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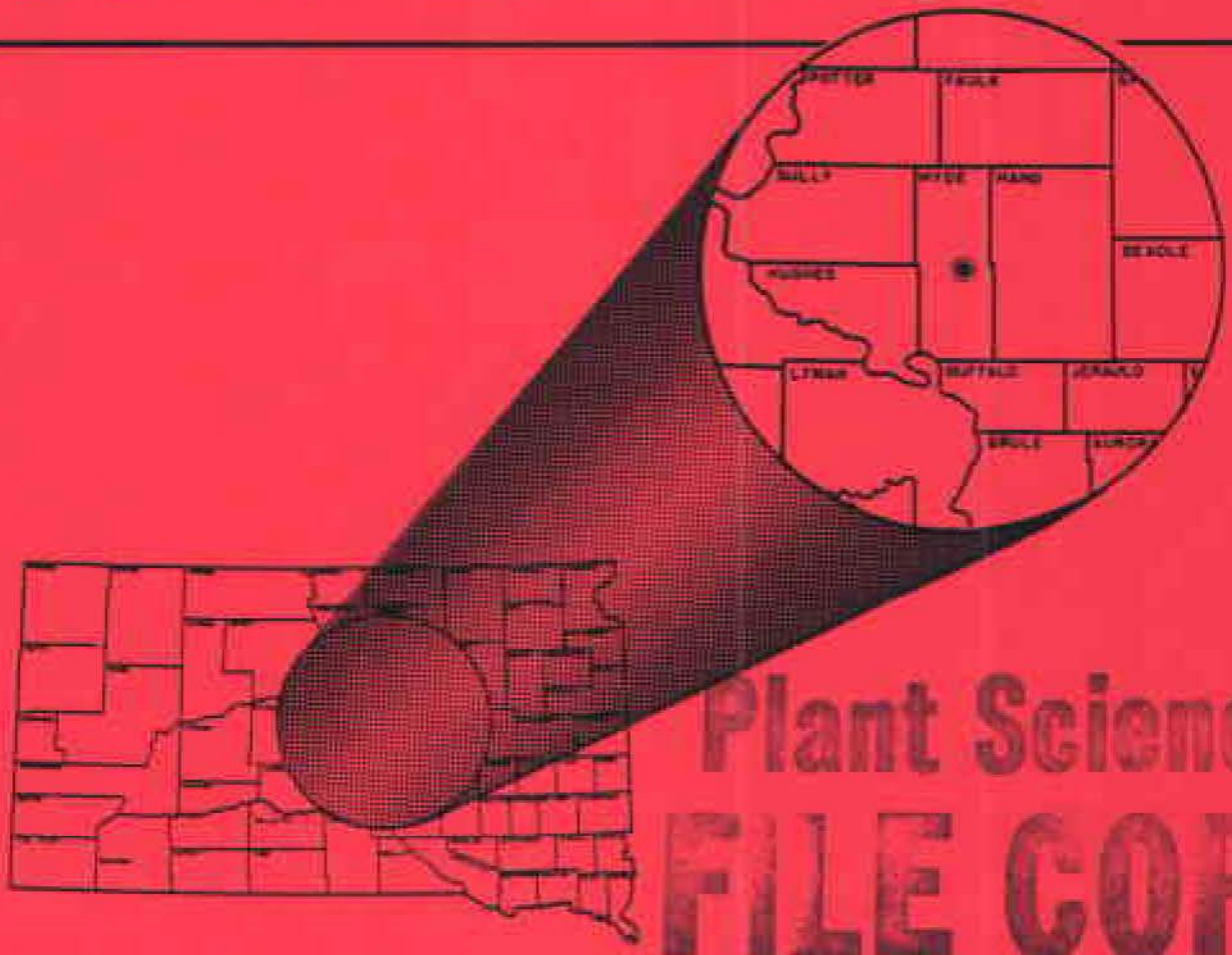
# Progress Report 1989

## Central Crops and Soils Research Station Highmore, South Dakota





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This report of the Central Crops and Soils Research Station at Highmore, South Dakota is a progress report and, therefore, the results presented are not necessarily complete nor conclusive. Any interpretation given is tentative because additional data from continuation of these experiments may produce conclusions different from those of any one year. The data presented in this report reflect the 1989 growing season.

Commercial companies and trade names are mentioned in this publication solely for the purpose of providing specific information. Mention of a company does not constitute a guarantee or warranty of its products by the Agricultural Experiment Station or an endorsement over products of other companies not mentioned.

This publication also reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and Federal agencies before they can be recommended. A complete set of 1989 results from SDSU herbicide demonstrations is available as Extension Circular 678 from your County Agent or SDSU.

South Dakota Agricultural Experiment Station
Brookings, South Dakota 57007

Dr. David Bryant, Dean

Dr. Raymond Moore, Director

## Introduction.....Brad C. Farber, Manager

With the close of 1989 comes the completion of ninety years of agricultural research at the Central Crops and Soils Research Station at Highmore, South Dakota. The year 1989, the centennial year of the State of South Dakota, was marked by numerous celebrations, centennial wagon trains, and a renewal of the pioneer spirit that has made South Dakota a great state in which to live.

The Agricultural Experiment Station System, of which the Highmore Station is a vital link, traces its origins to actions by early pioneers who recognized over 100 years ago the need for research to benefit agriculture, rural life and the environment. This system for research, which balances the needs of states, regions, and nation, is part of the land grant university system, which began with the passage of the Morrill Act of 1862. This Act provided for education by establishing land grant universities in every state and territory, but the provision for research was not included until 1887 when the Hatch Act was enacted and a State Agricultural Experiment Station was established in each state to provide research to support the educational mission of the universities.

The Highmore Research Farm was established in 1899, twelve years after passage of the Hatch Act, and was the first operating research farm in this region of the United States. The Research Farm has continually evaluated forages, small grains, and row crops for resistance to the various environmental and biological stresses found in this region of the nation. This station generally allows researchers the ability to evaluate current varieties and experimental materials under more adverse conditions than those in eastern South Dakota. Additional research at this station involves biological stresses such as nutrients, weeds, insects, diseases and moisture. Through the evaluation of woody plants, shrubs and trees, we may help alleviate human and animal stresses caused by wind. Trees and shrubs are aesthetically pleasing and generally reduce the daily stress of those who enjoy their beauty and the beauty of wildlife drawn to the food and shelter they provide.

Weather conditions in 1989 were somewhat of an improvement over the 1988 drought. Over five and one-half inches of rain fell in April (Table 2) which greatly benefited the winter wheat crop. Spring grains were just emerging when the heaviest rain fell and decreased stands slightly. Yields of spring wheat were 27 bu/A and near the long-term average at this site. Forage yields at the farm were one-third lower than in 1988. Precipitation received from May through August was more than six inches below normal while temperatures were slightly above normal (Tables 1 and 2). September rainfall was above normal and we ended the year with 16.8 inches total rainfall compared to the long term average of 18.3 inches.

Maintenance and repairs to the exteriors of the residence and seedhouse were completed in 1989. All windows were replaced in both buildings, vinyl siding and rain gutters were installed and foundations

repaired. The maintenance shop and tree storage sheds were insulated and steel siding installed on both buildings in 1989. A new 9' x 14' insulated garage door was installed on the southeast corner of the shop replacing a less efficient door that was nearly worn out. Two additional garage doors were closed in to make the shop more energy efficient. The next project to be completed in 1990 will be the addition of men's and women's restrooms in the seedhouse and remodeling of the office area in the seedhouse.

The annual twilight tour of research plots was held on June 27, 1989 at 5:30 in the evening. Lunch was served prior to the tours. The tour was well attended and participants listened to talks on small grain varieties, fertilizing forages, herbicide evaluations, forage research and seeding rates, canola and others.

The research conducted each year and included in this report involves long hours by staff from many disciplines at the university and the Highmore Research Farm. Their efforts in contributing to this publication each year are greatly appreciated. Support from producers, ranchers, Advisory Board members and County Agents from the central area is also greatly appreciated.

If anyone has comments or suggestions pertaining to research on the farm or questions and input on any other matter, please write or call.

