | 477.7b |
| Meyer | 647.6 | 797.6 | 689.6 | 2134.8 | 711.6a |
| Prophet | 293.8 | 467.7 | 599.7 | 1361.2 | 453.7b |

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

Mean yield = 547.69 pounds per acre
F - value for variety yield comparison = 6.29 (not significant at .05)
S.E.$\bar{x}$ = 56.82 lbs/acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 10.38%

Table 2. Yields of irrigated crambe in pounds per acre, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Rep. IV | Total | Mean 1/ |
|---|---|---|---|---|---|---|
| Indy | 671.6 | 989.5 | 1823.0 | 1295.3 | 4779.4 | 1194.9a |
| Meyer | 503.7 | 1247.3 | 2020.9 | 1403.2 | 5175.1 | 1293.8a |
| Prophet | 605.7 | 1469.2 | 2152.8 | 1403.2 | 5630.9 | 1407.7a |

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

Mean yield = 1298.78 pounds per acre
F - value for variety yield comparison = 2.68 (not significant at .05)
S.E.$\bar{x}$ = 65.09 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 5.01%

Table 3. Height in inches of dryland crambe, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|
| Indy | 34 | 35 | 32 | 101 | 34a |
| Meyer | 32 | 33 | 31 | 96 | 32b |
| Prophet | 31 | 29 | 30 | 90 | 30b |

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

Mean height = 31.89 inches
F - value for variety height comparison = 7.89*
S.E.$\bar{x}$ = .653 inches
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 2.04 %

Table 4. Height in inches of irrigated crambe, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Rep. IV | Total | Mean 1/ |
|---|---|---|---|---|---|---|
| Indy | 46 | 48 | 52 | 46 | 192 | 48a |
| Meyer | 35 | 44 | 45 | 44 | 168 | 42b |
| Prophet | 35 | 37 | 39 | 39 | 150 | 37c |

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

Mean height = 42.50 inches
F - value for variety height comparison = 21.26**
S.E.$\bar{x}$ = 1.32 inches
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 3.10%

TITLE: Millet Variety Trial

PROJECT: Miscellaneous Crops Investigations MS 758

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - H. N. Metcalf
Research Assistant - Dale E. Mahugh

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Evaluate three millet varieties for seed yield under dryland and two varieties under irrigation in northwestern Montana.

PROCEDURES: Two proso and one foxtail millet varieties were seeded at a rate of 22 pounds per acre under dryland. Due to insufficient seed only one proso and one foxtail millet were planted at a rate of 30 pounds per acre under irrigation. Both nurseries were seeded on May 18, 1973, utilizing a randomized complete block design. Plots consisted of 4 rows, 12 feet long with one foot between rows and plots. Sixteen square feet were harvested for yield from each plot on September 24, 1973.

RESULTS: Seed yields from "Golden" German Foxtail Millet under both dryland and irrigated conditions were not obtained because it did not mature. Although there were no significant differences under dryland, Akron did out yield Leonard by 32 pounds per acre (Table 1). Leonard under irrigation yielded 343 pounds per acre (Table 2).

Table 1. Yields of dryland millet in pounds per acre, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|
| Leonard | 48.0 | 36.0 | 66.0 | 150.0 | 50.0a |
| Akron | 161.9 | 54.0 | 30.0 | 245.9 | 82.0a |

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

Mean yield = 65.98 pounds per acre
F - value for variety yield comparison = .532 (not significant at .05)
S.E.$\bar{x}$ = 31.00 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ 46.97%

Note: The variety "Golden" German Foxtail Millet was not harvested because it did not mature.

Table 2. Yields of irrigated millet in pounds per acre, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Rep. IV | Total | Mean |
|---|---|---|---|---|---|---|
| Leonard | 293.8 | 521.7 | 245.9 | 311.8 | 1373.2 | 343.3 |

Note: The variety "Golden" German Foxtail Millet was not harvested because it did not mature.

