

UNIVERSITY OF WYOMING

**College of Agriculture
Agricultural Experiment Station
Archer and Torrington R&E Centers
Progress Report
2002**



This report contains the results of research conducted in 2001.

UNIVERSITY OF WYOMING

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ARCHER RESEARCH AND EXTENSION CENTER

The primary emphasis at the UW Archer Research and Extension Center (AREC) is to provide research data for dryland crop growers and sheep producers. Currently, 39 crop and livestock research trials are being conducted by 15 UW College of Agriculture scientists and affiliates.

Several types of dryland crop research are conducted at the AREC including winter wheat variety trials, conservation tillage, weed control, moisture conservation, alternative crops, grazing trials, and dryland crop and livestock production systems.

Recently AREC sheep research has been changed to focus on farm flocks and the importance of increasing productivity. Also, an economic analysis of production practices used on the 225-head AREC sheep flock will be included.

The Laramie County Conservation District is cooperating at the AREC to demonstrate different windbreak tree design plantings. The conservation district is developing the information that will be used, and the plot demonstration will be part of AREC field day events.

UW researchers at AREC and Monsanto are conducting a study on alternative cropping systems. This project is designed to provide continuous cropping on dryland farming, which could revolutionize the wheat fallow rotation system that has been in existence for 60 years in eastern Wyoming.

TORRINGTON RESEARCH AND EXTENSION CENTER

The primary emphasis at the UW Torrington Research and Extension Center (TREC) is to provide research results on irrigated crops and livestock feeding for beef and sheep. Research facilities for livestock have a capacity for more than 200 head of beef cattle and approximately 200 head of feeder/fat lambs. Livestock research involves nutritional studies on both sheep and cattle and ectoparasite studies on cattle.

The TREC does alternative crop studies on annual medic inter-seeding and revegetation, sainfoin emergence, and grazing corn production. Variety trials are conducted on alfalfa, corn hybrids, dry beans, turf grasses, spring small grains, winter wheat, annual medics, and Austrian winter peas. Other studies involve managing diseases in dry beans, potatoes, and sugar beets and controlling weeds in alfalfa, beans, corn, grasses, sugar beets, and small grains. The TREC also conducts research concerning nitrates in groundwater.

Master Gardeners maintain a garden plot at the center, and they offer tree and shrub planting and care demonstrations. Currently, Goshen County Master Gardeners are building a greenhouse at the TREC.

Cooperators are very generous in allowing UW and TREC personnel to conduct research on their land. UW's research and visibility have been greatly enhanced by these cooperators.

Official weather data collection sites for the National Weather Service are located at both the Archer and the Torrington Research and Extension Centers, and data is collected and reported daily.

AREC and TREC personnel take pride in answering agricultural questions as quickly and efficiently as possible, and they appreciate homeowners, producers, and all other interested individuals who visit the center or call for information.

Research and outreach serve as the foundation of all AREC and TREC programs. Local schools visit the centers each year, and field days and tours are open to the public. Research results are available at <www.uwyo.edu/agexpstn/exphome.htm>, in popular press articles, and upon request.

For general information about the four UW Research and Extension Centers, visit the Experiment Station Web site at <www.uwyo.edu/agexpstn/exphome.htm>.

2001 DRY BEAN PERFORMANCE EVALUATION

Jack Cecil, Jim Krall, and Jerry Nachtman
Torrington Research and Extension Center

Dry beans are produced in the southeast and northwest districts of the state. In the production year of 2000, Wyoming farmers produced 762,000 **cwt** of dry beans on 34,000 acres.

The 2001 dry bean performance evaluation was conducted at the TREC in a continuous and ongoing program in cooperation with the National Dry Bean Nursery. A wide range of new lines and newly released varieties is evaluated each year to select those best suited for southeast Wyoming dry bean producers. Both public and private entries are tested.

Materials and Methods

The performance evaluation was established under a lateral sprinkler irrigation system at the TREC. The soil was a Dwyer Mitchell sandy loam. The field was conventionally plowed and roller packed twice. A preplant chemical treatment of Eptam and Sonolan, 2 pt. and 1.75 pt., respectively, were incorporated with a lely-roteria mulcher at a depth of 4.5 inches.

The four row plots were planted with a Hege plot planter in a randomized block design with four replications on 30 inch row spacings. The trial was planted May 31 in plots 10 by 25 feet. Cultivation and hand weeding controlled weeds during the growing season. Irrigation water was applied as needed with a lateral sprinkler system throughout the growing season.

Visual estimates for days to 50 percent bloom (50 percent of plants at first bloom) and days to maturity (50 percent buckskin pods) were recorded. The plots were cut using a two row Pickett One Step, and the samples were threshed using a Hege plot combine. The seeds were cleaned using a Clipper Eclipse 324 Commodity Flow cleaner with three 24.5 by 22.25 screens.

Results and Discussion

Yielding abilities of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in the yield of the two entries is greater than the difference required for significance (DRS) shown in the table, little confidence can be placed in the superiority of one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials.

Early spring moisture was favorable for germination and seedling establishment. A hot, dry summer and fall allowed all entries to mature prior to frost. The very dry and hot conditions during flowering caused some decrease in pod set on some varieties. The moisture content of the beans at harvest averaged 12 percent. Yields across entries averaged 2182 pounds per acre and ranged from 1119 pounds per acre for H9659-41-3, a dark red kidney, to, 3756 pounds per acre for Othello, a pinto bean variety. A summary of the 2001 dry bean nursery is listed in Table 1.

Table 1. Agronomic data, Cooperative Dry Bean Nursery, Torrington, WY.

Name	Market Class	Yield pounds per acre	Seeds per pound	50 percent Buckskin Pods Days after Planting
H9673-87	Black	1920	2390	95
AC Mast	Small White	1860	2529	95
AC Trident	Small White	1504	2419	95
CPC 00125	Small White	2165	1609	90
Frigate	Small White	2364	2134	92
ISB 2598	Small White	1284	2555	92
93:207G	Great Northern	1615	1396	90
93:208G	Great Northern	1353	1363	94
98:163G	Great Northern	1449	1383	95
98:209G	Great Northern	2667	1441	93
ISB 5172	Great Northern	2361	1240	93
Matterhorn	Great Northern	2453	1279	95
UI 59	Great Northern	2253	1530	94
UI 465	Great Northern	2348	1435	94
US 1140	Great Northern	2535	1512	95
CDC Rosalee	Pink	2034	1265	92
93:219P	Pinto	3086	1595	92
Bill Z	Pinto	2901	1265	90
Buster	Pinto	2796	1207	95
CO 64342	Pinto	3005	1192	90
CO 75511	Pinto	2513	1320	92
CDC Pinnacle	Pinto	3015	1120	89
CDC Pintum	Pinto	2199	1388	92
ISB 1145	Pinto	2328	1260	90
Othello	Pinto	3756	1175	92
UI 111	Pinto	2736	1350	89
UI 114	Pinto	2682	1180	89
UI 1320	Pinto	2787	1222	92
R93-365	Red	2113	1292	92
CPC 99814	Cranberry	1613	900	92
Hooter	Cranberry	2160	947	95
H9659-37-2	Dark Red Kidney	1525	1022	95
H9659-41-3	Dark Red Kidney	1119	1085	93
Montcalm	Dark Red Kidney	1905	1042	93
Nichols	Dark Red Kidney	2115	1052	93
H9659-21-1	Light Red Kidney	2138	881	90
H9659-23-1	Light Red Kidney	1562	1155	90
CPC 00153	Mexican Yellow	1233	1259	94
CPC 00250	Mexican Yellow	1629	1197	95
CPC 12406	Mexican Yellow	2268	1228	95
Site Mean:		2183	1304	93
LSD (5%):		12.7	1.69	.61
CV%:		12.5	1.74	.25

2001 DRY GRAIN PEA VARIETY EVALUATIONS

Jim Krall, Jerry Nachtman, and Jack Cecil, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

Pea (*Pisum sativum*) is one of the world's oldest crops, first cultivated as many as 9,000 years ago. The dry grain from pea contains 20 to 25 percent crude protein, making it an attractive alternative protein supplement since there is little concern about when dry peas are fed in most livestock rations.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 5 at a rate of 30 pounds of N and 50 pounds of P₂O₅ per acre, and then the area was roller packed again. Eight commercially available, one Australian variety, and five lines of spring grain peas were included in the trial. Seeding rate of inoculated peas was 8 seeds per square foot and were sown with a small grain plot drill. Plots were replicated four times in a randomized complete block design. Plot size was 5 by 25 feet. Seeding date was April 5. Free standing height and final bloom date were recorded. The plots were combined July 19 after dry down following swathing on July 9.

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. PS610152 and Lifter yielded significantly more than PS710909 (Table 1). Majorette had the highest bushel weight at 64.1 pounds per bushel and Toledo the lowest at 58.5 pounds per bushel. The earliest maturing pea was Franklin at 78 days from planting until final bloom date, and the latest was Wyodun at 85 days. Wyodun was significantly taller at 26 inches than any other pea. PS710909 was the shortest at 14 inches.

Table 1. Grain yield, bushel weight, final bloom date, and height of irrigated pea varieties. TREC, 2001.

Variety	Yield Pounds/ acre	Weight Pounds/ acre	Days from planting until final bloom	Harvest height inches
PS610152	3760	63.5	79	15
Lifter	3610	63.8	83	19
PS7101149	3530	63.3	80	17
Salute	3490	63.0	81	21
Toledo	3480	58.5	81	20
Wirrega	3420	63.7	82	22
Wyodun	3390	63.7	85	26
Intrega	3360	64.0	81	21
Franklin	3280	61.9	78	15
Majorette	3260	64.1	80	19
Carneval	3160	64.0	82	20
Cruiser	2990	61.7	80	21
PS610324	2960	61.4	80	18
PS710909	2760	63.8	79	14
Mean	3240	62.9	81	19
DRS (0.05)	810	---	2	3

2001 EVALUATION OF GRAIN PEAS FOR FORAGE PRODUCTION

Jim Krall, Jerry Nachtman, and Jack Cecil, Torrington Research and Extension Center

Introduction

Wyodun pea grown for grain represents a possible new pea variety for our region. Another valuable use for this variety, as well as other varieties, may be for livestock forage. A variety trial was undertaken to identify grain pea varieties that may offer the option of production of forage. This would allow producers to maximize options as they respond to market demand.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 5 at a rate of 30 pounds of N and 50 pounds of P₂O₅ per acre, and then the area was roller packed again. Five spring peas and one vetch were included in the forage trial. Seeding rate of inoculated peas was 8 seeds per square foot, and the vetch at 75 pounds per acre. Both were seeded with a small grain plot drill. Plots were replicated 4 times in a randomized complete block design. Plot size was 5 by 25 feet. Seeding date was April 5. Forage was cut and growth stage recorded on June 18.

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. Wyodun yielded 8,940 pounds per acre, which was significantly more than Austrian winter pea and Namoi vetch at 5,800 and 3,710 pounds per acre respectively (Table 1). Namoi vetch had the highest moisture content at 93 percent with Arvica pea being the lowest at 81.9 percent.

Table 1. Yield and number of blossoms and pods of irrigated forages. TREC, 2001.

Forage	Forage Yield DM pounds/acre	Moisture percent	Number of blossoms	Number of pods
Wyodun Pea	8940	84.7	7	3
Arvica Pea	8140	81.9	7	3
Poneka Pea	7220	85.0	7	3
Carneval Pea	7140	82.5	12	6
Austrian Winter Pea	5800	86.0	2	0
Namoi Vetch	3710	93.0	7	2
Mean	6830	---	---	---
DRS (0.05)	2890	---	---	---

2001 IRRIGATED CHICKPEA VARIETY EVALUATIONS

Jack Cecil, Jim Krall, and Jerry Nachtman, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

A field trial was established at the TREC to evaluate varieties and lines of chickpeas suitable to southeastern Wyoming soils and climate. The chickpea (*Cicer arietinum l.*), also known as the garbanzo bean, belongs to the legume family. Chickpeas are included in the pulse crops along with peas, lentils, and fababeans. Pulses are the seeds of legumes that are used as food. There are two types of chickpeas: kabuli, the larger size seed type that is seen on the salad bars, and desi, the smaller size seed type that is ground and used as flour. Chickpeas are an important source of protein for humans in many of the developing countries. The chickpea and its residue can also be used as livestock feed. The chickpea fixes atmospheric nitrogen and acts as a "break crop" for diseases, pests, and weeds. Chickpeas may have an important role in dryland farming systems as an alternative for continuous cereal production or replacement of fallow.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 5 at a rate of 30 pounds of N and 50 lb of P₂O₅ per acre, and then the area was roller packed again. Three commercially available entries and five experimental lines of chickpeas were included in the trial. Seeding rate of inoculated chickpeas was 4.2 seeds per square foot and were sown with a small grain plot drill with 9 inch spacing. Plots were replicated four times in a randomized complete block design. Plot size was 5 by 25 feet. Seeding date was April 5. The plots were pulled on August 13 and allowed to dry until combining on August 27.

Results and Discussion

In the calculation of yield, plot width was adjusted to 4.5 feet because one opener plugged during seeding, resulting in a blank row. Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. WY K230 yielded the most at 3670 pounds per acre (Table 1). Sierra had significantly greater seed yield above a 22/64 round hole sieve (87 percent) than the other entries.

Table 1. Grain yield, seeds 22/64 screen, and percent brown pods at harvest of irrigated chickpea varieties. TREC, 2001.

Entry	Type	Yield Pounds/acre	Seeds per ounce	Percent brown pods at harvest*
WY K203	Kabuli	3670	69	75
WY D202	Desi	3570	---	92
Sanford	Kabuli	3280	74	92
Sierra	Kabuli	3270	87	83
WY D201	Desi	3180	---	95
Dwelley	Kabuli	3070	79	94
Evans	Kabuli	3040	73	81
CA9783165C	Kabuli	3030	80	84
Mean		3260	77	87
DRS (0.05)		NS	6	14

*Used as an indicator of maturity.

2001 LENTIL VARIETY EVALUATIONS

Jim Krall, Jerry Nachtman, and Jack Cecil, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

Lentil is one of the earliest cultivated crops in the world, with archeological evidence of it dating from the Stone Age. As a legume, lentil is a good fixer of nitrogen. Lentils are used as an important dietary protein source in India, Southeast Asia, and the Mediterranean. Worldwide production increased 20 percent between 1990 and 2000. Grain lentil has expanding market potential. Therefore, we undertook to evaluate lentil lines and cultivars in cooperation with the University of Nebraska.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 5 at a rate of 30 pounds of N and 50 lb of P₂O₅ per acre, and then the area was roller packed again. One commercially available and 11 lines of lentils were included in the trial. Seeding rate of inoculated lentils was 12 seeds per square foot and were sown with a small grain plot drill. Plots were replicated four times in a randomized complete block design. Plot size was 5 by 25 feet. Seeding date was April 5. The plots were combined July 30 by direct cutting with a grain header on an Almaco small plot combine.

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. The mean trial yield was 1,620 pounds per acre, with LC7601106E the high yielding line at 2,120 pounds per acre (Table 1). LC7601599T yielded the least at 930 pounds per acre. USDA reports the average lentil price (1999-2000) was \$11.10 per **cwt**. Based on this figure, the value of the crop produced in the trial could range between \$103 to \$235 per acre.

Table 1. Grain yield of irrigated lentil varieties. TREC, 2001.