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Table 1. Temperatures at the Central Research Farm - 1989.

| Month | 1989 Average Temperatures[a] Max. | Min. | Average | Normal[b] | Departure from normal |
|---|---|---|---|---|---|
| | ---------- | ---------- | °F | ---------- | |
| January | 31.8 | 10.4 | 21.1 | 12.6 | +8.5 |
| February | 19.0 | -0.4 | 9.3 | 19.5 | -10.2 |
| March | 34.8 | 16.9 | 25.9 | 29.7 | -3.8 |
| April | 60.9 | 33.7 | 47.3 | 45.7 | +1.6 |
| May | 70.8 | 45.1 | 58.0 | 57.5 | +0.5 |
| June | 81.9 | 51.7 | 66.8 | 67.3 | -0.5 |
| July | 91.3 | 62.1 | 76.7 | 74.0 | +2.7 |
| August | 88.8 | 59.6 | 74.2 | 72.7 | +1.5 |
| September | 75.1 | 48.8 | 62.0 | 62.0 | 0.0 |
| October | 63.9 | 36.1 | 50.0 | 50.1 | -0.1 |
| November | 42.4 | 21.5 | 31.9 | 32.4 | -0.5 |
| December | 20.3 | 1.9 | 11.1 | 19.9 | -8.8 |

[a] Calculated from daily observations.
[b] 30 year average (1951-1980).

Table 2. Precipitation at the Central Research Farm - 1989.

| Month | 1989 Precipitation | Normal[a] | Departure from normal | Greatest amount | Date |
|---|---|---|---|---|---|
| | ---------- | ---------- | inches | ---------- | |
| January | 0.00 T[b] | 0.34 | -0.34 | 0.00 T | 31 |
| February | 0.30 | 0.57 | -0.27 | 0.15 | 17 |
| March | 1.00 | 0.91 | +0.09 | 0.24 | 17 |
| April | 5.65 | 2.08 | +3.57 | 3.15 | 28 |
| May | 1.05 | 2.69 | -1.64 | 0.50 | 17 |
| June | 0.73 | 3.28 | -2.55 | 0.35 | 24 |
| July | 2.57 | 2.57 | 0.00 | 1.52 | 14 |
| August | 0.30 | 2.33 | -2.03 | 0.10 | 29 |
| September | 3.14 | 1.32 | +1.82 | 1.90 | 21 |
| October | 1.10 | 1.24 | -0.14 | 0.90 | 29 |
| November | 1.00 | 0.53 | +0.47 | 0.60 | 5 |
| December | 0.00 T | 0.47 | -0.47 | 0.00 T | 13 |
| TOTAL | 16.84 | 18.33 | -1.49 | | |

[a] 30 year average (1951-1980).
[b] Indicates trace of precipitation.

# FORAGE YIELD AND QUALITY OF SUMMER ANNUAL CROPS AS INFLUENCED BY PLANTING DATE

E. K. Twidwell, A. Boe, and K. D. Kephart

In South Dakota cool-season pastures decline in productivity during the late summer resulting in diminished forage supplies. Crops that are normally used to augment low forage supplies in late summer include annual and perennial warm-season perennial grass pastures, hay, and silage crops. Previous research also indicates that summer annual legumes such as cowpeas and mungbeans are adapted to South Dakota conditions and can produce adequate forage yields. At present it is not well understood how the productivity of these summer annual grasses and legumes is influenced by planting date. In drought conditions producers may be forced to plant summer annual crops in early to mid-summer and hope that they can produce adequate forage yields in a short period of time. The identification of the best species and optimum planting dates to use would be beneficial information. The objective of this study was to bmeasure and compare the forage yield and quality of four summer annual species planted on three dates.

## Materials and Methods

Cowpeas, mungbeans, soybeans, and Siberian millet were planted on May 15, June 12, and July 21. Plot size was 3.3 ft. x 10 ft. and row spacing was 10 inches. On each harvest date the center two rows of each plot were harvested for yield determination. The forage was weighed and a one pound subsample was taken for dry matter determination and future forage quality determinations. The millet planted on May 15 was harvested on July 28. The other three species were harvested on August 15. All species from the June and July plantings were harvested on August 15 and September 14, respectively.

## Results and Discussion

The species x planting date interaction was significant (Table 1). For the May 15 planting cowpeas, millet, and soybeans produced similar forage yields. Mungbeans, however, yielded at least 2.2 tons per acre less than the other species. For the June 12 planting millet had the highest forage yield, followed closely by cowpeas. Mungbeans and soybeans had forage yields of 0.8 and 0.6 tons per acre, respectively, which were significantly lower than the other two species (Table 1). There were no significant differences among species for the July 21 planting date.

Data from the first year of this study indicate that, from a forage production standpoint, cowpeas or millet would be the species of choice. Samples will be analyzed for crude protein, neutral-detergent fiber, and in vitro dry matter digestibility. These data will allow yield and forage quality information to be combined such that pounds of protein or digestble dry matter per acre can be calculated. This study will be repeated in 1990.

Table 1. Forage yield of four species planted on three different dates.

| Species | Planting date in 1989 | | |
|---|---|---|---|
| | May 15 | June 12 | July 21 |
| | ----------tons per acre---------- | | |
| Cowpeas | 2.7 | 1.6 | 1.5 |
| Millet | 2.6 | 2.1 | 1.2 |
| Mungbeans | 0.4 | 0.8 | 1.3 |
| Soybeans | 2.7 | 0.6 | 1.3 |

The LSD value for comparison of any two means is 0.5 tons per acre (P = 0.05).

# ALFALFA CULTIVAR YIELD TEST

Edward K. Twidwell, Kevin D. Kephart and Robin Bortnem

Two alfalfa cultivar yield experiments were conducted at the Central Crops and Soils Research Station during 1989. These tests were conducted to determine yield performance of various alfalfa cultivars and experimental lines when grown in central South Dakota.

The first study was planted in late April of 1987 and consisted of 24 cultivars (Table 1). Only one harvest was obtained during the 1989 growing season. Average total dry matter yield was 1.17 tons per acre and no significant differences were detected among the 24 entries. The average total yield for 1989 was one-third less than the 1988 average yield, presumably because of continuing drought. Precipitation received during the growing season was below normal in May, June, and August. Slightly above normal precipitation fell in September. No significant differences among cultivars were also found for the 2-year average yield. Our inability to detect significance in this study was probably drought related. Drought stress caused much variability in plant growth within the experiment. As uncontrollable variation increases, the power to detect significant differences among cultivars decreases. Drought conditions have been present at this location for the past 2 years.

The second experiment was planted in mid-May of 1989. Because of drought conditions present no harvests were made on this experiment in 1989. Despite the dry conditions, stand establishment in this study was considered a success.

These results are useful in selection of alfalfa cultivars of forage production. Measurements of forage yield taken over several years of harvest are usually more useful than the average from a single harvest.

Next years results should prove to be interesting. Abundant rainfall in September should have allowed the drought-stressed plants to recover for next year. Differences among cultivars associated with drought recovery should be expressed.

Table 1. Forage yield of 24 alfalfa cultivars planted April 27, 1987 at the Central Crops and Research Station, Highmore, South Dakota.

| Cultivar | 1988 2-cut Total | 1989 Cut 1 6/9 | 2-Year Avg.[a] | Relative Performance[b] |
|---|---|---|---|---|
| | tons/acre | | | % |
| Mohawk | 2.23 | 1.29 | 1.76 | 121 |
| Saranac | 2.21 | 1.31 | 1.76 | 121 |
| 636 | 2.08 | 1.39 | 1.73 | 119 |
| Saranac AR | 2.18 | 1.27 | 1.72 | 119 |
| Iroquois | 1.94 | 1.33 | 1.64 | 113 |
| Vernal | 1.85 | 1.30 | 1.57 | 108 |
| Big 10 | 1.87 | 1.23 | 1.55 | 107 |
| 120 | 1.89 | 1.18 | 1.53 | 105 |
| 8016 PCa3 | 1.81 | 1.25 | 1.53 | 105 |
| Magnum III | 1.79 | 1.18 | 1.48 | 102 |
| 526 | 1.74 | 1.22 | 1.48 | 102 |
| MTO S82[c] | 1.65 | 1.24 | 1.44 | 99 |
| MTO N82[c] | 1.70 | 1.18 | 1.44 | 99 |
| Emerald | 1.61 | 1.16 | 1.39 | 95 |
| DK 135 | 1.70 | 0.99 | 1.35 | 93 |
| Cimarron | 1.65 | 1.04 | 1.34 | 92 |
| Blazer | 1.59 | 1.07 | 1.33 | 91 |
| Eagle | 1.56 | 1.08 | 1.32 | 91 |
| SX 424 | 1.61 | 1.01 | 1.31 | 90 |
| WL 225 | 1.50 | 1.12 | 1.31 | 90 |
| Dynasty | 1.42 | 1.14 | 1.28 | 88 |
| Clipper | 1.44 | 1.10 | 1.27 | 87 |
| 532 | 1.48 | 1.06 | 1.27 | 87 |
| SX 217 | 1.24 | 0.92 | 1.08 | 74 |
| Average | 1.74 | 1.17 | 1.45 | |
| Maturity[d] | | 3.9 | | |
| LSD (0.05) | NS | NS | NS | |

[a] Two year average based on post-establishment year yields, 1988 and 1989.
[b] % Relative Performance - (cultivar 2-yr-average yield)/(2-yr-average of all cultivars.
[c] Experimental line, not currently marketed.
[d] Average harvest maturity. Value based on Kalu and Fick (1983) Index, mean-stage-by-count.