TITLE: Safflower Variety Trial

PROJECT: Miscellaneous Crops Investigations MS 758

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - H. N. Metcalf
Research Assistant - Dale E. Mahugh

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Evaluate four safflower varieties for seed yield under dryland and irrigated conditions in northwestern Montana.

PROCEDURES: Four safflower varieties were seeded at a rate of 20 pounds per acre under dryland and 25 pounds per acre under irrigation on May 18, 1973 in a randomized complete block design. Plot size was 4 feet by 12 feet with one foot between rows and plots. Sixteen square feet were harvested for yield from each plot on October 2, 1973.

RESULTS: Dryland yields were greater than irrigated yields for all entries. This could possibly be explained by the delayed maturity under irrigation. Under dryland, yields ranged from 601 pounds per acre to 1159 pounds per acre (Table 1). Under irrigation, yields varied from 203 pounds per acre to 544 pounds per acre (Table 2). In both plantings #87-14-6 had a significantly higher yield.

Table 1. Yields of dryland safflower in pounds per acre, Kalispell, 1973.

| Variety | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|
| 208 | 863.5 | 725.6 | 245.9 | 1835.0 | 611.7b |
| #87-42-3 | 1133.4 | 989.5 | 347.8 | 2470.7 | 823.6b |
| U.S. 10 | 1079.4 | 437.8 | 287.8 | 1805.0 | 601.7b |
| #87-14-6 | 1433.2 | 1361.3 | 683.6 | 3478.1 | 1159.4a |

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

Mean yield = 799.07 pounds per acre
F - value for variety yield comparison = 9.14*
S.E.$\bar{x}$ = 86.34 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 10.81%

Table 2. Yields of irrigated safflower in pounds per acre, Kalispell, 1973.

| Variety | Rept. I | Rep. II | Rep. III | Rep. IV | Total | Mean 1/ |
|---|---|---|---|---|---|---|
| 208 | 491.7 | 263.9 | 24.0 | 36.0 | 815.6 | 203.9b |
| #87-42-3 | 887.5 | 263.9 | 60.0 | 30.0 | 1241.4 | 310.4b |
| U.S. 10 | 731.6 | 161.9 | 30.0 | 95.9 | 1019.4 | 254.9b |
| #87-14-6 | 947.5 | 851.5 | 119.9 | 257.9 | 2176.8 | 544.2a |

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

Mean yield = 328.33 pounds per acre
F - value for variety yield comparison = 4.30*
S.E.$\bar{x}$ = 72.50 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 22.08%

TITLE: Effect of row spacing and seeding rate on seed yield of lentils under irrigated and dryland conditions.

PROJECT: Miscellaneous Crops Investigations MS 758

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

LOCATION: Northwestern Agricultural Research Center, Kalispell, Montana

DURATION: Indefinite

OBJECTIVE: Determine the cultural practices which will give maximum lentil yields in northwestern Montana.

PROCEDURES: Lentils (Lens esculenta) were seeded in rows of 12, 24 and 36 inches at varying seeding rates under dryland and irrigated conditions in a split block design with four replications on May 2, 1973. Under dryland, seeding rates varied from 9.6 pounds per acre to 28.8 pounds per acre and under irrigation varied from 9.6 pounds per acre to 33.6 pounds per acre. The number of rows per plot for the 12, 24 and 36 inch row spacings were four, four and three respectively. All rows were 12 feet in length. Harvest areas for the 12, 24 and 36 inch spacing were 16, 32 and 24 square feet, respectively. Four hundred pounds of 16-20-0 were applied prior to seeding. Both nurseries were harvested on August 8, 1973.

RESULTS: Average yields on irrigated land were 450 pounds greater than on dryland. Row spacings had a significant effect on yields under both regimes. Generally, yields decreased as space was increased. The optimum seeding rate on dryland was 19.2 pounds per acre which produced a yield of 2527 pounds per acre. The optimum seeding rate on irrigated land was 28.8 pounds per acre which produced a yield of over 3000 pounds per acre.