Variety	Yield lb/A
LC7601106E	2120
LC8602354T	2080
CDC Richlea	1980
LC7601086E	1910
LC8601817P	1810
LC7601080R	1790
LC460197L	1520
LC460212L	1510
LC8601787P	1370
LC460266B	1350
LC660829L	1040
LC7601599T	930
Mean	1620
DRS (0.05)	480

2001 WYOMING CORN HYBRID EVALUATION

Jerry Nachtman and Jim Krall, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

In cooperation with the University of Nebraska, the University of Wyoming evaluated 26 corn hybrid entries as part of an ongoing multi-location hybrid evaluation program. Contact the University of Nebraska for results from the Nebraska trials.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 20 at a rate of 150 pounds of N and 40 pounds of P₂O₅ per acre, and then the area was roller packed again. The corn trial was seeded on May 10 with a four row Hege plot planter. Plots were replicated four times in a randomized complete block design. Prowl at 1 qt. per acre + Marksman at 1 qt. per acre were applied on May 16 for weed control. Accent at 0.67 ounce per acre was applied on June 5 for grassy weed control. Corn population counts, tassel heights, and broken stalk counts were taken at harvest on October 25. Yield, test weight, and moisture content were determined at harvest using a Seed Spector II mounted on an Almaco small plot combine.

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. The mean trial plant population of 24,850 plants per acre is within recommended limits. Mean plant height was 8.5 feet and ranged from 8.1 to 9.1 feet. Yields were adjusted to 15.5 percent moisture content. Mean trial test weight was 55.5 pounds per bushel, ranging from 54.1 to 58.0 pounds per bushel. The trial mean yield was 134 bushel per acre ranging from 100 to 173 bushels per acre. Use DRS values to compare performance of hybrids.

Table 1. Yield, bushel weight, broken stalks, plant population, and tassel height of corn varieties. TREC, 2001.

Brand	Hybrid	Grain yield bushel per acre	Grain moist percent	Bushel weight pounds per bushel	Broken stalk percent	Plants per acre	Plant height feet	Grain ¹ value \$\$
KAYSTAR	KX-630	173	14.4	55.8	2.6	25300	8.2	349.69
ASGROW	RX452yg	167	14.6	57.6	8.5	25390	8.9	337.87
GRAND VALLEY	GVX2050	161	13.3	54.8	15.0	27500	8.5	332.94
DEKALB Genetics	DKC 46-26	155	13.0	57.5	11.6	22990	8.1	319.75
KAYSTAR	KX-6400RR	158	14.8	55.2	0.6	23570	8.4	319.65
FARM ENTRY #1		157	14.8	58.0	16.1	26910	8.2	317.32
GRAND VALLEY	SX1211	150	13.2	54.7	17.7	27990	8.5	314.60
GEERTSON SEED	GS-1020	157	15.7	54.9	5.4	26590	8.6	314.34
SEEDS 2000	X3132	150	15.0	55.5	7.7	24160	8.1	303.54
MYCOGEN	4231CL	146	14.1	55.9	8.4	31730	8.8	297.94
DEKALB Genetics	DKC 48-15	144	14.4	56.4	8.4	27960	8.5	295.70
GRAND VALLEY	SX1229	137	14.2	54.1	13.7	30780	8.4	281.62
GRAND VALLEY	SX1190	134	13.1	55.2	8.2	26610	9.1	279.65
WILCROSS	XX1190	135	13.8	54.3	7.4	24330	8.3	276.13
DEKALB Genetics	DKC 51-88	137	16.6	55.1	17.8	31020	8.8	269.76
GRAND VALLEY	GVX7259	125	13.1	54.6	6.3	20280	8.5	261.64
Public	HPALC7	120	14.1	56.0	9.2	22270	8.7	245.90
Public	HPALC5	119	14.4	54.7	9.4	24080	8.2	240.45
Public	HPALC2	118	15.4	54.4	12.5	22770	8.5	235.88
Public	HPALC8	115	14.1	55.1	14.3	23020	8.5	233.87
Public	HPALC3	104	13.3	55.2	15.3	21820	8.8	216.87
Public	HPALC4	104	13.9	55.2	12.1	20890	8.4	213.60
Public	HPALC6	102	14.0	55.6	14.8	21700	8.4	211.55
Public	HPALC10	104	14.7	55.6	12.0	21010	8.4	211.14
Public	HPALC9	103	14.6	55.7	10.7	20910	8.3	206.88
Public	HPALC1	100	13.9	55.2	15.4	21440	8.1	206.74
Average all entries		134	14.3	55.5	10.7	24850	8.5	273.73
DRS (0.05)		26	1.4	1.2	NS	3950	NS	52.50

¹Value represents \$2.00 corn after drying cost of 3.5 cents per bushel per point of moisture is subtracted.

2001 WYOMING CORN SILAGE EVALUATION

Jim Krall, Jerry Nachtman, and Jack Cecil, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

In cooperation with the University of Nebraska, the University of Wyoming evaluated six corn silage hybrid entries as part of an ongoing multi-location hybrid evaluation program. Contact the University of Nebraska for results from the Nebraska trials.

Materials and Methods

An irrigated site at the TREC was chosen for the variety evaluation plots. The area was prepared by plowing and roller packing. Dry fertilizer was applied on April 20 at a rate of 150 pounds of N and 40 pounds of P₂O₅ per acre, and then the area was roller packed again. The corn trial was seeded on May 10 with a four row Hege plot planter. Plots were replicated four times in a randomized complete block design. Prowl at 1 qt. per acre + Marksman at 1 qt. per acre were applied on May 16 for weed control. Accent at 0.67 ounces per acre was applied on June 5 for grassy weed control. Silage yield, plant height, and moisture measurements were taken at harvest on September 11.

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. Mean plant height was 10.2 feet (Table 1) and ranged from 9.2 to 11.2 feet. Yields were adjusted to 0 percent moisture content. The trial mean yield was 9.1 tons per acre ranging from 7.7 to 10 tons per acre. Mean silage protein was 7.4 percent and ranged from 6.7 to 8.4 percent. ADF values ranged from 25.4 to 33.5 percent with a mean of 28.8 percent. NDF values ranged from 49.2 to 55.4 percent with a mean of 52.3 percent. Use DRS values to compare the performance of hybrids.

Table 1. Yield, height, moisture, protein, ADF, and NDF of corn silage hybrids. TREC, 2001.

Brand	Hybrid	Silage yield tons per acre*	Plant height feet	Silage moisture percent	Silage protein percent	Silage ADF Percent	Silage NDF percent
Lfy.L.L.C.	MBS3811xLfy497L	10.0	10.6	64.5	7.3	25.4	51.5
Garst Seed CO	7850	9.5	9.9	68.1	7.6	27.5	52.1
Lfy.L.L.C	MBS3811xLfy669L	9.4	11.2	74.3	7.3	33.5	55.4
U.S. Seeds	US C1119ND	9.1	9.7	70.2	8.4	29.1	53.4
Geertson Seed	GS-1099	8.7	10.5	68.3	6.9	28.8	52.4
Garst Seed CO	8590IT	7.7	9.2	68.6	6.7	28.4	49.2
Mean		9.1	10.2	69.0	7.4	28.8	52.3
DRS (0.05)		NS	0.9	3.9	NS	NS	NS

*Yield is reported at 0 percent moisture.

2001 WYOMING DRYLAND PROSO MILLET VARIETY EVALUATION

Jerry Nachtman, Jim Krall, and Jack Cecil, Torrington Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

Proso millet is a crop that is increasing in acreage in southeastern Wyoming. It fits in well as a wheat/millet/fallow rotation to help use excess stored water. As a spring planted crop, it can help with the control of winter annual grassy weeds as well as providing an insect and disease break. To evaluate lines and varieties suitable to southeastern Wyoming, a field trial was established in cooperation with the University of Nebraska.

Materials and Methods

A dryland site on the Theron Anderson farm near Albin was chosen for the nursery. Twenty-five entries (including three red and three waxy types) of proso millet were seeded in a randomized complete block design with four replications on June 8, 2001. The plots were seeded using a six row disc plot drill with 9 inch spacing. The plots were harvested on September 21, 2001, using a Hege small plot combine. Yield, height, and lodging were determined. A five gram sub sample from each plot was counted to determine seed weight (seeds per five grams).

Results and Discussion

Yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of the one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. Minimal summer moisture reduced yields averaging only 7.8 cwt. per acre (Table 1). The high yielding entry was Sunrise at 13.0 cwt. per acre, and the low yielding line was 436625-waxy at 3.2 cwt. per acre. Six entries produced yields that were significantly higher than the waxy types that are noted for high gluten content. Seed counts per five grams ranged from 732 for 9,213; to 1059 for 436623-waxy. Overall height of the trial averaged 20 inches with Cope and 436625-waxy being the tallest at 26 inches. The shortest entries in the trial were 9668-18 and Dawn at 17 inches. Lodging was a significant factor for some entries of up to 63 percent for Dawn, with the average of the trial at 17 percent. Twelve entries exhibited less than 10 percent lodging.

Table 1. Yield, seed weight, height, and percent lodging of dryland proso millet grown at the Theron Anderson farm near Albin, Wyoming, in 2001.

Entry	Grain yield Cwt. per acre	Seeds per 5 grams	Plant height inches	Lodging percent
Sunrise	13.0	736	19	11
9213	12.8	732	22	1
Sunup	12.0	790	18	6
9217	11.6	758	20	16
Huntsman	10.9	771	22	2
9308	10.4	743	18	4
Earlybird	8.8	753	21	18
9304	8.7	761	20	5
9668-6	8.5	794	22	12
9668-5	8.3	774	18	14
9668-1	8.2	782	18	31
9239-red	8.1	829	23	4
9307	7.8	803	19	25
9668-17	7.8	772	18	33
9668-16	7.8	736	19	8
9668-18	7.0	804	17	46
9668-10	6.9	796	18	14
9210	6.7	813	20	54
Dawn	6.1	774	17	63
Cope	4.9	809	26	6
9241-red	4.8	881	22	1
436623-waxy	4.4	1059	20	6
436626-waxy	3.6	963	24	1
Cerise-red	3.5	956	18	59
436625-waxy	3.2	860	26	3
Average all entries	7.8	808	20	17
DRS (0.05)	5.6	38	3	27

2001 WYOMING WINTER WHEAT VARIETY PERFORMANCE TRIALS

Jerry Nachtman, Jim Krall, and Jack Cecil, Torrington Research and Extension Center
Roger Hybner, Sheridan Research and Extension Center
David Baltensperger, University of Nebraska Cooperator

Introduction

The 2001 winter wheat (*Triticum aestivum* L.) variety trials were conducted at three dryland and two irrigated locations in Wyoming and one dryland location in Nebraska. All varieties were evaluated for yield potential, bushel weight, protein content, heading date, and plant height.

Materials and Methods

Nurseries were seeded at a rate of 50 pounds per acre on dryland and 90 pounds per acre under irrigated conditions using a four row, 14 inch hoe plot drill on the southeast Wyoming sites; a six row, 12 inch disc plot drill in Nebraska; and a six row, 9 inch disc plot drill at Sheridan. Individual plot size was 5 by 17 feet for the southeast Wyoming sites, 6 by 17 feet for the Nebraska site, and 5 by 20 feet for the Sheridan site. The southeast Wyoming nurseries were fertilized at seeding by deep banding at a rate of (40-20-0) on the dryland plots and (80-40-0) on the irrigated plots. A dry fall and cool spring delayed both seeding and harvest of this year's wheat crop. Plots were arranged in a randomized complete block design with six replications. The nurseries were managed by the respective research center personnel and cooperating producers. All plots were harvested using an Almaco plot combine. Yield samples were weighed and yields were calculated. Bushel weight and protein were determined from a composite of the six plot samples for each variety. Protein analysis was accomplished using a whole grain infratec analysis computer. Data were subjected to statistical analysis where possible.

Chugwater: Twenty-four entries were seeded in a nursery September 27, 2000, in cooperation with John Baker on his farm east of Chugwater. The plots were harvested July 27, 2001.

Pine Bluffs: The nursery included 26 entries and was seeded October 3, 2000, in cooperation with Herb Mattson on his farm north of Pine Bluffs. The plots were harvested August 2, 2001.

Albin: Forty-two entries were seeded at this nursery on October 10, 2000, on a pivot-irrigated site in cooperation with Theron Anderson on his farm southwest of Albin. The nursery was seeded into millet stubble. The plots were harvested August 3, 2001.

Sheridan Research and Extension Center: The nursery was seeded September 27, 2000, with 23 entries. The plots only received 4.38 inches moisture during the growing season. The plots were harvested on July 23, 2001.

Torrington Research and Extension Center: The nursery contained 12 entries and was seeded September 27, 2000, on an irrigated area at the TREC. The plots were irrigated as needed and harvested July 13, 2001.

Goshen County/Scottsbluff County: The nursery was seeded in September 2000 with 45 entries in cooperation with Ken Hall on his farm south of Stegall, Nebraska. The plots were harvested July 2001.

Seeding of the 2001 dryland winter wheat nurseries was completed September 24, 2001. At four dryland locations (off-station cooperative sites near Pine Bluffs, Chugwater, Stegall, Nebraska, and at the SREC), 20, 18, 47, and 18 entries, respectively, were seeded. In two irrigated nurseries, 42 and 17 entries, respectively, were seeded, the first at an off-station cooperative site near Albin on September 23, 2001, and the second at the TREC on September 25, 2001.

Results and Discussion

The results for each individual location are shown in Tables 1 to 6. The yielding ability of different entries cannot be measured with absolute accuracy because of variations in soil fertility, moisture, and other factors. For this reason, small differences in yield have no significance. Unless the difference in yield of two entries is greater than the difference required for significance (DRS) shown in the tables, little confidence can be placed in the superiority of one over the other in that particular test. These differences are shown at the 5 percent level, meaning that differences as large or larger could be expected through chance alone in one of 20 trials. Entries are compared to Buckskin, which was planted on 60.3 percent of the Wyoming winter wheat acreage¹.

Dryland: At Chugwater no entries significantly yielded more than Buckskin (Table 1), but six entries (AP 502 CL, Nuplains, Avalanche, NuHorizon, Rampart, and 2137) yielded significantly less. Seven entries (Millennium, Alliance, NE97638, NE97558, NE97689, Wahoo, and NE97669) significantly yielded more than Buckskin at the Pine Bluffs site (Table 2) while one entry (Tomahawk) yielded significantly less than Buckskin. No entries yielded significantly more than Buckskin, but 11 entries (Rampart, NE97558, Golden Spike, NW97S278, Nuplains, AP 502 CL, Prowers, 2137, NuFrontier, NuHorizon, and Above) yielded significantly less than Buckskin at Sheridan, which had the lowest mean trial yield (22 bushels per acre) for the dryland nurseries. The Goshen County/Scottsbluff County nursery at Stegall, Nebraska, (Table 4) had the highest mean trial yield of 56 bushels per acre with 14 entries (Golden Spike, Wahoo, NE97426, NE97638, Millennium, NE97669, NE97689, NW97S182, Trego, Above, Arapahoe, NE97465, NuFrontier, and AP 502 CL) yielding significantly higher than Buckskin and four entries that yielded significantly less (Turkey, Vista, Betty, and Heyne).

Irrigated: At the Albin location the nursery averaged 63 bushels per acre (Table 5). Five of the top 12 entries in the trial were white wheats (NuFrontier, NW97S278, NW97S182, NW97S218, and NuHorizon). At Torrington (Table 6) the top two entries were white wheats (NuFrontier and Golden Spike).

Acknowledgments

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¹ Wyoming Agricultural Statistics, 2001. Wyoming Agriculture Station Service, Cheyenne Wyoming.

Table 1. 2001 Wyoming statewide winter wheat variety performance trial. John Baker cooperator, Chugwater, Wyoming.