# RESPONSE OF CRESTED WHEATGRASS TO PHOSPHORUS APPLICATION

Ron Celderman, Jim Cerwing, Ed Twidwell, and Ron Frederick

## Introduction

Cool-season grass response to phosphorus (P) fertilization has been documented in research studies in South Dakota. More research however, is needed to determine if soil test phosphorus is well correlated to yield response from P fertilizers. The following work was done to meet that need. In addition, the residual forage response (One year after application) was also measured.

## Methods

The study was done on the Mike Cowan farm in Hyde County. The site has a good stand of crested wheatgrass estimated to be at least 15 years old. Very little manure or fertilizer had been applied to the stand over this time which is typical of many grass stands. The soil at this site is classified as a Highmore series. It is a typical medium-textured (silt loam) soil found in central South Dakota. The phosphorus soil test in the 0-3 and 3-6 inch soil layers was 12 and 5 lb/A P, respectively. This is considered a low phosphorus test but is not unusual for soils under long-time grass stands. Other soil tests were considered adequate except for nitrogen (see below). Other soil tests (0-3") were: K - 720 lb/A, OM - 4.7%, pH - 6.7.

The phosphorus fertilizer was hand spread on 28 March 1988. The rates of phosphorus used were 0, 30, 60, 90 and 180 lb/A of $P_2O_5$ as 0-46-0 (Triple Super Phosphate). Sixty pounds of N/acre (as urea) was applied over the whole plot to eliminate nitrogen as a limiting variable in 1988. In 1989, an additional 90 pounds of N/acre was applied to the experiment area. No additional phosphorus was applied for the 1989 season.

Forage harvest was completed on 12 June 1988 and 13 June 1989 with a commercial duty lawn mower and bagging attachment.

## Results and Discussion

The two year forage yields are presented in Table 1.

The results show rather poor yields in 1988 and 1989. Rainfall received for the growing season for the two years was identical at 5.6 inches. However, the 1988 growing season was characterized by extremely high temperatures in May and June which probably limited forage yields of this cool-season grass. Forage response to phosphorus was limited in 1988 with better responses to residual phosphorus in 1989. The two year total indicates an average response of 500-600 lbs per acre of dry matter to 30-90 lbs $P_2O_5$. The very high rate of 180 lbs/A of $P_2O_5$ did provide a response of about 1400 lbs/A over the check for the two year period. These results would indicate poor efficiency of phosphorus uptake. This is probably due to the limited rainfall and the limited mobility of phosphorus in soil. Since the phosphorus was placed on the surface of the soil and moves very little, root uptake of the fertilizer was probably limited given the dry conditions. A method of placing phosphorus deeper in the soil, such as spoke injection or knifing may provide more efficient utilization of phosphorus by crested wheatgrass.

Additional data on first year yields and soil test levels at this site can be found in Soil Fertility Research Progress Reports 88-11.

Table 1. Influence of applied phosphorus on forage yield of created wheatgrass, Hyde County, 1988 and 1989.

| Rate of $P_2O_5$[1] | Forage Yield | | Two Year Total |
|---|---|---|---|
| | 1988 | 1989 | |
| | lb/A-Dry Matter | | |
| 0 | 2019 | 2767 | 4786 |
| 30 | 2038 | 3398 | 5436 |
| 60 | 2200 | 2928 | 5128 |
| 90 | 2054 | 3406 | 5460 |
| 180 | 2317 | 3892 | 6209 |

[1] Applied in 1988 only.

# INFLUENCE OF NITROGEN ON CRESTED WHEATGRASS

R. Gelderman, J. Gerwing, E. Twidwell, and R. Frederick

## Introduction

There is about 26 million acres of grassland in South Dakota. It is estimated that less than 5% of this grassland is fertilized. Research in South Dakota has shown, however, that forage yields nearly double with ample nitrogen applications on cool-season grasses. Cool-season grasses such as crested wheatgrass produce most of their growth during the early spring and respond well to late fall or early spring nitrogen applications. This work was done to demonstrate the effectiveness of nitrogen applications for cool season grass forage production.

## Methods

The study was done on the Mike Cowan farm in Hyde County. The site had a good stand of crested wheatgrass estimated to be at least 15 years old. Very little manure or fertilizer had been applied to the stand over this time which is typical of many grass stands. The soil at this site is classified as a Highmore series. It is a typical medium textured (silt loam) soil found in this area. The nitrogen was hand applied to the experimental area as urea (46-0-0) on September 14, 1988. The rates of actual nitrogen used were 0, 30, 60, 90, 120 and 150 pounds per acre. Each nitrogen treatment was replicated four times.

Phosphorus was spread over the entire experiment at a rate of 60 lbs/A $P_2O_5$ to eliminate phosphorus as a limiting variable. Soil moisture was considered very low at application time. The following spring the soil was moist to 30 inches deep. A total of 5.6 inches of rainfall was measured at the site from the time of application through forage harvest on June 13, 1989. The low amount of precipitation severely limited forage production.

## Results and Discussion

Dry matter yields are presented in Figure 1. The yields increased up to the 90 lb nitrogen rate. After that rate yields are statistically the same. Even with a very dry year the addition of 90 pounds of N increased forage production by 1 ton of dry matter over the check (from 2000 lbs to 4000 pounds per acre). Considering grass hay that is valued at $40 per ton, this "extra" yield would be worth $40.00 at a cost of $18.00 per acre (90 lbs N x $.20/lb). A total profit of $22.00 per acre (40-18) was realized by fertilizing with N. At this time, protein determinations have not been completed. These values are not considering any additional increase in protein which usually occurs. For the producer who is feeding cattle in a short hay year, fertilizing with nitrogen means purchasing less hay and minimizing reductions in cow herds.

In summary, the addition of 90 pounds of nitrogen per acre produced an extra ton of crested wheatgrass forage per acre in a very dry season.

# OAT RESEARCH

D. L. Reeves and Lon Hall

This was our second year of our preliminary herbicide tests. This is a cooperative test with the extension weeds staff which was grown at four locations this year. Six different varieties were used in this test. All plots were sprayed at the recommended stages.

The high rate of each treatment shows what would happen when a sprayer overlaps. In addition we hope the high rates will help identify oats sensitive to specific herbicides. The high rates of 2,4-D and Dicamba reduced yields 10% more than the low rates when averaged over the four locations this year. Dicamba treatments also had the greatest effect on test weight.

| | | Yield | | | |
|---|---|---|---|---|---|
| | | | % of check | | Test |
| Treatment | Rate Ai lb/A | bu/A | SE Farm | Avg. 4 locations | Weight lb/bu |
| Unsprayed | -- | 40 | -- | -- | 34.9 |
| MCPA amine | .5 | 37 | 97 | 99 | 35.1 |
| " " | 1.0 | 42 | 104 | 101 | 35.2 |
| 2,4-D amine | .5 | 31 | 78 | 93 | 35.3 |
| " " | 1.5 | 24 | 59 | 83 | 34.6 |
| Bronate | .75 | 39 | 98 | 94 | 35.2 |
| " | 1.5 | 40 | 100 | 93 | 35.0 |
| Dicamba + MCPA am | .125 + .25 | 31 | 76 | 91 | 34.4 |
| " " | .25 + .5 | 26 | 64 | 79 | 32.7 |

LSD .05 = 6 bu.