It seems that the optimum seeding rate and row spacing have been found under irrigation (12 inches at 28.8 pounds per acre). However, yields on dryland were the greatest at the lowest seeding rate (19.2 pounds per acre) at the closest spacing (12 inches). Therefore, the seeding rate could still possibly be reduced at that same row spacing.

907 Seeds/lb.



Table 1. Yields of dryland lentils in pounds per acre, Kalispell, 1973.

| Spacing (inches) | No. of seeds/ foot of row | Rate #/A | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|---|---|
| 12 | 4 | 19.2 | 2164.8 | 2398.8 | 3016.3 | 7579.9 | 2526.7a |
| 12 | 5 | 24.0 | 2110.8 | 2554.5 | 2551.5 | 7216.8 | 2405.6ab |
| 12 | 6 | 28.8 | 1757.0 | 2446.7 | 2626.7 | 6830.4 | 2276.8abc |
| 24 | 5 | 12.0 | 1974.4 | 1966.9 | 2215.7 | 6157.0 | 2052.3bcd |
| 24 | 6 | 14.4 | 1290.8 | 1861.9 | 2284.7 | 5437.4 | 1812.5cde |
| 24 | 7 | 16.8 | 1929.4 | 1874.0 | 2542.5 | 6345.9 | 2115.3abcd |
| 36 | 6 | 9.6 | 1291.3 | 1703.0 | 1713.0 | 4707.3 | 1569.1e |
| 36 | 7 | 11.2 | 1537.2 | 1791.0 | 2008.9 | 5337.1 | 1779.0de |
| 36 | 8 | 12.8 | 2120.8 | 1619.2 | 1759.1 | 5499.1 | 1833.0cde |

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

Mean yield = 2041.14 pounds per acre
F - value for variety yield comparison = 5.09**
S.E.$\bar{x}$ = 141.65 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 6.94 %

Table 2. Yields of irrigated lentils in pounds per acre, Kalispell, 1973.

| Spacing (inches) | No. of seeds/ foot of row | Rate #/A | Rep. I | Rep. II | Rep. III | Total | Mean 1/ |
|---|---|---|---|---|---|---|---|
| 12 | 4 | 19.2 | 2467.7 | 3094.3 | 2404.7 | 7966.7 | 2655.6ab |
| 12 | 5 | 24.0 | 2206.9 | 2758.5 | 2599.6 | 7565.0 | 2521.7ab |
| 12 | 6 | 28.8 | 2770.4 | 3052.3 | 3190.3 | 9013.0 | 3004.3a |
| 12 | 7 | 33.6 | 3292.2 | 2866.4 | 2179.8 | 8338.4 | 2779.5a |
| 24 | 5 | 12.0 | 2388.2 | 2211.3 | 2470.6 | 7070.1 | 2356.7ab |
| 24 | 6 | 14.4 | 2139.3 | 2515.6 | 2637.0 | 7291.9 | 2430.6ab |
| 24 | 7 | 16.8 | 2206.8 | 2509.6 | 2724.0 | 7440.4 | 2480.1ab |
| 24 | 8 | 19.2 | 2199.3 | 2596.6 | 2613.1 | 7409.0 | 2469.7ab |
| 36 | 6 | 9.6 | 2060.9 | 2378.7 | 2678.5 | 7118.1 | 2372.7ab |
| 36 | 7 | 11.2 | 2392.7 | 1962.9 | 2668.5 | 7024.1 | 2341.4ab |
| 36 | 8 | 12.8 | 2690.5 | 2696.5 | 1934.9 | 7321.9 | 2440.6ab |
| 36 | 9 | 14.4 | 2438.7 | 1667.1 | 1986.9 | 6092.7 | 2030.9b |

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

Mean yield = 2490.3 pounds per acre
F - value for variety yield comparison = 1.46 (not significant at .05)
S.E.$\bar{x}$ = 200.92 pounds per acre
C.V. = $\frac{S\bar{x}}{\bar{x}}$ = 8.07%