Entry	Grain yield bushels per acre	Protein percent	Test weight pounds per bushel	Heading height inches	Heading date-days from Jan. 1	Winter survival percent
Akron	34	12.8	59.1	19	166	88
NE97638	33	13.0	58.4	19	168	84
Nuwest*	33	14.2	58.5	20	171	81
NE98689	32	13.2	57.7	20	169	78
Pronghorn	31	13.6	59.6	20	165	82
Golden Spike*	31	14.0	56.2	20	172	75
Wahoo	31	14.2	58.7	20	168	86
Above**	30	13.0	59.1	18	165	74
Millennium	30	13.9	60.0	20	168	81
Arapahoe	30	14.9	58.2	20	169	88
Buckskin	30	14.4	60.0	21	168	74
Alliance	29	13.5	58.1	19	167	86
NuFrontier*	28	13.2	59.8	21	170	75
NW97S278*	28	13.8	58.4	19	167	76
NE97669	27	12.9	58.0	18	167	76
Lamar	27	14.2	60.5	21	169	76
Prowers	26	13.9	58.5	22	170	66
NE97558	26	13.8	59.7	20	170	89
AP 502 CL**	25	12.9	58.0	19	166	63
Nuplains*	25	14.4	59.4	20	171	81
Avalanche*	24	12.9	60.1	19	167	60
NuHorizon*	24	13.0	59.6	18	170	57
Rampart	24	14.1	57.5	20	171	77
2137	23	13.4	58.5	18	166	75
Average	28	13.6	58.8	20	168	77
DRS (0.05)	4	---	---	1	2	15

*Denotes hard white wheat

**Denotes Clearfield wheat

Table 2. 2001 Wyoming statewide winter wheat variety performance trial. Herb Mattson, cooperater, Pine Bluffs, Wyoming.

Entry	Grain yield bushels per acre	Protein percent	Test weight pounds per bushel	Heading height inches	Heading date-days from Jan. 1	Winter survival percent
Millennium	51	13.2	62.2	23	173	87
Alliance	48	12.7	60.3	20	171	78
NE97638	47	12.4	60.1	23	173	81
NE97558	47	12.4	60.3	24	174	89
NE97689	46	12.3	59.0	21	174	73
Wahoo	46	13.4	59.5	21	174	73
NE97669	46	12.8	60.1	19	173	69
NW97S278*	43	13.5	61.4	21	171	83
Golden Spike*	43	12.5	58.4	21	176	76
Nuwest*	42	13.1	60.1	22	176	82
Arapahoe	42	13.7	60.3	22	174	79
Above**	42	11.9	61.0	19	167	79
NuFrontier*	42	12.5	60.8	22	172	71
Pronghorn	41	13.9	62.1	24	168	87
Nuplains*	39	14.4	58.3	20	175	76
NuHorizon*	39	13.0	61.5	19	172	69
Rampart	39	13.4	60.3	21	176	77
Buckskin	38	13.6	60.3	24	173	72
Ogallala	37	14.4	63.1	17	168	73
AP 502 CL**	37	12.0	60.2	18	167	73
Prowers	37	13.4	61.7	24	173	79
Lamar	36	13.2	60.4	24	171	80
Avalanche*	35	12.9	62.3	19	172	62
Akron	32	13.2	60.3	---	---	---
2137	31	12.2	61.6	20	172	67
Tomahawk	31	13.2	60.8	20	173	58
Average	41	13.0	60.6	21	172	76
DRS (0.05)	7	---	---	2	3	17

*Denotes hard white wheat

**Denotes Clearfield wheat

Table 3. 2001 Goshen County/Scottsbluff County dryland winter wheat variety performance trial. Stan Hall, cooperater, Stegall, Nebraska.

Brand	Entry	Grain yield bushels per acre	Protein percent	Test weight pounds per bushel	1000 seeds per pound	Plant height inches
Gen Mills	Golden Spike*	66	11.9	56.7	15.3	34
----	Wahoo	65	11.8	56.6	16.0	33
----	NE97426	65	10.9	55.2	14.6	35
----	NE97638	64	11.3	56.2	15.7	33
----	Millennium	64	11.9	59.2	14.8	35
----	NE97669	63	11.9	57.7	15.0	30
----	NE97689	62	11.6	56.2	15.2	33
----	NW97S182*	62	12.8	59.0	14.6	36
----	Trego	61	11.7	59.8	15.0	30
----	Above**	60	12.3	59.1	13.7	31
----	Arapahoe	60	12.3	58.1	15.7	34
----	NE97465	59	13.1	60.0	14.6	38
Gen Mills	NuFrontier*	58	11.2	58.8	14.6	33
AgriPro	AP 502 CL**	58	11.9	57.8	13.7	30
----	Pronghorn	58	12.5	59.8	14.8	37
----	Niobrara	58	11.7	57.2	15.0	35
----	NE97558	57	12.3	57.1	17.7	34
AgriPro	AP85-385	57	12.3	57.1	17.7	34
----	Culver	57	11.9	57.6	14.4	33
----	Akron	57	11.3	59.0	16.2	32
----	Rampart	57	12.1	58.8	17.4	35
----	Scout 66	57	12.4	60.6	13.7	38
----	Halt	56	12.0	58.1	15.9	28
----	Alliance	56	11.7	58.5	16.0	32
----	Jagger	56	12.7	58.6	14.8	32
----	Windstar	56	12.8	56.9	16.2	34
----	NW97S278*	55	11.7	58.7	16.0	30

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(Table 3 continued)						
Brand	Entry	Yield	Protein	TWT	Seeds	Height
----	Cougar	55	13.2	60.2	14.5	36
----	Lamar	55	12.6	60.8	14.4	37
Gen Mills	NuHorizon*	55	11.3	60.2	15.7	28
----	2137	54	11.7	58.3	14.7	30
----	NW97S114*	54	10.9	59.9	16.4	30
Gen Mills	Nuwest*	54	12.9	58.7	18.9	34
----	Nuplains*	54	12.6	60.5	14.8	32
----	Wesley	54	13.1	57.7	15.0	28
----	Lakin	53	12.2	60.6	13.8	31
----	Buckskin	53	12.3	59.7	14.1	41
----	Avalanche	52	12.3	59.9	14.7	30
----	Prowers	52	12.5	59.9	14.4	36
----	N95L11881	49	12.9	57.5	18.0	35
----	NW97S218	49	13.0	58.2	14.7	30
----	Turkey	48	13.3	58.8	16.2	38
----	Vista	48	12.9	57.9	14.1	30
----	Betty*	47	13.4	59.1	16.5	32
----	Heyne*	42	14.6	58.7	15.0	28
Average		56	12.3	58.6	15.3	33
DRS (0.05)		5	1.0	1.3	1.8	2

*Denotes hard white wheat

**Denotes Clearfield wheat

Table 4. 2001 Wyoming statewide irrigated winter wheat variety performance trial, SREC.

Entry	Grain yield bushels per acre	Protein percent	Test weight pounds per bushel	Harvest height inches	Heading date-days from Jan.1
Alliance	30	11.0	63.1	22	145
NE97669	26	10.8	62.1	20	149
Wahoo	26	11.4	62.2	21	148
Buckskin	26	11.7	63.3	24	149
Pronghorn	24	11.7	62.7	21	146
Arapahoe	24	10.6	62.4	22	149
Nuwest*	24	12.3	62.4	22	153
NE97689	23	10.8	61.4	21	152
Avalanche*	23	11.4	64.1	20	146
Millennium	22	11.8	63.2	22	149
NE97638	22	11.5	62.1	21	151
Lamar	22	12.0	63.0	23	150
Rampart	21	12.4	62.4	22	149
NE97558	21	11.7	62.2	22	152
Golden Spike*	21	12.4	61.8	25	154
NW97S28*	21	13.5	63.8	18	148
Nuplains*	20	13.1	64.6	19	151
AP 502 CL**	20	11.5	61.3	19	144
Prowers	20	12.3	63.1	21	151
2137	19	11.6	63.3	20	150
NuFrontier*	19	11.3	63.8	18	149
NuHorizon*	18	12.2	64.0	17	150
Above**	18	11.8	62.4	19	145
Average	22	11.8	62.8	21	149
DRS (0.05)	5	---	---	2	2

*Denotes hard white wheat

**Denotes Clearfield wheat

Table 5. 2001 Wyoming statewide irrigated winter wheat variety performance trial. Theron Anderson, cooperator, Albin, Wyoming.

Brand	Entry	Grain yield bushels per acre	Test weight pounds per bushel	Heading height inches	Heading date-days from Jan.1	Winter survival percent
Gen Mills	NuFrontier*	74	62.8	24	171	89
----	Wahoo	73	60.0	23	171	91
----	NI98438	73	62.4	23	171	90
----	Millennium	73	62.2	25	172	91
----	NW97S278*	73	61.5	20	170	87
----	Jagger	72	62.4	21	168	89
----	NE97669	70	61.2	21	171	87
----	NE97689	70	58.6	23	172	92
----	NW97S182*	70	61.4	25	172	88
----	NE97S218*	69	62.1	22	172	87
----	NE97465	69	62.6	27	171	91
Gen Mills	NuHorizon*	68	62.3	21	171	89
----	Trego	67	60.6	21	170	92
----	Betty*	67	61.9	22	174	74
----	Alliance	66	56.3	21	169	88
----	NE97638	66	60.5	23	172	91
----	NI00413	65	62.6	18	166	84
----	NI00433	64	60.3	23	170	89
Gen Mills	Golden Spike*	63	59.2	23	176	89
----	Yumar	63	61.1	21	170	89
----	NI99416	62	57.7	20	169	89
----	Arapahoe	62	57.7	23	172	87
----	Wesley	61	60.7	21	171	67
----	Heyne*	61	63.4	21	172	81
AgriPro	AP85-385	61	62.8	20	169	86
----	NE97558	61	62.8	20	169	86
----	NI00437	60	62.6	20	170	91
----	Laredo	60	61.0	19	166	85

(Continued on next page...)

(Table 5 continued)

Brand	Entry	Yield	TWT	Height	Date	Survival
----	Culver	59	59.2	23	171	87
----	Akron	59	58.9	23	171	83
----	NI00438	59	62.0	19	166	87
----	Ogallala	58	63.8	18	168	85
----	Halt	57	59.4	19	167	87
----	2137	56	61.6	21	170	89
----	NI00439	56	59.8	19	170	88
----	NW97S114*	56	60.8	20	167	85
----	Lakin	55	61.5	21	169	87
----	Tomahawk	55	60.6	20	168	89
----	NE97426	55	56.5	23	172	91
----	Hondo	51	61.2	23	171	90
----	NI00432	51	61.2	23	172	87
----	Nuplains*	50	62.1	22	175	80
----	N95L11881	47	60.2	24	172	87
	Average	63	60.9	22	170	87
	DRS (0.05)	7	NS	2	1	8

*Denotes hard white wheat

Table 6. 2001 Wyoming statewide irrigated winter wheat variety performance, TREC.

Entry	Grain yield bushels per acre	Protein percent	Test weight pounds per bushel	Heading height inches	Heading date-days from Jan.1	Winter survival percent
NuFrontier*	92	12.6	61.4	27	152	94
Golden Spike*	89	12.9	59.1	23	158	98
Wesley	87	14.4	59.3	23	152	99
Ogallala	86	14.9	61.7	23	150	97
Alliance	86	12.8	59.3	24	151	98
NuHorizon*	85	12.4	60.7	22	152	98
Rawhide	84	13.9	60.6	26	151	98
Arapahoe	82	13.9	60.1	24	152	98
Nuwest*	81	13.8	59.0	24	157	95
W95-385	78	13.9	60.6	21	152	97
NE97558	78	13.5	60.3	25	156	99
Nuplains*	75	14.3	62.1	22	156	99
Average	84	13.6	60.4	24	153	98
DRS (0.05)	7	---	---	2	1	3

*Denotes hard white wheat

COOPERATOR BASED HEIFER DEVELOPMENT

Jim Freeburn and Mike Lindquist, Torrington Research and Extension Center
Wayne Tatman, Goshen County Extension Service
Frank Henderson, Converse County Extension Service
Doug Hixon, UW Department of Animal Science
Lynn Woodard, UW Department of Veterinary Sciences

The initial heifer development project is the first in what we hope will be an ongoing series of cooperator-driven beef research projects at the TREC. The project included 176 heifers from 15 beef producers in six counties. The project was completed in the 32-pen feedlot at the TREC. The focus of this initial research project was selected during two meetings in August and September and attended by UW employees and Wyoming cattle producers.

The objective of the study was to investigate two nutritional factors affecting the reproduction and growth of replacement heifers on Wyoming ranches. This study featured a 2 by 2 replication to investigate the following nutritional factors:

1. The effect of linear or constant rate of gain versus a nonlinear gain. Rates of gain for heifers in the nonlinear group were reduced initially then accelerated 60 days prior to the target breeding date.
2. The effects of using a custom Zinpro chelated mineral versus a trace mineralized salt block. All heifers were provided free choice white salt.

The project received support from a number of sources. Zinpro Mineral provided a custom mineral, Pharmacia and Upjohn provided lutalyse, and Pfizer Animal Health, Fort Dodge, and the Wyoming State Veterinary Laboratory provided veterinary supplies. Doug Hixon, Dave Moore, Cody Molle, and Dudley Booth provided AI technical services. The Wyoming Agricultural Experiment Station and the Wyoming State Veterinary Laboratory provided fiscal and human resources.

Materials and Methods

The heifers arrived at the TREC the second week of November. Upon arrival, all heifers were weighed and measured for hip height, and frame scores were computed for each. The heifers were sorted into large and small-framed groups, and those frame groups were then randomized into four subgroups. Each of the four subgroups was fed one of the following four rations:

- Constant gain/Zinpro mineral, plus salt
- Constant gain/trace mineral, plus salt
- Varied gain/Zinpro mineral, plus salt
- Varied gain/trace mineral, plus salt

The heifers were fed to reach a target breeding weight, estimated at two-thirds of mature body weight, 30 days prior to breeding dates. Heifers reached target breeding weights by April 20 and were bred by artificial insemination between May 19 and May 26, 2001. The heifers were synchronized for estrous by using MGA and lutalyse.

The heifers fed for linear gain needed to gain 1.2 to 1.4 pounds per head per day and were fed accordingly. The heifers in the nonlinear gain group were fed a maintenance or minimum gain diet until 60 days prior to the target date. At that time, the rate of gain was increased to over 2 pounds per head per day to reach the target breeding weight. The impacts on both economics and reproduction (as evidenced by observed estrous) were evaluated in the study.

Table 1. Rates of gain

Rates of gain for the various groups were as follows:

<u>Group</u>	<u>Average Daily Gain</u>
Small frame	1.27 pounds per day
Large frame	1.41 pounds per day
Zinpro	1.34 pounds per day
Trace mineral	1.34 pounds per day

<u>Subgroup</u>	<u>Average Daily Gain</u>
Constant gain/small frame	1.24 pounds per day
Varied gain/small frame	1.29 pounds per day
Constant gain/large frame	1.44 pounds per day
Varied gain/large frame	1.39 pounds per day

Table 2. Feed prices used in the study.

November 15 to February 18	
Alfalfa (including \$10 per ton for grinding)	\$92 per ton
Silage	22 per ton
Sorghum (including \$10 per ton for grinding)	70 per ton
Corn	4 per cwt.
February 19 to May 5	
Alfalfa (including \$10 per ton grinding)	\$92 per ton
Silage	26 per ton
Wheat hay (including \$10 per ton grinding)	40 per ton
Corn	4.25 per cwt.