The test was conducted at four locations so we can gain an idea of how spraying affected the oats in different environmental conditions. This location had the largest reductions due to Dicamba + MCPA at both sites. The difference between locations emphasizes the importance of the growang conditions when determining how herbicides affect oats.

TRISTATE: The Tristate oat test is grown here every year. It has 10 new entries from each of the Dakotas and Minnesota each year. These are grown at only three locations in each state. The best entries in this test are advanced to regional tests. The overall yield average was 46 bu/A with a high of 56 and a low of 38. Test weights averaged 34.4 lb/bu with a high of 38.6 and a low of 28.9.

## SPRING WHEAT BREEDING

F. A Cholick and K. M. Sellers

The Advanced Yield Trial was the only breeding nursery grown at the Highmore Station in 1989 and this trial was also grown at 8 additional sites throughout the spring wheat production area. The number of breeding trials grown in 1989 were limited due to the availability of seed after the drought of 1988. This trial is made up of experimental lines that are in their second, third, fourth, or more years of statewide testing. These lines have performed equal to or superior to the best checks in previous years for yield, agronomic traits, disease resistance, and quality characteristics. The primary objective of this trial is to evaluate experimental lines developed by the breeding program for potential varieties. Planting and harvest dates were April 19 and July 25, respectively. The seeding rate was 28 seeds per square foot and the plots were fertilized for a 40 bu/A yield goal. Stand establishment was excellent, however a heavy rain caused an extremely hard crust after emergence. It appeared that the crusting occurred after emergence but it reduced the tillering potential which probably reduced the yield potential of the 1989 crop.

The average yield was 27.1 bu/A which was 68% greater than the drought affected crop in 1988 and approximately equal to the long-term average for this nursery at this site. Yields ranged from 31.5 to 18.8 bu/A. In the top yield group there were two checks, Butte 86 and Guard, and six experimental lines. Four experimental lines included that were in their second year of statewide testing and the line SD2980 which is being increased for potential release in 1990 were also in the top group. With one exception all of the experimental lines had higher test weight than Butte 86 and they were all equal or earlier than Butte 86. The protein content of these lines varied but with one exception they were all acceptable. Test weight averaged 58.1 lbs/bu with a range of 56.0 to 60.2 lbs/bu. Protein content averaged 17.2% and ranged from 15.4 to 19.0%. The 1989 crop at this station was near normal for grain yield, test weight, plant height, and number of days from emergency to heading; however, the protein content was somewhat higher than normal. In a two year average at this site 9 experimental lines were in the top yield group. This group also contained the check varieties Butte 86, Guard, and Stoa and averaged 23.8 bu/A compared to 15.4 bu/A for the long-term check Chris. It is important to note that all 9 of these experimental lines were also in the top yielding group when averaged over all test sites for the past two years. The Highmore site adds valuable data for the spring wheat breeding project in that it generally provides a stress environment which differentiates among experimental lines and this is required for the selection phase of the breeding process.

# SMALL GRAIN TRIALS - CROP PERFORMANCE TESTING

J. J. Bonnemann

Four small grain trials were grown at the Central Substation during 1989. The crops were: winter wheat, barley, oats, and spring wheat.

The yields and quality varied. Winter wheat yields were very good, the other crop yields were affected by stage of maturity during periods of stress. Test weights were medium to low in all trials. Hot, dry periods were the primary cause of lower yields and quality.

Additional yield and agronomic data for the Central Substation and all small grain trials in the state are found in EC 774 (rev.), 1990 Variety Recommendations, Small Grain. This publication is available from the Bulletin Room, SDSU, Brookings, SD 57007 or local county extension offices.

1989 Oat Trial, CPT, Central Substation, Highmore, SD.

| | | Variety Means | |
|---|---|---|---|
| Variety Name | Yield | Test Wt. | Plant Ht. |
| Settler | 60.1 | 32.1 | 29.0 |
| Ogle | 56.6 | 29.0 | 28.5 |
| Moore | 55.3 | 28.1 | 32.5 |
| Sandy | 54.6 | 30.3 | 33.0 |
| Trucker | 54.5 | 32.7 | 32.3 |
| Valley | 53.4 | 31.4 | 26.8 |
| Horicon | 53.2 | 29.9 | 28.0 |
| Don | 52.9 | 31.7 | 27.0 |
| Hazel | 52.6 | 32.2 | 26.5 |
| Porter | 52.4 | 29.2 | 29.0 |
| Burnett | 50.9 | 31.9 | 31.5 |
| Wright | 50.2 | 33.2 | 34.0 |
| Lancer | 50.1 | 30.7 | 28.5 |
| Lyon | 49.4 | 28.3 | 34.2 |
| Proat | 47.0 | 29.5 | 30.5 |
| Preston | 46.9 | 31.9 | 31.3 |
| Webster | 46.4 | 29.8 | 28.3 |
| Hamilton | 45.6 | 28.2 | 26.3 |
| Steele | 45.4 | 30.3 | 33.3 |
| Hytest | 43.9 | 25.3 | 33.0 |
| Starter | 43.6 | 34.0 | 29.8 |
| Kelly | 42.9 | 35.0 | 30.3 |
| Overall Mean | 50.6 | 31.0 | 30.4 |
| LSD (0.05) = | 4.6 | | |
| C.V. | 6.4% | | |

1989 Spring Wheat Trial, CPT, Central Substation, Highmore, SD

| Variety name | Yield | Variety Means Test weight | Plant height | Protein percent |
|---|---|---|---|---|
| W2501 | 41.1 | 51.8 | 26.3 | 16.2 |
| Nordic | 39.5 | 54.2 | 28.0 | 15.9 |
| 2375 | 38.6 | 56.3 | 28.5 | 17.1 |
| Marshall | 38.1 | 49.0 | 27.3 | 16.6 |
| Celtic | 37.3 | 54.9 | 29.5 | 17.4 |
| 2369 | 37.0 | 56.4 | 27.3 | 17.2 |
| W2502 | 36.2 | 51.9 | 27.3 | 16.8 |
| Norseman | 36.1 | 53.0 | 25.5 | 17.8 |
| Fjeld | 34.6 | 52.0 | 26.3 | 16.9 |
| Telemark | 33.9 | 50.4 | 25.3 | 17.5 |
| Butte 86 | 33.8 | 54.6 | 28.8 | 17.1 |
| Vance | 33.7 | 52.2 | 28.5 | 17.5 |
| Alex | 33.7 | 50.3 | 33.0 | 18.4 |
| Len | 32.7 | 53.3 | 29.0 | 18.7 |
| Amidon | 32.4 | 53.0 | 31.0 | 17.5 |
| Guard | 32.4 | 55.6 | 26.0 | 17.7 |
| Gus | 32.3 | 52.0 | 27.0 | 18.1 |
| Prospect | 31.5 | 54.3 | 28.0 | 17.4 |
| Stoa | 31.4 | 51.4 | 29.0 | 17.7 |
| Shield | 31.1 | 55.8 | 29.3 | 17.0 |
| Angus | 31.0 | 52.2 | 28.0 | 17.9 |
| Grandin | 30.7 | 53.5 | 28.8 | 17.9 |
| Minnpro | 27.8 | 51.1 | 28.3 | 18.0 |
| Chris (Check) | 27.2 | 50.3 | 34.3 | 18.6 |
| Overall Mean | 33.6 | 53.3 | 28.6 | 17.4 |
| LSD (.05) = | 5.0 | | | |
| C.V. | 10.6% | | | |

1989 Barley Trial, CPT, Central Substation, Highmore, SD.

| Variety name | Yield | Variety Means Test weight | Plant height | Protein percent |
|---|---|---|---|---|
| Bowman | 64.8 | 49.0 | 28.8 | 12.4 |
| Azure | 62.4 | 45.6 | 30.3 | 12.4 |
| Morex | 59.4 | 43.6 | 30.3 | 12.0 |
| Gallatin | 57.9 | 44.9 | 29.5 | 13.5 |
| Robust | 55.9 | 44.8 | 29.8 | 12.6 |
| Primus II | 55.7 | 47.3 | 28.8 | 12.3 |
| Hazen | 53.1 | 42.9 | 28.0 | 12.8 |
| B1602 | 48.3 | 44.0 | 27.5 | 12.7 |
| Glenn | 44.3 | 44.1 | 26.8 | 13.5 |
| M 52 | 41.3 | 43.7 | 25.3 | 12.7 |
| Overall Mean | 54.3 | 45.0 | 28.5 | 12.7 |
| LSD (.05) | 8.1 | | | |
| C.V. | 10.3% | | | |