The silage fed from May 6 to May 29 was priced at \$32 per ton. These prices are an accurate reflection of the local market at that time. Yardage was charged at the rate of 25 cents per head per day. No chute charges were assessed.

Table 3. Feed and other costs per head¹

Constant Gain/Large Frame		Varied Gain/Large Frame	
Feed through Dec. 11	\$ 15.30	Feed through Dec. 11	\$ 15.30
Feed Dec. 11 to Feb. 19	43.77	Feed Dec. 11 to Feb. 19	39.24
Feed Feb. 19 to May 5	51.35	Feed Feb. 19 to May 5	47.35
Feed May 6 to May 25	15.60	Feed May 6 to May 25	15.60
Total Feed Costs	\$126.02	Total Feed Costs	\$117.49
Yardage 191 days @ \$.25	47.75	Yardage 191 days @ \$.25	47.75
Minerals	3.85	Minerals	3.85
Rumensin	4.87	Rumensin	4.87
Vaccines, vet, MGA, lutalyse (much was donated)	2.87	Vaccines, vet, MGA, lutalyse (much was donated)	2.87
Research and breeding work valued at over \$40	Donated	Research and breeding work valued at over \$40	Donated
Total cost per heifer to May 25	\$185.36	Total cost per heifer to May 25	\$176.83
Constant Gain/Small Frame		Varied Gain/Small Frame	
Feed through Dec. 11	\$ 15.30	Feed through Dec. 11	\$ 15.30
Feed Dec. 11 to Feb. 19	40.93	Feed Dec. 11 to Feb. 19	40.06
Feed Feb. 19 to May 5	47.70	Feed Feb. 19 to May 5	46.02
Feed May 6 to May 25	15.60	Feed May 6 to May 25	15.60
Total Feed Costs	\$119.53	Total Feed Costs	\$116.98
Yardage 191 days @ \$.25	47.75	Yardage 191 days @ \$.25	47.75
Minerals	3.85	Minerals	3.85
Rumensin	4.87	Rumensin	4.87
Vaccines, vet, MGA, lutalyse (much was donated)	2.87	Vaccines, vet, MGA, lutalyse (much was donated)	2.87
Research and breeding work valued at over \$40	Donated	Research and breeding work valued at over \$40	Donated
Total cost per heifer to May 25	\$178.87	Total cost per heifer to May 25	\$176.32

¹These costs do not include the price of Zinpro mineral which was donated. The mineral cost of \$3.85 per head includes the price of the trace mineral blocks fed to half the heifers and the white salt provided to all heifers.

Conclusions and Observations

The cost to feed the heifers in the nonlinear rate-of-gain group was less than for those fed to gain in a linear fashion. Cost per head was reduced approximately \$8.50 in the large-framed heifers and about \$2.50 per head in the small-framed group. The reduced costs for feed were associated primarily with a reduction in average body size for the feeding period and lower feed requirements for the heifers whose gains were accelerated at the end of the feeding period.

If the appearance of estrous is an indicator, the heifers fed in the nonlinear group excelled in reproduction as well. Of the total of 162 heifers that were synchronized, 86 percent (or 139 head) were observed in standing estrous and bred by artificial insemination. Following are the statistics on the number of heifers in each group detected in heat and subsequently bred by artificial insemination.

Table 4. Percentage of heifers detected in heat and bred by artificial insemination (AI).

<u>Feed Group</u>	<u>Percentage Bred by AI</u>
Constant gain/large frame	90%
Varied gain/large frame	98%
Large frame average	94%
Constant gain/small frame	73%
Varied gain/small frame	88%
Small frame average	81%

The results of the mineral comparison appear to be inconclusive and are still being analyzed by UW faculty members.

Acknowledgments

Troy Cecil, Dick Swanson, Willie Dillman, and Jerry Nachtman fed the cattle and helped with weighing. Ginny Stull kept records, paid invoices, prepared reports, and typed materials for a variety of producer meetings, news releases, and internal UW reports.

INTEGRATED PEST MANAGEMENT USING PRECISION HERBICIDE APPLICATION

Dave Claypool, Steve Miller, and Craig Alford, UW Department of Plant Sciences
Larry Held, UW Department of Agricultural and Applied Economics
Wendy Berelson, Wyoming Geographic Information Science Center

Skeletonleaf bursage (SB) is a noxious, perennial weed that is difficult and expensive to control. Little agronomic, economic, or biological information is available on the species. Research is needed to obtain basic information in order to develop integrated pest management strategies that effectively control the weed, are economical, and minimize environmental impact.

The objective of this project is to establish the foundation for an integrated pest management program for control of SB in corn and hard red winter wheat using the technologies of precision herbicide application, global positioning system (GPS), and geographic information systems (GIS). This objective will be achieved by: 1) using GPS to create detailed maps of SB patches in a field; 2) quantifying the impact of SB on corn and wheat yield on an area basis (fraction of a management unit infested); 3) quantifying the impact of SB plant density on corn and wheat yield; 4) comparing the efficacy of two management systems, precision herbicide application (PHA) or whole-field herbicide application (WFA), on SB control over three years; 5) evaluating the economic effectiveness of PHA versus WFA; and 6) correlating the spatial and temporal variability of SB to selected soil physical and chemical properties using GIS.

This project is funded by the Western Region Integrated Pest Management Program (WRIPM).

Materials and Methods

Severe winter kill prevented data collection in winter wheat as originally planned in 2001. An SB-infested field was planted to corn on May 30. Prior to planting, SB patches were mapped with GPS. Croplan 266RR Mr-B30, an 85 day Roundup Ready hybrid, was planted at a rate of 17,500 seeds per acre in 30 inch rows. Roundup at a rate of 1 qt. per acre was used to control weeds other than SB. Some minor frost damage occurred at the V4 stage (June 18). Herbicide treatments were applied July 2. Percent ground cover of SB was visually estimated on July 6 at the V9 stage. SB was sampled and counted in 0.25-m² quadrats on July 13 for yield and density.

Experimental design was a randomized complete block with four replicates and three treatments. Treatments consisted of an unsprayed control, WFA, and PHA of clopyralid plus flumetsulam, which was applied as Hornet herbicide on July 2. Application rate was 2.4 fluid ounces per acre at a cost of \$9.10 per acre. Each plot was divided into three 30 by 30 feet cells. All cells were sprayed in the WFA treatment. In the PHA treatment, only those cells with an infested area of 15 percent or greater, as determined with GPS, were sprayed.

Drought prevented the corn from reaching maturity, so whole plants were harvested on September 13 for silage yield. Harvest area was 12.5 square feet. A 5 square feet quadrat of SB was sampled for dry matter yield and plant density from the center of this area. Four height ranges of corn were identified as measured from ground to base of flag leaf: 0 to 2.0 feet (0 to 60 centimeters), 2.0 to 3.3 feet (60 to 100 centimeters), 3.3 to 4.6 feet (100 to 140 centimeters), and 4.6 to 5.9 feet (140 to 180 centimeters). Height ranges were used as an indicator of the density of SB patches. An adjusted silage yield (weighted average) was calculated based on samples from each height range.

Results

Distribution of SB was highly variable throughout the experimental area, and it affected corn height. Infested area of cells as measured with GPS on May 28 ranged from 8 to 100 percent with a mean of 56 percent. Percent ground cover estimates ranged from 0.5 to 50 percent with a mean of 16 percent. On July 13, SB yield ranged from 1.0 to 45.1 grams per square meter; density ranged from 4 to 60 plants per square meter (1 m² = 10.76 ft²). Table 1 summarizes corn and SB data. Treatments did not significantly affect corn yield.

Table 1. Summary of corn and skeletonleaf bursage data for 2001.

Herbicide treatment	Adjusted silage yield	Cell area infested with SB - preplant	SB ground cover July 6
	Tons per acre	Percent	Percent
Check	1.97	52.8	16.7
Whole-field application	1.91	55.5	17.6
Precision application	1.95	58.4	14.0
ANOVA	NS	NS	NS
CV (percent)	15.5	36.2	68.6

Harvest date September 13, 2001

NS = nonsignificant

**MONSANTO CENTER OF EXCELLENCE
UW ARCHER RESEARCH AND EXTENSION CENTER
2001 CROP REPORT**

Cory Pexton, Jim Freeburn, Phillip Bulgin, and Keith Heschke, Archer Research and Extension Center
Jeff Tichota, Monsanto Corporation
Jim Cochran, Laramie County Conservation District

The Monsanto Center of Excellence is an ongoing project conducted with the involvement of Monsanto Corporation, the University of Wyoming, and the Laramie County Conservation District. The project consists of a no-till cropping system with a series of different rotations for each field. The project has been ongoing since 1999 and is slated to continue through 2004. The Monsanto Center of Excellence project, consisting of 18.9 acres, is located just east of the AREC. The 18.9 acres are broken down into nine fields, numbered 209-217.

Materials and Methods
(by field)

Field Rotation

Fallow 2000

209 Demo 2001 2.02 acres Fallow 2002

During the first week of May this demonstration field was planted with Carneval grain peas at a rate of 10 pounds per acre utilizing a Haybuster hoe drill. The day after it was planted, the field was sprayed with 1 pt. per acre of Roundup. The peas were harvested around the first week in August, yielding 320 pounds per acre. After harvest the field was fallowed using Fallow Master at 44 ounces per acre.

Millet 2000

210 Spring Forage 2001 1.90 acres Winter Wheat 2002

During the first week of April, 40 pounds N + 10 pounds P₂O₅ per acre of fertilizer was applied. This crop was planted in the last week of April using a Haybuster hoe drill. The planting rate was 47 pounds per acre of Australian winter peas mixed with 22 pounds per acre of Monida oats. After planting and before emergence, the field was sprayed with 1 pt. per acre of Roundup. The oats and peas were combined in the last week of August, yielding 23.2 bushels per acre. After harvest the field was sprayed with Fallow Master at 44 ounces per acre.

Spring Forage 2000

211 Winter Wheat 2001 1.67 acres Sunflower 2002

Pronghorn winter wheat was planted in the middle of September 2000 at a rate of 50 pounds per acre utilizing the Haybuster hoe drill. We had a very dry fall, and the winter proved to be very harsh with very little moisture and strong gusty winds. Due to winter conditions, winter kill was substantial. We sprayed in late May with a tank mix of 1 pt. per acre Buctril + ½ pt. per acre 2,4D. The weed control was 80 percent effective due to weather conditions and pre-existing conditions. The wheat heads emerged around the second week of June at about 18 inches. Harvest took place around the second week in August yielding only 19.7 bushels per acre due to low populations. Weeds were controlled with Paraquat after Harvest.

Winter Wheat 2000

212 Sunflower 2001 1.95 acres Millet 2002

During the first week of April, 40 pounds N + 20 pounds P₂O₅ per acre of fertilizer was applied. The field was sprayed with 34 ounces per acre Prowl + 1 pt. per acre Roundup. The last week in May using a Max emerge II vacuum planter Hysun 450 AK # 2, sunflowers were planted in 30 inch rows at a population of 17,500. The sunflowers began to bud in the first week of August. Harvest took place in the middle of October, yielding 1,003 pounds per acre.

Sunflower 2000

213 Millet 2001 1.88 acres Spring forage 2002
During the first week of April, 40 pounds N + 20 pounds P₂O₅ per acre of fertilizer was applied. Weeds were controlled up to planting using Roundup Ultra Max. Using a double disc drill, foxtail millet was planted at a rate of 21 pounds per acre. In the second week of August, the millet was swathed and baled. The millet yielded 30 bales at 80 pounds per bale, 2,400 pounds per acre. Weed problems were minimal after harvest, requiring one spraying with Roundup Ultra Max.

Demo 2000

214 Fallow 2001 2.29 acres Demo 2002
A fallow state was maintained using Fallow Master + Ammonium Sulfate supplied by Monsanto Corporation.

Spring forage 2000

215 Winter Wheat 2001 2.80 acres Corn 2002
Pronghorn winter wheat was planted in September 2000 at a rate of 50 pounds per acre utilizing the Haybuster hoe drill. We had a very dry fall, and the winter proved to be very harsh with little moisture and strong gusting winds. Due to winter conditions, winter kill was substantial. We sprayed in late May with a tank mix of 1 pt. per acre Buctril + 1/2 pt. per acre 2,4-D. The weed control was 80 percent effective due to weather conditions and pre-existing conditions. The wheat heads emerged around the second week of June at about 18 inches. Harvest took place the second week in August, yielding 17 bushels per acre due to low populations. Weeds were controlled with Paraquat after harvest.

Winter wheat 2000

216 Corn 2001 1.95 acres Spring forage 2002
During the first week of April, 40 pounds N + 20 pounds P₂O₅ per acre of fertilizer was applied. Before planting, weeds were controlled with Roundup Ultra Max. DEKALB Hybrid seed corn was planted during the middle of May using a Maxemerge II vacuum planter at a population of 30,000 seeds per acre. Two weeks after planting, the Roundup ready corn was sprayed with a rate of 1 qt. per acre Roundup Ultra + 1.7 pounds per acre ammonium sulfate. The corn tasseled in the last week in July. The field remained mostly free of weeds throughout the growing season. The corn was combined during late October, yielding 45 bushel per acre.

Corn 2000

217 Millet 2001 2.38 acres Winter Wheat 2002
During the first week of April, 40 pounds N + 20 pounds P₂O₅ per acre of fertilizer was applied. Weeds were controlled up to planting using Roundup Ultra Max. Using a double disc tye drill, foxtail millet was planted at a rate of 21 pounds per acre. The second week of August the millet was swathed and baled. The millet yielded 36 bales at 80 pounds per bale, 2,880 pounds per acre. Weed problems were minimal after harvest, requiring one spaying with Roundup Ultra Max.

The AREC staff would like to express special thanks to Jeff Tichota, Monsanto Corporation, and Jim Cochran, Laramie County Conservation District, for their substantial contributions to the project.

PERFORMANCE OF DRYLAND GRAZING CORN

David Koch and Jeffery Flake, UW Department of Plant Sciences

Corn varieties, bred for use as forage, can be stockpiled and consumed in the late fall or early winter to extend the grazing season and reduce winter feeding costs. High sugar forage corn has a good fit for stockpiling because it is tall growing, strong stalked, and has better feed quality than other stockpiled grasses. Cargill HS 60A, a modified silage-corn variety, has improved feed quality in part because it is male sterile, allowing plant nutrients to accumulate in the leaves and stalks rather than in grain. As opposed to grain corn, grazing corn in a rotation is advantageous because 1) grain maturity is not a concern, 2) it can be grown in marginal grain production areas, 3) foundering risks are minimized, 4) palatability of stalks and leaves is improved, 5) nutrient cycling is improved, and 6) harvesting, one of the largest costs of corn production, is eliminated when the crop is grazed. Aside from the need for higher plant populations for maximum forage production (higher seed costs), the production practices are the same as for grain corn. Successful stands have been established using a grain drill by shutting off every other seed opening (16 inch rows). Wyoming producers have begun growing HS 60A corn for fall and winter grazing under irrigation. Additionally, it has been grown at the AREC the past three years under dryland conditions. This report summarizes the dryland performance of HS 60A over the last 4 years at the AREC. Since this research was completed, Cargill HS 60A was withdrawn from the market. Grain production due to failure of the variety to remain sterile was one reason for market withdrawal.

Methods

Although each of the six experiments included in this summary contained specific objectives with various seeding rates and methods, a treatment common to all the studies was HS 60A planted at 30,000 seeds per acre on 30 inch row spacings with a John Deere MaxEmerge vacuum planter. This summary compares that treatment across field sites and years. Planting dates are shown in Table 1. Except for 2000, fields were fallowed through the summer and fall the year before corn was planted. All fields received between 50 and 100 pounds of N.

Results

Figure 1 shows March to August rainfall and forage corn yields. Yields ranged from 1.5 to 3.5 tons of dry matter per acre and were generally higher with increasing rainfall. Only one of the six trial fields sown to forage corn failed to produce. This was the year 2000 site that grew under drought conditions (1.1 inches of precipitation from March to August). While soil moisture was available for excellent germination, dry weather dominated thereafter and the corn ceased growing at about 12 inches tall in early July. In 1998, however, similar dry conditions prevailed (1.6 inches of precipitation from March to August), yet 2.3 tons of forage corn was produced. The big difference in these two years was the difference in land management the fall before. Where the forage corn failed, triticale was fall sown the previous year and then sprayed out with Roundup® at 6 to 8 inches tall on May 11, 2000. That same day, HS 60A was sown just behind the Roundup application. Therefore, failure at this location/year was attributed to poor soil moisture reserves (lack of fallow the preceding fall) in combination with drought conditions following emergence.

With a seeding rate of 30,000 seeds per acre, actual plant populations ranged from 25,000 to 31,000 plants per acre. Reduced germination was often attributed to difficulty in getting seed deep enough for moist soil contact in the dryland environment. A positive correlation between seeding rate and forage corn yield was demonstrated in the 1999 study (20,000 seeds per acre < 30,000 < 40,000 > 50,000, see 2000 report). As noted, peak forage yield was with 40,000 seeds per acre. Corn heights at maturity ranged from 2 to 6 feet within and among studies. Variation in corn height appeared to be related to moisture stress relative to the soil's water-holding capacity and weed competition.

Planting dates were as early as May 11 and as late as June 14 (Table 1). Interestingly, the best yield was observed with the latest planting (June 14). The June 14 planted study received the greatest rainfall, again indicating that moisture is the key limitation in production. In 2001, two sites were sown identically but 20 days apart with the later planting yielding 0.5 tons less than the earlier. However, nitrogen was applied to the earlier seeding before corn

emergence but applied postemergence (12 inch corn) on the later planting, which may have exacerbated this yield difference.

Leaf yield relative to the whole plant yield in the dryland environment was especially interesting after the first season (1998), in which 54 percent of the yield was from leaf growth (Table 1). Livestock first consumed leaf tissue along with the uppermost stalk when turned in to graze. The crude protein content of forage corn leaf tissue has been observed to be nearly twice that of the stalk crude protein in some years, but this difference is not so marked in other years. The data of subsequent years, however, has shown that leaves comprise between 22 and 54 percent of the total forage. Drier conditions may increase leaf tissue yields relative to the whole plant.

Of the annual forages suited to dryland production in the lower elevations of southeastern Wyoming, high sugar forage corn is a good option for both yield and quality. Forage corn is a water-intensive crop, and, short of abnormally wet spring and summer conditions, will require stored moisture from a previous fallow to produce adequately. The 2001 seed price for Cargill HS 60A was \$64 per bag (53.6 pounds, 80,000 kernels). This equates to a \$24 per acre seed cost, and fertilizer inputs are necessary as well. Lambs gain well (0.3 pounds per day) on forage corn, and ewes, with their strong jaws, can utilize even tough, lower stalks. Therefore, lambs should be turned out first, followed by ewes. Preliminary weight gain data from first-year heifers grazing forage corn looks promising as well. Grazing forage corn should be managed to leave sufficient residue to prevent wind erosion. At least 50 percent ground cover should remain as well as at least 6 to 8 inches of stubble. Dry corn leaves on stockpiled forage corn have been susceptible to loss in windstorms. Grazing earlier before leaves become dry and brittle may be prudent in high wind areas. As with any forage, rotational or strip grazing, if practical, will improve utilization.

Figure 1. March to August rainfall and dryland corn yields at Archer, WY (1998 - 2001).

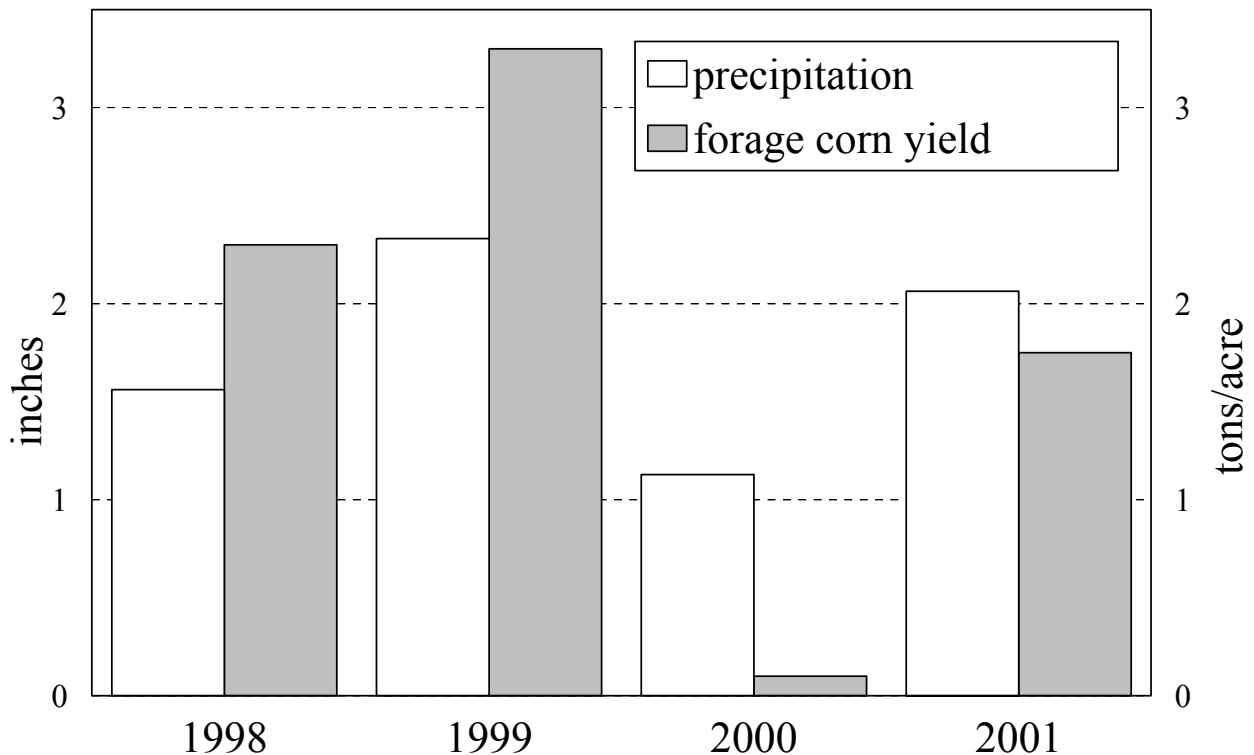


Table 1. High sugar forage corn performance over four years and six locations.

Site	Planting Date	Precipitation Mar - Aug (inches)	Target Population (plants/A)	Actual Population (plants/A)	Harvest Date	Height Range (inches)	Average Height (inches)	Yield t/A	Leaf Yield (%)
1	21-May-98	9.4	30,000	27,588	09-Sep	24 - 72	48	2.3	54
2	14-Jun-99	16.0	30,000	31,450	14-Sep	56 - 72	65	3.3	33
3	14-Jun-99	16.0	30,000	29,040	11-Oct	43 - 57	49	3.3	22
4	11-May-00	8.3	30,000	31,214	crop lost to drought				
5	05-Jun-01	13.4	30,000	25,265	19-Sep	30 - 54	41	2.0	40
6	16-May-01	13.4	30,000	26,659	19-Sep	41 - 63	50	1.5	31

**RESPONSE OF WINTER WHEAT AFTER FALLOW,
WINTER WHEAT, AND GRAZED AUSTRIAN WINTER PEA**

Jim Krall and Jerry Nachtman, Torrington Research and Extension Center
Dave Claypool, UW Department of Plant Sciences

Introduction

The concept of the re-integration of crops and livestock into today's farming operations is appealing. Benefits of diversification may be numerous. Since 1994 dryland studies have been conducted to determine the feasibility of utilizing peas as the forage component to integrate livestock into the wheat-summer fallow cropping system, replacing 12 of the 14 months of summer fallow with Austrian Winter Pea.

Materials and Methods

Two identical replicated studies were initiated in 1994 and 1995 at the AREC. Results from individual years for these studies have been reported previously. Here is a report on the comparison of wheat production after fallow, winter wheat, and grazed Austrian Winter Pea. Conventional tillage practices were used in wheat-fallow, and minimum tillage practices were followed in the production of wheat in the other systems, with herbicides used when necessary to manage weeds. Austrian Winter Pea was planted in the fall for short-term grazing, with lambs beginning in June and termination occurring by July 1 to conserve soil water.

Results and Discussion

The year 2001 was the last year of the evaluation of winter wheat plant-back. Table 1 shows the comparison between fallow, grazed pea, and winter wheat. It is important to note that wheat yields after peas and after fallow are not significantly different and that wheat protein content is significantly different. Long-term, grazed peas significantly reduce soil water compared to fallow. This had no significant negative effect on the subsequent wheat yield although there was a trend toward lower yield after peas of 2.9 bushels per acre. In effect, wheat protein was significantly higher by 1.7 percent following grazed peas compared to fallow. Even though the peas are depleting soil moisture in the rooting zone, perhaps the increase in organic matter may be improving organic soil N, thus helping the wheat better utilize soil moisture. The termination of grazing by July 1 improved winter wheat grain protein compared to fallow with only a trend toward reduction in yield.

Table 1. Winter wheat and plant available soil water after fallow, grazed pea, and winter wheat over time. AREC, 1995-2001.

Rotation	Yield	Test weight	Protein	Available soil water 0 to 2 ft. ¹	Available soil water 0 to 3 ft. ¹
	Bushels per acre	Pounds per bushel	percent	Inches	Inches
Fallow-wheat	33.5	58.1	12.4	2.5	2.8
Grazed peas-wheat	30.6	57.5	14.1	1.9	2.1
Continuous wheat	17.9	58.0	12.4	1.9	2.2
ANOVA ²					
Year (rep)	***	**	*	**	***
Rotation	***	NS	**	+	+
LSD (.05)	4.9	1.5	1.1	0.5	0.7
CV (%)	13.9	2.0	6.6	19.3	24.1

¹ Soil water measured at wheat planting.

² +, *, **, *** Significant at P > 0.10, 0.05, 0.01, and 0.001, respectively.

SPRING BARLEY VARIETY PERFORMANCE EVALUATION

Lyle Bjornestad and Mike Killen, Powell Research and Extension Center
Roger Hybner, Sheridan Research and Extension Center
Jerry Nachtman, Torrington Research and Extension Center
Gurn Brown, UW Lincoln County CES

The variety performance evaluations conducted by the Wyoming Agricultural Experiment Station are a continuous and ongoing program. In cooperation with the Western Spring Barley Nursery and private seed companies, a wide range of germplasm is evaluated each year.

Advanced yield trials are grown at Research and Extension Centers in Powell and Sheridan. During 2001 trials were also conducted on the Padlock Ranch near Dayton, Wyoming, the Dave Hinman farm near Wheatland, Wyoming, and on the Ron Crook farm near Freedom, Wyoming. These trials are situated to best represent the major spring small grain growing areas in Wyoming.

A preliminary yield trial is conducted at Powell in conjunction with the advanced yield trial. This trial is used to screen new germplasm received each year. Varieties selected from this trial are then tested in the advanced trials.

The objective of these performance evaluations is to evaluate experimental germplasm for release as varieties for production in Wyoming. Growers should identify varieties that perform well in their area and then conduct on-farm variety trial evaluations using their management practices.

Materials and Methods

The experimental design of all trials was three replications of a randomized complete block. Measurements included heading date, height, lodging, grain yield, test weight, and kernel plumpness. Data were analyzed using SAS procedures for analysis of variance.

Ron Crook Farm: The experiment was located near Freedom, Wyoming, during 2001. The soil in the study area was prepared for planting by spring chiseling and rolling. On May 16, a total of 12 barley varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 1.5 inch, and the seeding rate was 100 pounds of seeds per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Padlock Ranch: The experiment was located Dayton, Wyoming, during 2001. The soil, a Nuncho-Emigrant Association (fine, montmorillonitic, mesic; Aridic Argiustolls), had a cropping history of: 2000 fallow and 1999, small grains. The soil in the study area was prepared for planting by spring chiseling and rototilling. Fertilizer was applied at the rate of 100 pounds of nitrogen per acre in the form of ammonium nitrate (34-0-0). On April 12, a total of 12 barley varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2 inch, and the seeding rate was 100 pounds of seeds per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Powell Research and Extension Center: The soil, a Garland clay loam (fine, mixed, mesic; Typic Haplargid), had a cropping history of 2000, sugar beets; 1999, barley; and 1998, sugar beets. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied on April 12 at the rate of 120 pounds N and 50 pounds P₂O₅ in the form of ammonium nitrate (34-0-0) and diammonium phosphate (11-52-0). The soil in the study area was prepared for planting by fall plowing, roller harrowing, and leveling. On April 17, a total 42 barley varieties was established in plots 7.3 by 20 feet using double disk openers set at a row spacing of 7 inches. The seeding depth was 1.5 inches, and the seeding rate was 100 pounds of seeds per acre. Weeds were controlled by a post application of a tank mixture of bromoxynil and MCPA (Bronate) and difenzoquat (Avenge) broadcast at 0.50, 0.50, and 0.75 pounds of active ingredient per acre. Furrow irrigations were April 28, May 25, June 1, June 30, July 15, and August 1. Subplots 4.5 by 8 feet were harvested on August 21 using a Wintersteiger plot combine.

Sheridan Research and Extension Center: The soil, a Wyarno clay loam (fine, montmorillonitic, mesic; Ustollic Haplargid), had a cropping history of 2000, fallow; 1999, small grains; and 1998, fallow. The soil in the study area

was prepared for planting by fall chiseling, followed by spring chiseling and roller harrowing. On April 12, a total of 12 barley varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2.5 inches, and the seeding rate was 50 pounds of seeds per acre. Subplots, 4.5 by 15 feet, were harvested using an Almaco plot combine.

Dave Hinman Farm: The experiment was located near Wheatland, Wyoming, during 2001. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied at the rate of 150 pounds N, 78 pounds P₂O₅, and 50 pounds Potash. On March 22, a total of 12 barley varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 9 inches. Weeds were controlled by a post application of Harmony and Salvo applied by Simplot at the labeled rates for each chemical. Subplots were harvested on July 27 using an Almaco combine.

Acknowledgments

Appreciation is extended to Ron Crook, Dave Hinman, Steve Miller and crew, and the Powell, Sheridan, and Torrington Research and Extension Center staffs for their assistance during 2001.

Table 1. Agronomic performance of spring barley genotypes grown at the Ron Crook farm in Freedom, Wyoming, during 2001.

Variety	Row type	Heading	Grain ¹	Test	Kernel plumpness	
		date	yield	weight	6/64	5.5/64
		Day of year	bushels per acre	pounds per bushel	% above screen	
Malt Use						
Legacy	6	184	94	46	90	97
Drummond	6	183	90	47	92	98
B1202	2	186	81	50	96	99
Galena	2	188	78	49	87	97
Merit	2	190	74	49	90	97
Stander	6	185	70	49	96	99
Harrington	2	187	58	48	93	99
Feed Use						
UT004467	6	180	101	46	76	89
Step toe	6	181	88	45	91	98
WPBDA587-124	6	187	84	46	89	97
Baronesse	2	186	83	49	88	97
Tango	6	182	77	44	77	89
LSD _{0.05}		2	NS	2.2	11	NS
Mean		185	81	47	89	97

¹Coefficient of variation = 22.8%.