1989 Winter Wheat Trial, CPT, Central Substation, Highmore, SD

| Variety name | Variety Means Yield | Test weight | Plant height | Protein percent |
|---|---|---|---|---|
| Rodeo | 65.0 | 56.1 | 33.5 | 14.8 |
| Quantum 542 | 64.4 | 53.6 | 39.3 | 15.2 |
| TAM 107 | 64.1 | 58.5 | 30.5 | 13.3 |
| Quantum 562 | 62.5 | 51.3 | 34.2 | 14.7 |
| Abilene | 61.5 | 59.5 | 30.0 | 14.8 |
| Norkan | 60.3 | 56.5 | 35.0 | 14.8 |
| WH80001 | 60.1 | 54.3 | 33.8 | 14.9 |
| TAM 200 | 60.1 | 59.2 | 31.0 | 14.0 |
| Arapahoe | 58.9 | 54.9 | 33.0 | 14.6 |
| Siouxland | 56.6 | 55.8 | 35.8 | 14.3 |
| Thunderbird | 56.5 | 57.4 | 34.0 | 14.8 |
| WH32362 | 56.1 | 55.8 | 34.8 | 15.2 |
| Quantum 546 | 55.9 | 54.5 | 33.3 | 14.6 |
| Dawn | 55.0 | 56.0 | 36.5 | 14.6 |
| WH52498 | 53.6 | 51.9 | 34.5 | 15.1 |
| Sage | 53.3 | 55.4 | 39.5 | 14.7 |
| Centura | 52.2 | 55.8 | 35.0 | 14.7 |
| Bennett | 51.9 | 56.1 | 34.5 | 14.8 |
| Colt | 51.7 | 54.5 | 30.3 | 14.4 |
| Norwin | 51.5 | 54.4 | 34.5 | 13.8 |
| Cody | 51.3 | 53.7 | 34.3 | 15.3 |
| Redland | 50.9 | 54.4 | 32.8 | 13.4 |
| Seward | 50.7 | 55.0 | 37.5 | 15.0 |
| Lancota | 48.8 | 56.3 | 38.3 | 15.7 |
| Brule | 47.6 | 53.5 | 34.5 | 14.0 |
| Scout 66 | 45.2 | 56.0 | 36.8 | 15.1 |
| Tibor | 44.1 | 53.6 | 37.3 | 14.8 |
| Roughrider | 43.0 | 56.3 | 37.5 | 15.9 |
| Rose | 42.8 | 55.8 | 33.8 | 15.8 |
| Norstar | 40.2 | 56.6 | 38.5 | 15.8 |
| Agassiz | 36.8 | 52.2 | 36.5 | 16.4 |
| Overall Mean | 52.6 | 55.2 | 35.1 | 14.8 |
| LSD (.05) | 10.3 | | | |
| C.V. | 14.1% | | | |

## WINTER WHEAT

Jeff Gellner

Approximately 750 plots were harvested at Highmore in 1989. Yields were excellent for the standard varieties ranging from 37 bu/acre for Agassiz to 65 bu/acre for Rodeo. The average yield was 53 bu/acre. Several advanced lines also yielded well in the breeding trials. SD87143, SD87141, and SD87105 yielded 61, 60, and 58 bu/acre, respectively. This compares to yields for Siouxland, Rose, and Abilene of 53, 49, and 46 bu/acre. These three varieties are the checks in the breeding trials. Winterkill and disease were not a problem. Leaf rust did occur on most varieties.

The same number of plots were seeded on September 14, 1989 in a fallowed seedbed. I continue to use Highmore for early and late generation yield testing in my program along with gathering information on winter survival.

# WEED CONTROL

Leon J. Wrage, Paul O. Johnson and David A. Vos

Weed control field evaluations and demonstrations are directed to important weed problems in major crops produced in the area. The station has been the primary station site for winter wheat herbicide evaluation for crop tolerance and for kochia. The 1989 season represents the second year for corn weed control. Grain sorghum evaluations relate primarily to crop tolerance with postemergence treatments. The station also is the primary site for cheatgrass studies in winter wheat.

## Kochia Herbicide Evaluation in Winter Wheat

The primary objective is to evaluate herbicide performance for kochia. Data reflects performance typical for the area in 1989. Uniform, moderately heavy weed pressure. The most effective treatments increased yield approximately 20% when compared to the check. Early season weather conditions were very dry. Five treatments provided at least 90% control. Combination mixes with Ally, Harmony Extra or Express appeared equally effective. The reduced Banvel rate reduced kochia control. Contrast the results with those reported for an off-station farm cooperator site with resistant kochia.

Table 1.

| Treatment | lb/A act. | % Koch | Yield bu/A | Test Wt. |
|---|---|---|---|---|
| Check | ---- | 0 | 29.3 | 52.2 |
| 2,4-D ester | .5 | 12 | 34.2 | 54.3 |
| 2,4-D ester+28% N | .5+10 gal | 30 | 35.2 | 53.6 |
| 2,4-D amine | .5 | 0 | 25.3 | 52.7 |
| MCPA ester | .5 | 2 | 31.5 | 53.6 |
| Ally+2,4-D ester+X-77 | .0037+.25+.25% | 81 | 36.5 | 54.3 |
| Ally+Banvel SGF+X-77 | .0037+.06+.25% | 82 | 35.3 | 53.3 |
| Harmony+2,4-D ester+X-77 | .023+.25+.25% | 80 | 32.7 | 53.1 |
| Harmony Ex+2,4-D ester+X-77 | .023+.25+.25% | 92 | 33.8 | 54.0 |
| Harmony Ex+2,4-D ester+ X-77+28% N | .023+.25+.25%+10 gal | 92 | 32.5 | 53.8 |
| Harmony Ex+Banvel SGF+X-77 | .023+.06+.25% | 91 | 33.9 | 53.8 |
| Harmony Ex+Buctril+X-77 | .023+.187+.25% | 90 | 35.2 | 54.2 |
| Express+2,4-D ester+X-77 | .0156+.25+.25% | 91 | 37.0 | 54.6 |
| Bronate | .5 | 55 | 32.9 | 54.0 |
| Bronate | .75 | 65 | 36.2 | 54.1 |
| Bronate+2,4-D ester | .38+.25 | 55 | 35.4 | 53.7 |
| Curtail | .595 | 12 | 34.4 | 53.8 |
| Banvel SGF+MCPA amine | .12+.38 | 79 | 36.0 | 53.6 |
| Banvel SGF+2,4-D ester | .12+.25 | 81 | 36.2 | 54.3 |
| Banvel SGF+2,4-D ester | .06+.25 | 66 | 38.1 | 54.5 |
| LSD (.05) | | 11.4 | 6.7 | 1.6 |

Evaluated: 7/20/89
Applied: 5/10/89

Koch = Kochia
Data are an average of 4 reps.

## Resistant Kochia Herbicide Evaluation

Primary objective is to evaluate herbicide combinations for control of sulfonyl-urea resistant kochia. Moderate weed infestation; some variability in crop stand. Dicamba in combinations provided the most acceptable control. Dicamba at .12 lb caused excessive visual crop response expressed as stunting and abnormal culm development. Lower rates provided satisfactory crop tolerance. Test conducted under very dry early spring conditions. Crop development was slowed; reflecting stress conditions.

Table 2.

| Treatment | lb/A act. | % Kocz 6-6-89 | % Kocz 7-21-89 | VCRR 7-21-89 |
|---|---|---|---|---|
| Check | ---- | 0 | 0 | 0.0 |
| Clean+Banvel+X-77 | .0155+.12+.25% | 88 | 85 | 23.8 |
| Clean+MCPA ester+X-77 | .0155+.25+.25% | 48 | 16 | 0.0 |
| Clean+MCPA ester+X-77 | .0155+.5+.25% | 54 | 19 | 2.5 |
| 2,4-D ester | .5 | 52 | 39 | 3.8 |
| Bronate | .75 | 72 | 48 | 0.0 |
| Bronate+2,4-D ester | .5+.25 | 76 | 61 | 0.0 |
| Bronate+Banvel | .5+.0625 | 80 | 86 | 1.3 |
| *Amber+2,4-D ester+X-77 | .009+.25+.25% | 68 | 39 | 0.0 |
| *V-23031+X-77 | .0053+.25% | 35 | 5 | 0.0 |
| LSD (.05) | | 15.4 | 10.9 | 9.6 |

* Experimental treatment

Kocz = Kochia

Applied: 5/13/89

VCRR = Visual Crop Response Rating
0 = no effect
100 = complete kill

## Corn Herbicide Demonstration

Weed pressure was light. Strengths and weaknesses for grass or annual broadleaves are apparent. The 2-year average provides a measure of consistency.