NS = non significant.

Table 2. Agronomic performance of spring barley genotypes grown at the Padlock Ranch in Dayton, Wyoming, during 2001.

Variety	Row type	Lodging ¹	Plant	Grain ²	Test	Kernel plumpness	
		index	height	yield	weight	6/64	5.5/64
			Inches	bushels per acre	pounds per bushel	% above screen	
Malt Use							
Legacy	6	1	27	72	45	91	97
B1202	2	1	23	71	47	95	98
Merit	2	1	28	67	46	90	97
Stander	6	1	28	67	47	92	97
Drummond	6	1	29	66	46	90	97
Harrington	2	1	27	60	46	93	98
Galena	2	1	25	59	45	86	96
Feed Use							
UT004467	6	1	27	76	42	73	91
Step toe	6	1	28	69	42	85	95
Baronesse	2	1	25	69	46	87	96
Tango	6	1	28	64	40	71	89
WPBDA587-124	6	1	19	59	41	80	95
LSD _{0.05}		NS	3	NS	4.7	16	NS
Mean		1	26	67	44	87	97

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 11.9%.

NS = non significant.

Table 3. Agronomic performance of spring barley genotypes. PREC, 2001.

Variety	Row type	Plant height Inches	Lodging ¹ index	Grain ² yield bushels per acre	Test weight pounds per bushel	Kernel plumpness	
						6/64	5.5/64 %above screen
Malt Use							
Stander	6	30	2.3	126	51	97	99
Morex	6	30	1.1	126	52	97	99
Drummond	6	33	1.5	122	50	95	98
Merit	2	30	1.9	118	52	93	98
Legacy	6	30	1.7	116	50	95	99
2B97-4299	2	28	1.2	111	52	98	99
Harrington	2	31	2.5	110	52	97	99
92Ab5180	6	26	1.0	108	47	65	79
BCD 47	2	23	2.3	105	51	93	99
MT960099	2	26	3.1	104	52	90	98
6B95-2482	6	32	3.1	102	51	95	99
Galena	2	26	1.4	102	52	93	98
ND15422	6	30	3.5	101	50	96	99
WA10138-96	2	27	1.1	100	53	97	99
MT9970116	2	33	3.2	99	54	98	99
MT9970116	2	33	3.2	99	54	98	99
WA8682-96	2	29	2.5	98	51	92	98
CDC Select	2	30	2.2	95	52	98	99
TR 167	2	33	2.5	94	54	98	99
2B96-5057	2	27	2.6	88	52	98	99
CDC Copeland	2	32	1.0	87	53	97	99
B1202	2	31	4.3	84	50	93	98
95SR149C	2	31	4.5	84	52	96	99
2B97-4077	2	30	1.0	83	52	97	99
Feed Use							
UT95B1216-4087	6	30	1.0	141	50	93	99
Tango	6	28	2.2	128	48	89	97
UT97B1480-1632	6	28	1.0	127	51	95	99
UT004467	6	27	1.0	126	49	77	92
Steptoe	6	29	1.7	123	48	96	98
ID93Ab688	6	27	1.7	122	49	83	98
UT003757	6	27	1.0	121	48	85	97
BZ594-20	2	25	1.0	120	53	98	99
WA8709-96	2	28	1.6	110	53	95	99
Baronesse	2	26	1.8	109	52	93	98
PB1972R7090	2	28	1.0	108	54	98	99
MT960228	2	29	3.5	105	52	93	99
WA10147-96	2	25	1.0	105	52	97	99
BZ96-117	2	31	1.3	102	53	96	99
PB1952R517	2	28	1.0	101	54	98	99
WPBDA587-124	6	19	1.8	101	49	91	97
CDC Helgason	2	30	1.0	100	54	97	99
PB152RA629	2	29	1.0	98	52	97	99
CDC Bold	2	27	2.5	98	53	95	98
LSD _{0.05}		3.4	2.6	19	NS	NS	NS
Mean		29	1.8	107	51	94	98

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 10.6%.

Table 4. Agronomic performance of spring barley genotypes. SREC, 2001.

Variety	Row type	Plant height Inches	Grain ¹ yield bushels per acre	Test weight pounds per bushel	Kernel plumpness	
					6/64	5.5/64
					% above screen	
Malt Use						
Legacy	6	19	32	46	55	91
Galena	2	20	30	48	48	90
Merit	2	20	29	43	47	83
Drummond	6	21	28	46	51	90
Harrington	2	20	28	46	60	90
B1202	2	18	27	43	47	88
Stander	6	21	27	47	60	93
Feed Use						
Step toe	6	20	37	47	73	94
Tango	6	19	30	44	37	86
Baronesse	2	19	29	47	39	88
UT004467	6	16	29	47	42	84
WPBDA587-124	6	14	26	44	49	92
LSD _{0.05}		2.4	NS	2	11	6
Mean		19	29	46	51	89

¹Coefficient of variation = 13.3%
NS = non significant.

Table 5. Agronomic performance of spring barley genotypes grown at the Dave Hinman farm in Wheatland, Wyoming, during 2001.

Variety	Row type	Heading date Day of year	Plant height Inches	Grain ¹ yield bushels per acre	Test weight pounds per bushel	Kernel plumpness	
						6/64	5.5/64
					% above screen		
Malt Use							
Stander	6	164	25	102	49	86	95
Drummond	6	163	27	97	48	89	96
Galena	2	166	24	94	48	82	89
Legacy	6	163	26	91	48	85	94
Merit	2	167	25	89	45	72	84
B1202	2	166	24	88	47	88	92
Harrington	2	166	25	79	47	77	91
Feed Use							
UT004467	6	163	22	112	46	80	88
Baronesse	2	164	25	99	48	88	94
Step toe	6	163	26	98	45	73	87
Tango	6	163	24	94	46	85	94
WPBDA587-124	6	164	18	89	44	78	86
LSD _{0.05}		1.2	2.4	12.3	2.2	3.4	NS
Mean		164	24	94	47	82	91

¹Coefficient of variation = 8.1%
NS = non significant.

SPRING OAT VARIETY PERFORMANCE EVALUATION

Lyle Bjornestad and Mike Killen, Powell Research and Extension Center
Roger Hybner, Sheridan Research and Extension Center
Jerry Nachtman, Torrington Research and Extension Center
Gurn Brown, UW Lincoln County CES

The variety performance evaluations conducted by the Wyoming Agricultural Experiment Station are a continuous and ongoing program. In cooperation with the Northwestern States Oats Nursery and private seed companies, a wide range of germplasm is evaluated each year.

Advanced yield trials are grown at Research and Extension Centers in Powell and Sheridan. During 2001 trials were also conducted on the Padlock Ranch near Dayton, Wyoming, the Dave Hinman farm near Wheatland, Wyoming, and on the Ron Crook farm near Freedom, Wyoming. These trial sites are selected to best represent the major small grain growing areas in Wyoming.

A preliminary yield trial is conducted at Powell in conjunction with the advanced yield trial. This trial is used to screen new germplasm received each year. Varieties selected from this trial are then tested in the advanced trials conducted throughout Wyoming. The numbered varieties tested during 2001 are experimental germplasm lines.

The objective of these performance evaluations is to evaluate experimental germplasm for release as varieties for production in Wyoming. Growers should identify varieties that perform well in their area and then conduct on-farm variety trial evaluations using their management practices.

Materials and Methods

The experimental design of all trials was three replications of a randomized complete block. Measurements included heading date, plant height, lodging, grain yield, and test weight. Data were analyzed using SAS procedures for analysis of variance.

Ron Crook Farm: The experiment was located near Freedom, Wyoming, during 2001. The soil in the study area was prepared for planting by spring chiseling and rolling. On May 16, a total of 10 oat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 1.5 inches, and the seeding rate was 100 pounds of seed per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Padlock Ranch: The experiment was located near Dayton, Wyoming, during 2001. The soil, a Nuncho-Emigrant Association (fine, montmorillonitic, mesic; Aridic Argiustolls), had a cropping history of 2000, fallow and 1999, small grains. The soil in the study area was prepared for planting by spring chiseling and rototilling. Fertilizer was applied at the rate of 100 pounds N per acre in the form of ammonium nitrate (34-0-0). On April 12, a total of 10 oat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2 inches, and the seeding rate was 100 pounds of seeds per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Powell Research and Extension Center: The soil, a Garland clay loam (fine, mixed, mesic; Typic Haplargid), had a cropping history of 2000, canola; 1999, sugar beets; and 1998, small grains. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied on April 13 at the rate of 120 pounds N and 50 pounds P₂O₅, in the form of ammonium nitrate (34-0-0) and diammonium phosphate (11-52-0). The soil in the study area was prepared for planting by fall plowing, roller harrowing, spring roller harrowing, and leveling. On April 17, a total of 30 oat varieties was established in plots 7.3 by 20 feet using double disk openers set at a row spacing of 7 inches. The seeding depth was 1.5 inches, and the seeding rate was 100 pounds of seeds per acre. Weeds were controlled by a post application of bromoxynil and MCPA (Bronate) broadcast at 0.50 and 0.50 pounds of active ingredient per acre on June 2. Furrow irrigations were April 29, May 25, June 3, June 29, July 14, and July 29. Subplots 4.5 by 8 feet were harvested on August 28 using a Wintersteiger plot combine.

Sheridan Research and Extension Center: The soil, a Wyarno clay loam (fine, montmorillonitic, mesic; Ustollic Haplargid), had a cropping history of 2000, fallow; 1999, small grains; and 1998, fallow. The soil in the study area was prepared for planting by fall chiseling, followed by spring chiseling and roller harrowing. On April 12, a total of 10 oat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2.5 inches, and the seeding rate was 50 pounds of seeds per acre. Subplots, 4.5 by 15 feet, were harvested using an Almaco plot combine.

Dave Hinman Farm: The experiment was located near Wheatland, Wyoming, during 2001. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied at the rate of 150 pounds of N, 78 pounds P₂O₅, and 50 pounds of Potash. On March 22, a total of 10 oat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 9 inches. Weeds were controlled by a post application of Harmony and Salvo applied by Simplot at the labeled rates for each chemical. Subplots were harvested on July 27 using an Almaco combine.

Acknowledgments

Appreciation is extended to Ron Crook, Dave Hinman, Steve Miller and crew, and the Powell, Sheridan, and Torrington Research and Extension Center staffs for their assistance during 2001.

Table 1. Agronomic performance of oat genotypes grown at the Ron Crook Farm in Freedom, Wyoming, during 2001.

Variety	Heading date	Lodging ¹ index	Grain ² yield	Test weight
	Day of year		bushels per acre	pounds per bushel
90AB1620	191	1	141	40
94AB5543	191	1	118	38
Celsia	189	1	118	40
Powell	191	1	116	40
Otana	190	1	114	39
Monida	191	1	110	38
95AB12584	188	1	103	37
95AB11633	192	1	103	38
95AB12743	190	1	100	37
95AB10854	193	1	95	39
LSD _{0.05}	2.1	NS	NS	NS
Mean	191	1	112	38

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 21%

NS = non significant.

Table 2. Agronomic performance of oat genotypes grown at the Padlock Ranch in Dayton, Wyoming, during 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
95AB10854	37	1	101	40
95AB12743	35	1	96	37
Powell	34	1	89	37
Celsia	37	1	80	35
94AB5543	36	1	73	38
95AB11633	32	1	71	39
90AB1620	35	1	68	37
95AB12584	35	1	68	36
Monida	42	1	59	35
Otana	41	1	59	37
LSD _{0.05}	2.1	NS	NS	NS
Mean	36	1	76	37

¹Lodging index: 1 = upright, 9 = flat

²Coefficient of variation = 32%

NS = non significant.

Table 3. Agronomic performance of oat genotypes. PREC, 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
87AB5632	32	1.0	171	36
ABSP19-9	36	1.8	166	39
95AB12743	32	1.0	160	36
90AB1322	28	1.0	159	37
Monida	34	3.0	158	35
91AB502	31	1.8	156	37
96AB8796	28	1.0	155	27
UC125	30	1.0	153	39
ABSP9-2	35	1.5	149	39
91AB406	30	1.0	148	39
Killdeer	36	2.1	147	36
90AB1620	34	1.5	145	40
ABSP14-6	31	1.6	140	38
Otana	38	3.3	140	36
CDC Pacer	40	3.6	140	38
87AB4983	35	2.3	137	37
87AB5125	33	1.2	138	37
Powell	30	1.4	136	37
UC129	30	1.3	135	36
UC128	33	2.0	135	36
Ajay	38	1.2	132	39
95AB10854	32	1.1	131	39
OT382	41	4.1	129	38
94AB5543	34	1.7	128	40
Celsia	31	1.8	124	37
Whitestone	39	3.8	124	38
Derby	40	4.1	120	37
95AB12584	31	1.0	118	37
Rio Grande	37	1.0	119	37
CDC Dancer	36	2.4	112	40
Cayuse	39	3.1	110	37
95AB11633	33	1.3	85	41
LSD _{0.05}	5.6	2.3	38	2.9
Mean	34	1.3	137	38

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 14.3%

Table 4. Agronomic performance of oat genotypes. SREC, 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
Monida	24	1	52	32
Powell	19	1	48	32
94AB5543	22	1	48	34
90AB1620	21	1	48	37
95AB10854	21	1	48	32
95AB12584	24	1	47	33
95AB12743	20	1	42	31
Celsia	24	1	40	31
Otana	24	1	35	33
95AB11633	22	1	32	31
LSD _{0.05}	NS	NS	NS	3.6
Mean	22	1	44	33

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 30.6%

NS = non significant.

Table 5. Agronomic performance of oat genotypes grown at the Dave Hinman farm in Wheatland, Wyoming, during 2001.

Variety	Plant height	Heading date	Grain ¹ yield	Test weight
	Inches	Day of year	bushel per acre	pounds per bushel
95AB12743	23	167	125	32
95AB10854	23	171	121	38
Celsia	21	166	119	36
Monida	26	171	119	34
94AB5543	22	171	117	37
95AB12584	23	169	117	36
Otana	27	169	113	38
Powell	22	169	112	37
90AB1620	24	167	108	38
95AB11633	21	168	88	35
LSD _{0.05}	2.9	2.5	15.1	2.8
Mean	23	169	114	36

¹Coefficient of variation = 8.5%

NS = non significant.

SPRING WHEAT VARIETY PERFORMANCE EVALUATION

Lyle Bjornestad and Mike Killen, Powell Research and Extension Center
Roger Hybner, Sheridan Research and Extension Center
Jerry Nachtman, Torrington Research and Extension Center
Gurn Brown, UW Lincoln County CES

The variety performance evaluations conducted by the Wyoming Agricultural Experiment Station are a continuous and ongoing program. In cooperation with the Uniform Hard Red Spring Wheat Nursery and private seed companies, a wide range of germplasm is evaluated each year.

Advanced yield trials are grown at Research and Extension Centers in Powell and Sheridan. During 2001 trials were also conducted on the Ron Crook farm near Freedom, Wyoming, the Dave Hinman farm near Wheatland, Wyoming, and the Padlock Ranch near Dayton, Wyoming. These trials are situated to best represent the major small grain growing areas in Wyoming.

A preliminary yield trial is conducted at Powell in conjunction with the advanced yield trial. This trial is used to screen the new germplasm received each year. Varieties selected from this trial are then tested in the advanced trials conducted throughout Wyoming.

The objective of these performance evaluations is to evaluate experimental germplasm for release as varieties for production in Wyoming. Growers should identify varieties that perform well in their area and then conduct on-farm variety trial evaluations using their management practices.

Materials and Methods

The experimental design of all trials was three replications of a randomized complete block. Measurements included heading date, plant height, lodging, grain yield, and test weight. Data were analyzed using SAS procedures for analysis of variance.

Ron Crook Farm: The experiment was located near Freedom, Wyoming, during 2001. The soil in the study area was prepared for planting by spring chiseling and rolling. On May 16, a total of 10 spring wheat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 1.5 inches, and the seeding rate was 100 pounds of seed per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Padlock Ranch: The experiment was located near Dayton, Wyoming, during 2001. The soil, a Nuncho-Emigrant Association (fine, montmorillonitic, mesic; Aridic Argiustolls), had a cropping history of 2000, fallow, and 1999, small grains. The soil in the study area was prepared for planting by fall chiseling and rototilling. Fertilizer was applied at the rate of 100 pounds of nitrogen per acre in the form of ammonium nitrate (34-0-0). On April 12, a total of 10 wheat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2 inches, and the seeding rate was 100 pounds of seeds per acre. Subplots 4.5 by 15 feet were harvested using a Wintersteiger plot combine.

Powell Research and Extension Center: The soil, a Garland clay loam (fine, mixed, mesic; Typic Haplargid), had a cropping history of 2000, canola; 1999, sugar beets; and 1998, sugar beets. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied on April 13 at the rate of 120 pounds N and 50 pounds P₂O₅, in the form of ammonium nitrate (34-0-0) and diammonium phosphate (11-52-0). The soil in the study area was prepared for planting by spring plowing, roller harrowing, and leveling. On April 17, a total of 42 wheat varieties was established in plots 7.3 by 20 feet using double disk openers set at a row spacing of 7 inches. The seeding depth was 1.5 inches, and the seeding rate was 100 pounds seed per acre. Weeds were controlled by a post application of a tank mixture of bromoxynil and MCPA (Bronate) and difenzoquat (Avenge) broadcast at 0.50, 0.50, and 0.94 pounds of active ingredient per acre on May 25. Furrow irrigations were April 29, June 3, June 29, July 14, and July 29. Subplots 4.5 by 8 feet were harvested on August 29 using a Wintersteiger plot combine.

Sheridan Research and Extension Center: The soil, a Wyarno clay loam (fine, montmorillonitic, mesic; Ustollic Haplargid), had a cropping history of 2000, fallow; 1999, small grains; and 1998, fallow. The soil in the study area was prepared for planting by fall chiseling, followed by spring chiseling and roller harrowing. On April 12, a total of 10 wheat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 8 inches. The seeding depth was 2.5 inches, and the seeding rate was 50 pounds of seeds per acre. Subplots 4.5 by 15 feet were harvested using an Almaco plot combine.

Dave Hinman Farm: The experiment was located near Wheatland, Wyoming, during 2001. The soil was fertilized for a yield goal of 100 bushels of grain per acre. Fertilizer was applied at the rate of 150 pounds N, 78 pounds P₂O₅, and 50 pounds Potash. On March 22, a total of 10 spring wheat varieties was established in plots 5 by 20 feet using double disk openers set at a row spacing of 9 inches. Weeds were controlled by a post application of Harmony and Salvo applied by Simplot at the labeled rates for each chemical. Subplots were harvested on July 27 using an Almaco combine.

Acknowledgments

Appreciation is extended to Ron Crook, Dave Hinman, Steve Miller and crew, and the Powell, Sheridan, and Torrington Research and Extension Center staffs for their assistance during 2001.

Table 1. Agronomic performance of hard red spring wheat genotypes grown at the Ron Crook farm in Freedom, Wyoming, during 2001.

Variety	Heading date	Lodging ¹ index	Grain ² yield	Test weight
	Day of year		bushels per acre	pounds per bushel
McNeal	190	1	75	56
McVey	190	1	72	56
MN97803	190	1	69	55
N99-0010	189	1	69	55
IDO0560	192	1	68	58
N96-2444	189	1	64	58
Stoa	190	1	60	56
98S0191060-8	190	1	56	56
WA7859	189	1	51	58
ND729	189	1	42	58
LSD _{0.05}	1	NS	NS	NS
Mean	190	1	63	56

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 20.9%.

NS = non significant.

Table 2. Agronomic performance of hard red spring wheat genotypes grown at Padlock Ranch in Dayton, Wyoming, during 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
IDO0560	31	1	71	60
McVey	33	1	67	60
98S0191060-8	37	1	66	61
Stoa	36	1	63	60
McNeal	33	1	63	60
MN97803	33	1	60	61
N99-0010	29	1	60	60
N96-2444	38	1	58	62
ND729	35	1	57	62
WA7859	35	1	56	62
LSD _{0.05}	2.6	NS	NS	1.6
Mean	34	1	62	61

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 9.2%.

NS = non significant.

Table 3. Agronomic performance of hard red spring wheat genotypes. PREC, 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
N97-0100	28	1	88	64
N99-0010	27	1	86	63
Verde	30	1	83	63
IDO0560	25	1	85	61
MN97063	29	1	84	63
WA7899	30	1	82	64
2375	31	1	81	63
FA900-720	32	1	81	65
98S0191-60-8	34	1	79	63
N97-0117	28	1	78	64
MN97448	30	1	77	64
MN97803	30	1	76	64
McNeal	34	1	76	63
N96-2444	35	1	76	63
ND740	28	1	76	62
MT9874	31	1	75	62
SD3546	30	1	73	63
FA900-793	26	1	72	64
N97-0189	27	1	72	64
WA7875	31	1	71	63
WA7859	33	1	71	62
SD3540	31	1	70	63
ND743	32	1	70	64
RL4958	32	1	70	61
ND741	31	1	69	62
SD3367	32	1	68	63
McVey	30	1	67	62
Keene	34	1	67	64
N97-2627	30	1	66	63
ND729	34	1	65	64
N96-0055	27	1	65	64
SD3506	34	1	64	65
ND742	28	1	62	62
Stoa	31	1	61	63
SD3496	32	1	58	63
BW270	37	1	58	64
Chris	39	1	53	61
Marquis	38	1	41	62
LSD _{0.05}	3.3	NS	14.7	1
Mean	31	1	72	63

¹Lodging index: 1 = upright, 9 = flat.²Coefficient of variation = 12.8%

Table 4. Agronomic performance of hard red spring wheat genotypes. SREC, 2001.

Variety	Plant height	Lodging ¹ index	Grain ² yield	Test weight
	Inches		bushels per acre	pounds per bushel
McNeal	27	1	28	56
ND729	28	1	28	62
N99-0010	26	1	26	60
IDO0560	26	1	25	58
98S0191060-8	30	1	24	60
WA7859	30	1	24	60
McVey	24	1	24	56
Stoa	28	1	23	61
MN97803	26	1	23	61
N96-2444	31	1	23	61
LSD _{0.05}	3.4	NS	NS	2.4
Mean	28	1	25	59

¹Lodging index: 1 = upright, 9 = flat.

²Coefficient of variation = 18.3%.

NS = non significant.

Table 5. Agronomic performance of hard red spring wheat genotypes grown at the Dave Hinman farm in Wheatland, Wyoming, during 2001.

Variety	Heading date	Plant height	Grain ¹ yield	Test weight
	Day of year	Inches	bushels per acre	pounds per bushel
WA7859	164	23	70	59
Stoa	163	25	65	61
N96-2444	165	24	65	60
IDO0560	165	21	65	58
98S0191060-8	163	23	64	60
MN97803	164	23	63	61
ND729	163	24	63	63
McNeal	168	22	62	59
McVey	165	21	62	58
N99-0010	164	21	54	59
LSD _{0.05}	2.1	NS	NS	1.3
Mean	165	23	63	59

¹Coefficient of variation = 5.6%.

NS = non significant.

WINTER HARDY ASSESSMENT OF EIGHT CREEPING BENTGRASS CULTIVARS

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Commercial grass seed production has increased on the central high plains in recent years. Turfgrass types such as bluegrass and fescue, as well as some forage grasses, are in production on more than 2,000 acres in the Nebraska panhandle and southeastern Wyoming. An additional species might be creeping bentgrass if local seed production information on this species is available. An initial concern is winter hardiness since local golf course managers estimate up to 15 percent winter kill annually on their putting greens.

Materials and Methods

In order to assess winter hardiness in creeping bentgrass, three replicated trials containing eight entries were planted on August 14, 15, and 16, 2001, in Torrington, Wyoming, Morrill, Nebraska, and Scottsbluff, Nebraska, respectively. This experiment was conducted as a randomized complete block design with four replications. The plots were seeded using a six row plot drill with 12 inch spacing. Plots were 6 by 20 feet in length.

Results and Discussion

Early winter (December 2000) and spring (2001) assessments of winter hardiness were conducted. One trial, the Morrill, Nebraska, site, was abandoned due to establishment problems. At the remaining two trials there were differences between entries in initial stand (Table 1) that carried through into the spring. Although the winter of 2000 - 2001 was colder than what had been experienced in recent years (Figure 1), winter loss measured by differences in early winter and spring stand was considered minimal after the first winter. Vigor ratings were evaluated and reported in Table 2.

Assessments will continue for two more winters and will include measurements of seed production.

Figure 1. Monthly Minimum Temperatures (F) at Torrington

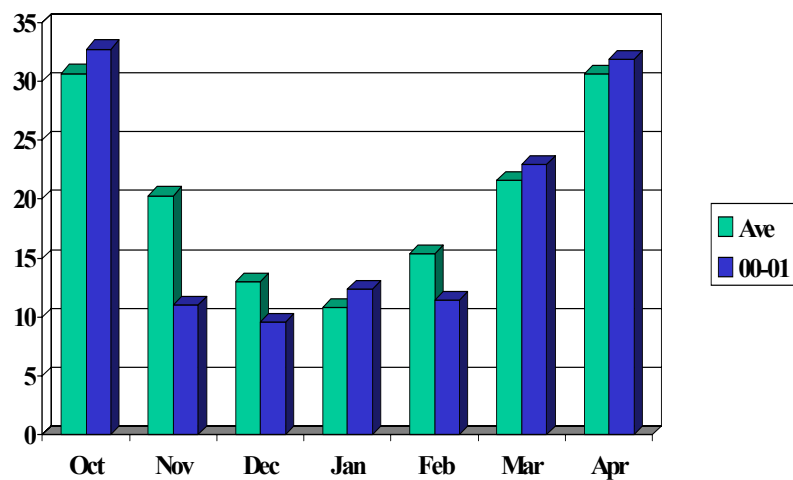


Table 1. Percent stand

Cultivar	Torrington			Scottsbluff		
	Fall	Spring	Difference	Fall	Spring	Difference
Cato	31a	24a	-7	31a	25a	-6
Crenshaw	35a	42ab	+7	30a	24a	-6
L-93	91d	90c	-1	90c	87d	-3
Penncross	81cbd	88c	+7	84cb	74c	-10
Penneagle	78cb	68bc	-10	80cb	76c	-4
Providence	86cd	90c	+4	85cb	73cb	-12
SR1020	81cbd	85c	+4	78cb	69cb	-9
Procup	73b	68bc	-5	73b	65b	-8

Table 2. Vigor 1-5 scale

Cultivar	Torrington	Scottsbluff	Mean
Cato	1.8a	0.5a	1.2
Crenshaw	1.5a	0.5a	1.0
L-93	4.8d	5.0d	4.9
Penncross	4.5dc	4.3dc	4.4
Penneagle	3.2bc	4.0c	3.6
Providence	4.6dc	3.8cb	4.2
SR1020	4.3dc	3.8cb	4.1
Procup	2.9ab	3.0b	3.0

YIELDS OF STOCKPILED, PERENNIAL FORAGES OVER THE YEARS FOLLOWING ESTABLISHMENT

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Introduction

Stockpiling forage in order to extend the grazing season to later in the fall and winter has the potential to reduce the costs incurred with producing and feeding hay. Perennial grasses and legumes were established in March 1997 at the AREC. Each fall (November - December) since establishment, these forages have been evaluated for dry matter production. This report presents five-year average yields. Initial quality data for these forages can be found in the 2000 report.

Methods and Materials

Sixteen forage species were sown at Archer, a dryland site, on March 28, 1997 (Table 1). Entries included newly released varieties from the grass-breeding program of Kay Asay, Logan, Utah. Seeding was done with a Tye® no-till drill by taping seed box openings to achieve a 24 inch row spacing. Ground preparation ahead of seeding included a chisel plow operation followed by disking. The ground had been in summer fallow the previous year. The experiment was conducted as a randomized complete block design with four replications. Plots were 2.4 by 4.6 meters (8 by 15 feet).

Yields were typically estimated by clipping all of the forage within a 1 square meter quadrat. Quadrats were set in the center two rows of each plot. Clipping height was 8.9 centimeters (3.5 inches) above the soil surface; however, samples were cut at 5 centimeters (2 inches) above the soil surface in 1997. Where leaves and stems had fallen to the ground, the plants were held erect before clipping to include the mass of this vegetation as well. Clipped forage was dried at 60°C (140°F) for 48 hours, and yields were expressed as kilograms of dry matter per hectare. Fall yield determinations were made in December 24, 1997, November 5, 1998, November 3, 1999, December 7, 2000, and December 6, 2001.

Weed control was accomplished with a narrow rototiller, hand weeding, and select hand sprayer applications of bromoxynil (Buctril®) at 1.5 pt. per acre. No fertilizer was applied to the plots. Each March, the entire plot area was mowed and the residue removed.

Results and Discussion

Fifty-five centimeters (21 inches) of precipitation fell on these dryland plots in the six months after they were planted, resulting in excellent stands and first-year yields for most of the forage species (Figure 1). Long-term average precipitation for this same period at Archer is 25 centimeters (9.7 inches). Averaged across species, yields each year were positively correlated to the amount of spring rainfall received (Figure 1). Winter snowfall totals were similar among years (Figure 2).

Initial sainfoin and forage kochia seedlots were poor. Sainfoin was replanted with an improved seedlot, and multiple kochia seedlings were made to ensure robust stands of both species by the spring of 1998. Forage kochia and sainfoin were not harvested in 1997 because of these establishment problems.

Nearly all the legume leaves were lost to frost before the fall sampling; further, legume yields appeared to suffer to a small degree from deer predation, particularly the sainfoin plots.

Most of the species exhibited no spreading tendency and remained in their originally planted rows. By year five, however, a few of the rhizomatous grasses were well on their way to forming a sod across the entire plot area. These included intermediate wheatgrass, pubescent wheatgrass, Newhy hybrid wheatgrass, and western wheatgrass. Another case of spreading occurred with forage kochia. Initially, fairly large shrubs, 20 to 35 centimeters tall (8 to 14 inches), of kochia remained isolated from one another in the plot with much bare ground between plants. However, during the spring/summer of 2001, many new kochia seedlings sprouted (from seed) and filled most of the

bare areas. These seedlings remained small at 3 to 13 centimeters tall (1 to 5 inches) throughout the 2001 growing season.

1997 Yields: Following the extraordinarily wet establishment spring/summer of 1997, December yields of tall, intermediate, pubescent, and hybrid wheatgrass were about 4,000 kg. per ha. (1.8 tons per acre) (Table 2). Western wheatgrass and the wildrye grasses yielded about 2,000 kg. per ha. (0.9 tons per acre). Alfalfa and cicer milkvetch yielded 1,300 and 2,400 kg. per ha. (0.6 and 1.1 tons per acre), respectively.