Table 3.

| | | Percent Weed Control | | | |
|---|---|---|---|---|---|
| | | 1989 | | 2-Year Avg. | |
| Treatment | lb/A act. | Crft | Rrpw | Gr | Bdlf |
| PREPLANT INCORPORATED | | | | | |
| Check | ---- | 0 | 0 | 0 | 0 |
| Eradicane | 4 | 98 | 55 | 98 | 74 |
| Eradicane+atrazine | 4+1 | 97 | 87 | 98 | 92 |
| Eradicane+Bladex | 4+2 | 98 | 88 | -- | -- |
| Eradicane+atrazine+Bladex | 4+.5+1.5 | 96 | 88 | -- | -- |
| Sutan+ | 4 | 92 | 60 | 95 | 78 |
| SHALLOW PREPLANT INCORPORATED | | | | | |
| Dual | 2.5 | 90 | 45 | 94 | 70 |
| Lasso | 3 | 91 | 58 | 93 | 75 |

| Treatment | lb/A act. | Percent Weed Control 1989 Grft | 1989 Rrpw | 2-Year Gr |
|---|---|---|---|---|
| **PREEMERGENCE** | | | | |
| Atrazine | 2.5 | 65 | 87 | 79 |
| Bladex | 3 | 72 | 78 | 81 |
| Dual | 2.5 | 84 | 40 | 83 |
| Dual | 1.65 | 60 | 15 | -- |
| Lasso | 3 | 89 | 62 | 70 |
| Lasso | 2 | 72 | 30 | -- |
| Prowl | 1.5 | 86 | 48 | 79 |
| Ramrod | 6 | 96 | 57 | 86 |
| *acetachlor | 2.5 | 92 | 71 | 87 |
| Lasso+atrazine | 2+1 | 85 | 89 | -- |
| Lasso+Bladex | 2+2 | 81 | 72 | -- |
| Dual+atrazine | 2+1 | 80 | 72 | 75 |
| Dual+Bladex | 2+2 | 76 | 76 | -- |
| Atrazine+Bladex | .75+2.25 | 75 | 68 | -- |
| Ramrod+Bladex | 4+2 | 88 | 65 | 84 |
| Lasso+Bladex+atrazine | 2+1.5+.5 | 82 | 83 | -- |
| **EARLY POSTEMERGENCE** | | | | |
| Prowl+atrazine | 1.5+1 | 89 | 88 | -- |
| Prowl+Bladex | 1.5+1.5 | 93 | 94 | -- |
| Atrazine+COC | 1.5+1 qt | 83 | 98 | -- |
| Bladex+X-77 | 2+.5% | 86 | 96 | -- |
| Tandem+Bladex+atrazine+ X-77 | .5+1+.5+.5% | 90 | 98 | -- |
| **PREEMERGENCE & EARLY POSTEMERGENCE** | | | | |
| *Ramrod&Tough+atrazine | 4&.45+.6 | 82 | 99 | -- |
| Ramrod&Banvel | 4&.5 | 84 | 99 | -- |
| **PREEMERGENCE & POSTEMERGENCE** | | | | |
| Ramrod&Banvel | 4&.25 | 80 | 89 | 86 |
| Ramrod&2,4-D amine | 4&.5 | 83 | 62 | 78 |
| Ramrod&Basagran+ atrazine+COC | 4&.52+.52+1 qt | 78 | 80 | -- |
| Ramrod&Buctril | 4&.38 | 80 | 96 | 74 |
| Ramrod&Buctril+atrazine | 4&.25+.5 | 86 | 99 | 80 |
| Ramrod&Banvel+atrazine | 4&.25+.5 | 84 | 88 | 81 |
| **EARLY POSTEMERGENCE & POSTEMERGENCE** | | | | |
| *Banvel&DPX-79406+COC | .5&.0313+.75 qt | 92 | 98 | -- |
| LSD (.05) | | | | 21.4 |

* Experimental herbicide

Grft = Green foxtail - light
Rrpw = Redroot pigweed - light

Evaluated: 8/11/89
PPI&PRE: 5/13/89
EPOS: 6/6/89
POST: 6/23/89
Planting Date: 5/13/89

Data are an average of 2 ratings/

Rainfall: 1st week .50 inches
2nd week .35 inches

## Postemergence Herbicide Evaluation in Sorghum

Primary objective for these tests is to determine crop response for postemergence herbicides. The plots were essentially weed free. Visual crop injury and yield differences are due to treatment effects. Ester forms of 2,4-D at above labeled rates (.5 lb) and Banvel applied late produced the most distinct crop injury. Buctril combinations, 2,4-D amine and Banvel at labeled rates and timing did not result in adverse crop response.

Table 4.

| | | 1989 | | 2-Year Avg. | |
|---|---|---|---|---|---|
| Treatment | lb/A act. | VCCR | Yield bu/A | VCCR | Yield bu/A |
| POSTEMERGENCE | | | | | |
| *Banvel+atrazine | .5+1 | 0.0 | 33.2 | 0.0 | 41.3 |
| PREEMERGENCE & POSTEMERGENCE | | | | | |
| Ramrod&2,4-D ester | 3&.25 | 1.0 | 25.5 | 0.5 | 42.4 |
| *Ramrod&2,4-D ester | 3&.5 | 2.0 | 29.2 | 4.8 | 42.7 |
| Ramrod&2,4-D amine | 3&.5 | 0.0 | 31.4 | 0.0 | 44.3 |
| Ramrod&Banvel | 3&.12 | 0.3 | 36.0 | 0.2 | 46.7 |
| Ramrod&Banvel | 3&.25 | 0.8 | 34.9 | 1.7 | 43.0 |
| Ramrod&Banvel+X-77 | 3&.25+.75% | 1.5 | 36.1 | 0.8 | 46.5 |
| Ramrod&Buctril | 3&.375 | 0.0 | 30.4 | 0.0 | 43.3 |
| Ramrod&Buctril+ atrazine | 3&.25+.5 | 0.0 | 29.6 | 0.0 | 41.9 |
| Ramrod&Buctril+ atrazine | 3&.375+1 | 1.0 | 33.6 | 0.5 | 45.5 |
| PREEMERGENCE & LATE POSTEMERGENCE | | | | | |
| Ramrod&2,4-D ester | 3&.5 | 0.0 | 40.6 | 0.0 | 47.2 |
| Ramrod&2,4-D amine | 3&.5 | 0.0 | 37.9 | 0.0 | 45.2 |
| *Ramrod&Banvel | 3&.25 | 3.2 | 11.2 | 3.6 | 27.8 |
| *Ramrod&Banvel+X-77 | 3&.25+.75% | 4.0 | 11.7 | 6.2 | 24.8 |
| Ramrod&Buctril | 3&.375 | 0.0 | 36.4 | 0.0 | 46.5 |
| LSD (.05) | | 0.8 | 15.2 | 1.5 | 8.5 |

* Experimental treatment

VCRR = Visual Crop Response Rating

0 = no effect
10 = complete kill

Data are an average of 3 reps.

Evaluated: 8/11/89
PRE: 5/26/89
POST: 6/23/89
LPOS: 7/20/89
Planting Date: 5/26/89
Rainfall: 1st week .53 inches
2nd week .00 inches

# FIELD EVALUATION OF WOODY PLANT MATERIALS

Russell J. Haas - Plant Materials Specialist - SCS

The field evaluation site at Highmore, South Dakota, continues to be the "garden spot" of the 13 field evaluation planting sites located in North Dakota, South Dakota, and Minnesota. The excellent maintenance is reflected in the good survival and rate of growth of the trees.

Performance data from this site has been used to support the cooperative release of several tree and shrub cultivars in the past few years. The following cultivars have been released in cooperation with the Soil Conservation Service and the Agricultural Experiment Stations in North Dakota, South Dakota, and Minnesota:

'Cardan' green ash (1979)
'Oahe' hackberry (1982)
'Scarlet' Mongolian cherry (1984)
'Sakakawea' silver buffaloberry (1984)
'Centennial' cotoneaster (1987)

In 1990, ND-14 harbin pear will be released as 'McDermand' pear and ND-20 Arnold hawthorn as 'Homestead' hawthorn.

These cultivars are now in large scale production and have been well accepted and extensively used for field and/or farmstead windbreaks, wildlife, recreation, and highway rights of way plantings in the Dakotas and Minnesota. Some of these cultivars are being tested for adaptation in Montana, Wyoming, Colorado, Kansas, Nebraska, Missouri, Iowa, and the east coast.

Promising accessions being considered for release in the near future are:

ND-629 amur maple (1991)
SD-131 mayday (1991)
ND-83 late lilac (1992)
ND-283 Russian almond (1992)
ND-1879 honeylocust (1993)
ND-11 amur honeysuckle (1995)
ND-1134 plum (1995)

## 1989 ACTIVITIES

April 17 - Survival and winter injury data was recorded on the accessions planted in 1989. Survival ranged from 40% to 100%.

The following new accession was added for evaluation in 1989.

| ACCESSION NUMBER | GENUS/SPECIES ORIGIN/SOURCE |
|---|---|
| 'Freedom' | honeysuckle<br>*Lonicera korolkowii*<br>U of MN, WCES, Morris, MN |

This new variety was released by the University of Minnesota for its resistance to the honeysuckle aphid.

Minor pruning was done to remove damaged branches, basal sprouts, and to develop proper form. Plants in weak condition due to poor adaptation and performance were removed.

September 21 - Survival and growth measurements were recorded on the accessions planted in the spring and older accessions scheduled for evaluation. Heat and drought stress was noted on nearly all species. Overall survival at this site this year was better than at any other site.

GENERAL COMMENTS

--- The tall tree block (Block #1), the medium tall tree block (Block #2), and the shrub block (Block #3) are completely filled. A program of removal of those accessions that are not promising will be initiated.

--- The low, wet area in the southwest corner of the tall tree block will be used to evaluate accessions of hybrid poplars in 1990.

--- Overflow from the tall tree block (Block #1) will be planted in the open areas in the conifer block (Block #4). This new block will be considered Block #5.

--- Fruit/seed has been harvested from trees of several of the released cultivars and provided to nurseries in North Dakota, South Dakota, and Minnesota. The resulting trees are utilized in field and farmstead windbreaks, etc., in those states and others in the Midwest.

# DRIP IRRIGATION PROJECT - 1989

## (Five-Year Results of Highmore Drip Plots)

Tom Hurford - SCS

Introduction: The Highmore Drip Irrigation Special Study was initiated with funds made available from the Resource Conservation Act of 1977. The purpose of the study was twofold. First, it was set up to evaluate the growth enhancement benefits of drip irrigation on various species of trees and shrubs commonly planted in windbreaks in South Dakota. The second aspect was to quantify the effect of drip irrigation on the survival of commonly used windbreak species.

The Highmore site is located one-half mile west of Highmore, South Dakota, on the South Dakota State University Agricultural Experiment Station. The site is located in LRA 053. Average annual precipitation is 17.0 inches. The soil is primarily a Glenham loam which is in windbreak suitability group 3.

Methods: The drip irrigation system was set up originally with a timer to provide each tree with six gallons of water per week. The second year tensiometers were installed and hooked up to the control mechanism to provide water only when needed. Mechanical problems necessitated that the third year the timer be reinstalled and from then until the present trees in the permanent growth plots received eight gallons per tree per week. The annual plots containing the survival portion of the study received three waterings a week consisting of two gallons per application resulting in a total application of six gallons of water per tree per week.

The site where growth under drip irrigation was looked at consisted of four sets. One set contained shrub species, one contained medium sized trees, one contained conifers, and one contained tall deciduous trees. Within each set were two treatments, 1) drip irrigation, and 2) dryland. Each treatment was replicated twice and each replication contained five plants.

The growth of all plants was measured annually for five years. The values shown in Table 1 under the height and width columns are averages for all plants in both replications.

The survival portion of the study area contained annual plantings of deciduous trees and conifers in an attempt to quantify the effect of drip irrigation on survival.

These plots were checked twice annually, once in fall and once in the spring following the spring when the seedlings were planted. The previous year's plantings were destroyed each spring. The plantings were not located in the same plot each year to minimize the effect of soil borne disease.

A summary of the growth of the trees and shrubs is contained in Table 1. The response of the various species to drip irrigation was quite variable. It is apparent that many species responded not at all or only slightly to drip irrigation. It is interesting to note that the weed control in all plots was exceptionally good and that the elimination of weeds in the nonirrigated treatments very well might have mitigated, to a

large extent, the beneficial influence of the irrigated replications over the nonirrigated replications. This would be consistent with long-term experience which has shown that weed control is an essential ingredient for successful establishment and growth of trees and shrubs in South Dakota. Good weed control has the effect of reducing moisture stress on trees and shrubs.

It is interesting to note also in reviewing the data (not shown in Table 1) that the increase in growth of the irrigated replications did not, with the exception of blue spruce and scotch pine, equal or exceed one full years' growth under dryland conditions. In most cases, the increase in growth of the irrigated treatments over the dryland treatments was not significant. Even in those cases where the increase was it is very doubtful whether the benefit realized would justify the cost of drip irrigation.

The survival portion of the study revealed some positive benefits in the case of two species. Blue spruce and bur oak showed a significant increase in survival as a result of drip irrigation. However, again if the cost of drip irrigation is considered, it is doubtful that the benefits realized would justify the expenditure in drip irrigation. One interesting thing observed was the survival of potted ponderosa pine exceeded that of the irrigated bare root stock. This indicates that moisture is only one of several factors affecting survival of seedlings and hints that other factors such as root development of the seedlings, wind damage, and weed control are probably just as important. Certainly some of these are moisture related in so much as root development, exposure to wind and weed control affect available moisture. However, as evidenced by the increased survival of potted ponderosa pine over bare root stock, available moisture alone does not account for the results.

TABLE 1
(5-YEAR GROWTH)

| SPECIES | HEIGHT IN CM | WIDTH IN CM | TREATMENT | PERCENT INCREASE IN HEIGHT OVER DRYLAND | PERCENT INCREASE IN WIDTH |
|---|---|---|---|---|---|
| Skunkbush sumac | 150 | 346 | Drip Irrigated | -4% | 0 |
| (Rhus trilobata) | 157 | 345 | NonIrrigated | -- | -- |
| Caragana | 238 | 175 | Drip Irrigated | 7 | 7 |
| (Caragana arborescens) | 223 | 163 | NonIrrigated | -- | -- |
| 'Centennial' Cotoneaster | 227 | 366 | Drip Irrigated | 8 | 11 |
| (cotoneaster integerrima) | 210 | 329 | NonIrrigated | -- | -- |
| Peking Cotoneaster | 170 | 275 | Drip Irrigated | 16 | 26 |
| (Cotoneaster acutifolia) | 146 | 218 | NonIrrigated | -- | -- |
| Common Lilac | 149 | 260 | Drip Irrigated | 14 | 70 |
| (Syringa vulgaris) | 131 | 153 | NonIrrigated | -- | -- |
| American Plum | 289 | 353 | Drip Irrigated | 15 | 9 |
| (Prunus americana) | 252 | 323 | NonIrrigated | -- | -- |
| 'Sakakawea' Silver Buffalo-berry | 255 | 310 | Drip Irrigated | 26 | 35 |
| (Sheperdia argentea) | 202 | 230 | NonIrrigated | -- | -- |
| 'Scarlet' Mongolian Cherry | 124 | 219 | Drip Irrigated | 2 | 7 |
| (Prunus fruiticosa) | | | | | |
| Arnold Hawthorne | 209 | 154 | Drip Irrigated | 12 | 15 |
| (Crategus arnoldiana) | 187 | 134 | NonIrrigated | -- | -- |
| Siberian Crabapple | 293 | 270 | Drip Irrigated | 12 | 12 |
| (Malus baccata) | 261 | 241 | NonIrrigated | -- | -- |
| Siberian Apricot | 350 | 394 | Drip Irrigated | 17 | 20 |
| (Prunus armeniaca sibirica) | 300 | 327 | NonIrrigated | -- | -- |
| Harbin Pear | 212 | 137 | Drip Irrigated | 6 | -3 |
| (Pyrus ussuriensis) | 200 | 141 | NonIrrigated | -- | -- |
| 'Schubert' Chokecherry | 268 | 228 | Drip Irrigated | 36 | 52 |
| (Prunus virginiana) | 197 | 150 | NonIrrigated | -- | -- |
| Amur Maple | 271 | 321 | Drip Irrigated | 17 | 25 |
| (Acer ginnala) | 232 | 257 | NonIrrigated | -- | -- |
| Midwest Manchurian Crabapple | 274 | 296 | Drip Irrigated | 13 | 10 |
| (Malus baccata mandshurica) | 242 | 270 | NonIrrigated | -- | -- |

Height and width measurements shown are averages of two replications.