1998 Yields: The spring/summer precipitation during 1998 of 24 centimeters (9.4 inches) was more typical of this region. Grasses yielded 1,500 to 2,000 kg. per ha. (0.7 to 0.9 tons per acre) (Table 2). Tall wheatgrass yielded best at 2,500 kg. per ha. (1.1 tons per acre), while basin wildrye and western wheatgrass yielded poorest at <1,000 kg. per ha. (<0.5 tons per acre). Forage kochia yield was the greatest among all species at 3,000 kg. per ha. (1.3 tons per acre). This plant has fine, dense, woody stems with a very fine and inconspicuous leaf and appears well suited to drought conditions. Legume yields following this drier season were modest at 600 to 800 kg. per ha. (0.3 to 0.4 tons per acre).

1999 Yields: In November of 1999, following another moist spring/summer at 40 centimeters of precipitation (16 inches), only tall wheatgrass yielded above 4,000 kg. per ha. (1.8 tons per acre) (Figure 2). The remainder of the wheatgrasses and the wildryes yielded similarly indicating that wildryes establish more slowly than the wheatgrasses. Exceptions to this included Russian wildrye and western wheatgrass that yielded only 2200 and 1800 kg. per ha., respectively. Forage kochia and the legumes yielded between 2,300 and 1,700 kg. per ha. (1 and 0.8 tons per acre) in the fall of 1999.

2000 Yields: The spring/summer precipitation during 2000 was again typical of the long-term average at 21 centimeters (8.3 inches). While this rainfall amount was similar to that received in 1998, grass yields were generally lower than 1998, ranging from 950 to 1,820 kg. per ha. (0.4 to 0.8 tons per acre). Conversely, legume yields were greater than 1998 yields but still down from wetter years. The big surprise was kochia that yielded a mere 921 kg. per ha. (0.4 tons per acre) compared to a yield of 2,266 kg. per ha. (1 ton per acre) in 1998.

2001 Yields: A slightly wetter than normal spring/summer in 2001 at 34 centimeters of precipitation (13.4 inches) generally produced grass yields between 1,500 and 2,000 kg. per ha. (0.67 and 0.89 tons per acre). Legume yields were below 1,000 kg. per ha. (0.45 tons per acre). Kochia was again the surprise species yielding 2,423 kg. per ha. (1.08 tons per acre), highest of all the species for 2001. Improved kochia yield may have been due, in part, to the increased number of seedlings that appeared to sprout from seed (seed dropped by adjacent mature shrubs) early in the spring of 2001.

Five-Year Averages: Generally the grasses averaged about 2,000 to 2,500 kg. per ha. (0.89 to 1.11 tons per acre) over the last 5 years with the wheatgrasses tending to slightly out-produce the wildryes. Tall and intermediate wheatgrass yields averaged slightly better than most species at 2,907 and 2,643 kg. per ha. (1.3 and 1.2 tons per acre), respectively. Poorest average yield from the grasses was western wheatgrass at 1,486 kg. per ha. (0.66 tons per acre). Forage kochia yield averaged 1,729 kg. per ha. (0.77 tons per acre), quite respectable given the better protein content associated with this species. While legumes also have better protein, their poor average yields (Nov. to March) of 800 to 1,300 kg. per ha. (0.36 to 0.58 tons per acre) make them less attractive as a stockpiled forage. Legumes should be grazed before or soon after the first killing frost to minimize dry matter losses.

Table 1. Species selected for the perennial, winter forage study at Archer, WY.

Common name	Variety	Species name
Crested Wheatgrass	'CD-II'	<i>Agropyron cristatum</i>
Hybrid Wheatgrass	'Newhy'	<i>Agropyron repens</i> x <i>Agropyron spicatum</i>
Hybrid Wheatgrass	'RS-H'	<i>Agropyron repens</i> x <i>Agropyron spicatum</i>
Intermediate Wheatgrass	'Greenar'	<i>Thinopyrum intermedium</i>
Pubescent Wheatgrass	'Luna'	<i>Thinopyrum intermedium</i>
Tall Wheatgrass	'Alkar'	<i>Thinopyrum ponticum</i>
Western Wheatgrass	'Rosana'	<i>Pascopyrum smithii</i>
Altai Wildrye	'Angustus'	<i>Leymus angustus</i>
Altai Wildrye	'Prairieland'	<i>Leymus angustus</i>
Basin Wildrye	'Trailhead'	<i>Leymus cinereus</i>
Mammoth Wildrye	'Volga'	<i>Leymus condensatus</i>
Russian Wildrye	'Bozoisky'	<i>Psathyrostachys juncea</i>
Forage Kochia	'Immigrant'	<i>Kochia prostrata</i>
Alfalfa	'Ladak'	<i>Medicago sativa</i>
Cicer Milkvetch	'Windsor'	<i>Astragalus cicer</i>
Sainfoin	'Remont'	<i>Onobrychis viciifolia</i>

Figure 1. Precipitation received from April to September and average fall forage yield across species (1997 - 2001).

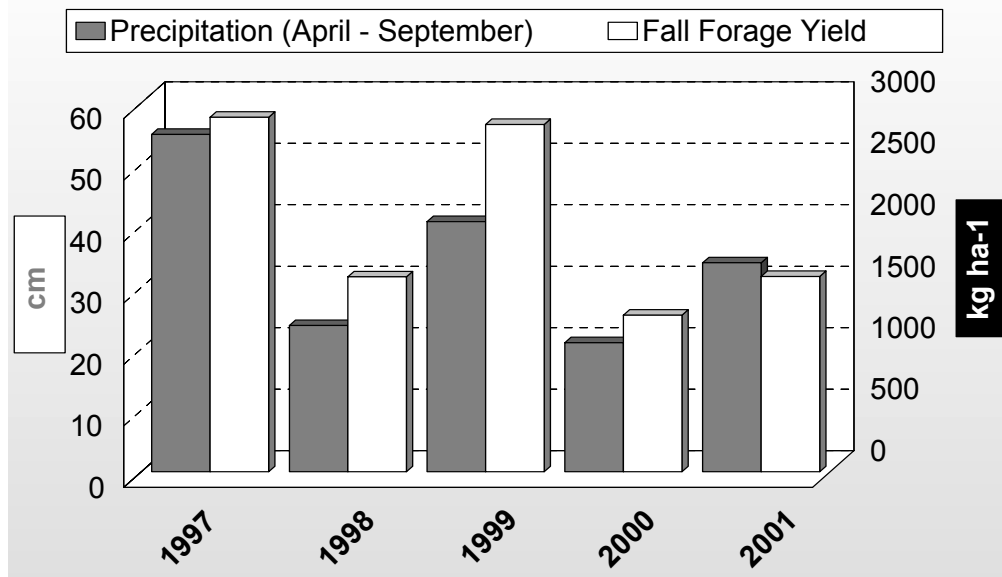


Figure 2. Snow accumulation at Archer, WY, November through February.

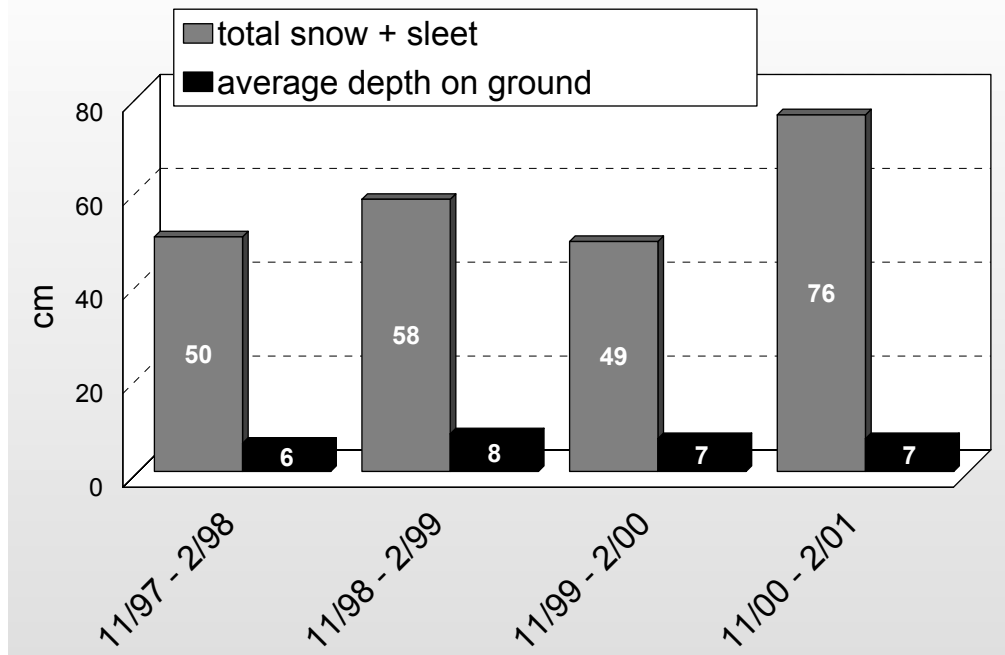
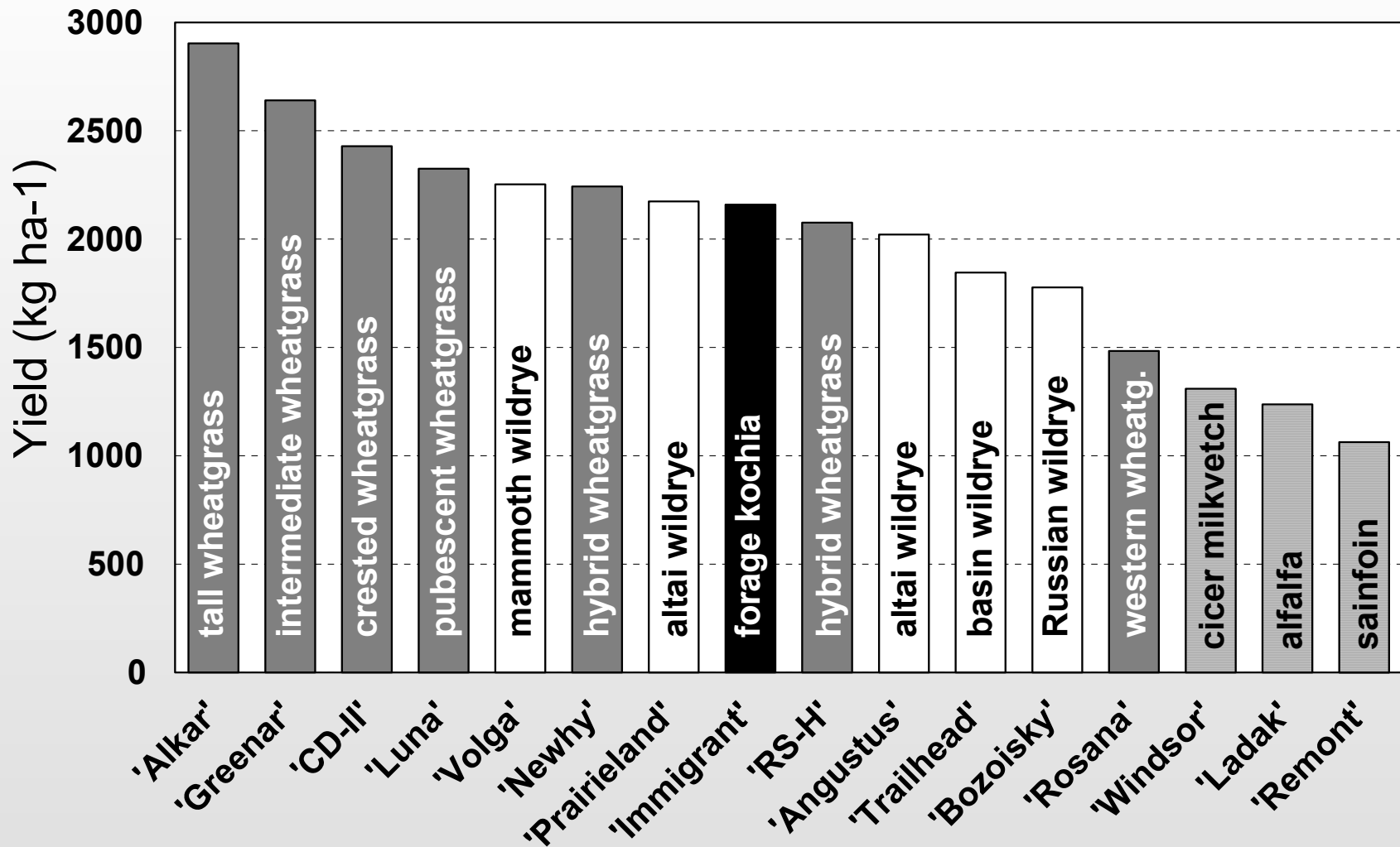


Table 2. Fall yields (Nov. - Dec.) of stockpiled perennial forages at Archer, WY, 1997 - 2001.

Species	kg/ha										
	1997		1998		1999		2000		2001		5-yr Avg.
Tall Wheatgrass, 'Alkar'	3959	a	2480	ab	4536	a	1738	a	1821	abc	2907
Intermediate Wheatgrass, 'Greenar'	4198	a	2158	bcd	3570	b	1263	cd	2025	ab	2643
Crested Wheatgrass, 'CD-II'	3608	a	1780	cdef	3504	b	1817	a	1450	bcde	2432
Pubescent Wheatgrass, 'Luna'	3856	a	1421	efgh	3447	bc	1063	def	1851	abc	2327
Mammoth Wildrye, 'Volga'	2666	b	2301	bc	2827	bcd	1601	ab	1881	abc	2255
Hybrid Wheatgrass, 'Newhy'	4388	a	1471	efgh	2615	bcde	1012	def	1741	bc	2245
Altai Wildrye, 'Prairieland'	2052	bcd	1977	bcde	3338	bc	1739	a	1781	bc	2177
Hybrid Wheatgrass, 'RS-H'	3875	a	1287	fghi	2486	cde	1238	cde	1504	bcde	2078
Altai Wildrye, 'Angustus'	1975	bcd	1823	bcdef	3340	bcde	1418	bc	1558	bcd	2023
Basin Wildrye, 'Trailhead'	1677	cd	959	ghi	3481	b	1376	bc	1748	bc	1848
Russian Wildrye, 'Bozoisky'	1978	bcd	1612	defg	2257	de	1517	abc	1526	bcde	1778
Forage Kochia, 'Immigrant'	.		3035	a	2266	de	921	f	2423	a	1729
Western Wheatgrass, 'Rosana'	2390	bc	898	hi	1830	e	950	ef	1360	cde	1486
Cicer Milkvetch, 'Windsor'	2445	bc	658	i	1688	e	860	f	904	ef	1311
Alfalfa, 'Ladak'	1306	d	698	i	2121	de	1011	def	1058	def	1239
Sainfoin, 'Remont'	.		826	hi	1916	de	869	f	644	f	851
Avg. across species	2884		1586		2826		1275		1590		1958

Statistical differences only measured between species within a given year. Means followed by different letters within a column are different at alpha 0.05.

Figure 3. Fall (November) yields of perennial, stockpiled forages at Archer, WY, averaged over five years* (1997 - 2001)



* Forage kochia and sainfoin yields averaged over 4 years (1998 - 2001).

Related Publications

**DEPARTMENT OF ANIMAL SCIENCE
2001 ANNUAL REPORT**

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**2001 PLANT PATHOLOGY RESEARCH
AND DEMONSTRATION PROGRESS REPORTS**

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SUGAR BEET RESEARCH 2001

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**WEED CONTROL RESEARCH
AGRONOMIC CROPS 2001**

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