Table 1 (continued)

| SPECIES | HEIGHT IN CM | WIDTH IN CM | TREATMENT | PERCENT INCREASE IN HEIGHT OVER DRYLAND | PERCENT INCREASE IN WIDTH |
|---|---|---|---|---|---|
| Russian Olive | 351 | 382 | Drip Irrigated | 11 | 8 |
| (Elaeagnus angustifolia) | 317 | 353 | NonIrrigated | -- | -- |
| Black Hills Spruce | 122 | 59 | Drip Irrigated | 17 | 4 |
| (Picea glauca densata) | 103 | 57 | NonIrrigated | -- | -- |
| 'Rosebud' Ponderosa Pine | 81 | 65 | Drip Irrigated | 33 | 20 |
| (Pinus ponderosa) | 61 | 52 | NonIrrigated | -- | -- |
| Eastern Redcedar | 197 | 169 | Drip Irrigated | 2 | -2 |
| (Juniperus virginiana) | 193 | 172 | NonIrrigated | -- | -- |
| Rocky Mountain Juniper | 144 | 121 | Drip Irrigated | 2 | -7 |
| (Juniperus scopulorum) | 141 | 130 | NonIrrigated | -- | -- |
| Colorada Blue Spruce | 82 | 65 | Drip Irrigated | 19 | 20 |
| (Picea pungens) | 69 | 54 | NonIrrigated | -- | -- |
| Scotch Pine | 115 | 99 | Drip Irrigated | 62 | 87 |
| (Pinus sylvestris) | 71 | 53 | NonIrrigated | -- | -- |
| Green Ash | 346 | 246 | Drip Irrigated | 4 | 2 |
| (Fraxinus pennsylvanica) | 334 | 242 | NonIrrigated | -- | -- |
| 'Cardan' Green Ash | 302 | 223 | Drip Irrigated | -6 | -1 |
| (Fraxinus pennsylvanica) | 320 | 225 | NonIrrigated | -- | -- |
| Siberian Elm | 420 | 450 | Drip Irrigated | 6 | 6 |
| (Ulmus pumila) | 397 | 426 | NonIrrigated | -- | -- |
| Black Walnut | 222 | 221 | Drip Irrigated | 3 | 2 |
| (Juglans nigra) | 205 | 217 | NonIrrigated | -- | -- |
| ND-1879[1/] Honeylocust | 493 | 286 | Drip Irrigated | 5 | 27 |
| (Gleditsia triacanthos) | 469 | 226 | NonIrrigated | -- | -- |
| 'Oahe' Hackberry | 287 | 259 | Drip Irrigated | 23 | 16 |
| (Celtis occidentalis) | 234 | 224 | NonIrrigated | -- | -- |
| Bur Oak | 194 | 128 | Drip Irrigated | 53 | 45 |
| (Quercus macrocarpa) | 127 | 88 | NonIrrigated | -- | -- |
| Silver Maple | 367 | 421 | Drip Irrigated | 3 | 6 |
| (Acer saccharinum) | 357 | 398 | NonIrrigated | -- | -- |

Height and width measurements shown are averages of two replications.

[1/] Denotes SCS Plant Materials accession number

TABLE 2

SURVIVAL

| SPECIES | PERCENT SURVIVAL DRIP IRRIGATED | DRYLAND | PERCENT INCREASE OVER NONIRRIGATED |
|---|---|---|---|
| Green Ash (Fraxinus pennsylvanica) | 100 | 98 | 2 |
| 'Oahe' Hackberry (Celtis occidentalis) | 82 | 80 | 2 |
| Bur Oak (Quercus macrocarpa) | 100 | 72 | 28 |
| Ponderosa Pine (Bareroot) (Pinus ponderosa) | 55 | 44 | 11 |
| Ponderosa Pine (Potted) (Pinus ponderosa) | 95 | 80 | 15 |
| Blue Spruce (Picea pungens) | 96 | 64 | 32 |

THE
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AND

NORTH DAKOTA
AGRICULTURAL EXPERIMENT STATION

AND

SOUTH DAKOTA
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AND

MINNESOTA
AGRICULTURAL EXPERIMENT STATION

AND

NORTH DAKOTA ASSOCIATION
OF SOIL CONSERVATION DISTRICTS

AND

SOUTH DAKOTA ASSOCIATION
OF SOIL CONSERVATION DISTRICTS

Notice to Nurserymen of the Naming and Release of 'Centennial' cotoneaster.

Centennial cotoneaster, Cotoneaster integerrima Medikus, is a seed propagated cultivar recommended for use in multi-row farmstead and field windbreaks, wildlife habitat, and plantings associated with revegetation of transportation and transmission corridors and recreation development.

Centennial is a large shrub 8-12 feet (240-360 cm) in height with spreading branches. The leaves are alternate, ovate or oval, acute or obtuse, glabrous and dark blue-green above, whitish and greenish tomentose beneath, 3/4 to 2 inches (19-50mm) long, turning red brown in autumn. Pale pink flowers are produced in May-June and the bright red globular fruit mature in August. The fruit is utilized by many species of wildlife.

Cotoneaster integerrima is native to Europe, western Asia and Siberia. Accession ND-177, 5729T, PI-113095, originated as seed from the USDA, Agricultural Research Service, Experiment Station, Cheyenne, Wyoming, in 1957. It was received by the Experiment Station as plant introduction A39228 from China.

The USDA Soil Conservation Service has evaluated the adaptation and performance of Centennial cotoneaster at the Plant Materials Center located at Bismarck, North Dakota.

Field evaluation studies were conducted cooperatively with the Soil Conservation Service and South Dakota State University, Central Research Station, Highmore, South Dakota; University of Minnesota, West Central Experiment Station, Morris, Minnesota; USDI, Fish and Wildlife Service, Lake Andes National Wildlife Refuge, Lake Andes, South Dakota; North Dakota State Forest Service; and other state and federal agencies, and conservation district cooperators.

Observations at test locations have shown slight damage from the bacterial disease, fireblight Erwinia amylovora which has proven fatal to Cotoneaster acutifolia Lindt and Cotoneaster lucida Schlecht. Slight symptoms of the disease have been noted on Centennial, but not severe enough to weaken the plant. The fruit and seed production (quality and quantity), resistance to fireblight, attractive foliage and fruit, and large size with spreading branches make Centennial cotoneaster a valuable conservation plant equal to, or superior to, other comparable species: Peking cotoneaster Cotoneaster acutifolia; hedge cotoneaster Cotoneaster lucida; red tatarian honeysuckle Lonicera tatarica L; and siberian peashrub Caragana arborescens sibirica Lam.

Centennial has performed well on deep, fine to moderately fine textured well drained soils and climatic conditions typical of the northern Great Plains.

The result of these studies and others in adjacent states indicate that Centennial is primarily adapted to North Dakota, South Dakota, and Minnesota as shown in figure 1.

The USDA, Soil Conservation Service, Plant Materials Center, P. O. Box 1458, Bismarck, North Dakota 58502, will maintain breeders seed and foundation stock of Centennial cotoneaster. Certified seed (source identified and selected class) will be available from growers approved by State Certified Seed Departments. Standards for all classes of seed are published in the North Dakota Tree and Shrub Certification Standards, North Dakota State Seed Department, Fargo, North Dakota, 1974.