

Grantsville Off-Center Advanced Test Site
1995 Progress Report
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INTRODUCTION

The purpose of the Grantsville Off-Center Advanced Test Site is to evaluate and demonstrate the potential of grasses and shrubs for revegetation and forage for livestock and wildlife in areas of 10-12 inch annual precipitation in northwestern Utah. Many sites within this region are heavily infested with cheatgrass and this test site may also identify plant materials which will establish and compete in such sites. The site is in MLRA 28A, Great Salt Lake Area of the Western Range and Irrigated region of the Intermountain United States.

The site is located approximately 5 miles southeast of Grantsville, Utah on land owned by the Grantsville Soil Conservation District. The site is fenced to exclude livestock. The off-center advanced test site was previously planted in 1988 but due to drought and grasshopper infestation the seeding failed.

The soil on the site is a Taylorsflat Loamy Substratum, 0 - 3 percent slope. Soils are very deep, formed in alluvium on terraces under greasewood and grasses. A typical profile has a pale brown loam surface layer 3 inches thick. The underlying layer is pale brown to very pale brown loam to a depth of 60 inches or more. Permeability is moderate and available water capacity is very low. The pH is 8.5 - 9.0. There are scattered pockets of deposited blow sand on the test site. The dominant vegetation of the natural plant community is bottlebrush squirreltail, Wyoming big sagebrush and greasewood. The site is a semidesert alkali loam range site. The elevation is 4350 feet, the average annual air temperature is 45 - 52°F and the frost free period is 110 - 140 days.

MATERIALS AND METHODS

The off-center advanced test site is composed of three components, the inter-center strain trial, row spacing trial and a display nursery. The inter-center strain trial includes a block of 31 grass accessions and a block of 7 shrub accessions which are arranged into two separate complete randomized block designs with 4 replications.

The purpose of the row spacing trial is to demonstrate the effect of row spacing on plant growth and forage production. The trial may also identify the ideal spacing to exclude or reduce weedy species within a planting. The row spacing trial is composed of 'Hycrest' crested wheatgrass and 'Bozoisky' Russian wildrye arranged with three rows of each cultivar beginning at a 6 inch row spacing gradually increasing to 48 inch row spacing over a distance of 150 feet and replicated twice. Permanent markers are established on the middle row of each species to collect data representing average row spacing widths of 6, 12, 18, 24, 36, and 48 inches.

The display nursery includes 48 accessions of grasses, forbs, and shrubs to allow landusers and agency personnel to view examples of released cultivars and promising accessions that are adapted to the general area.

The area had been used previously for testing purposes. However, the vegetation was dominated by cheatgrass and annual weeds. The site was burned September 1, 1993. Early in the summer of 1994, the site was lightly disked. On November 14-15, 1994 the site was culti-packed three times and on November 15-16, 1994 the grass and forb plots and cover crop were planted. The shrub plots and row spacing trial were seeded with a hand pushed belt seeder on April 4, 1995. The reason for delaying planting of the shrub plots was to obtain the most fresh seed possible. The row spacing trial was delayed until spring because of wet field conditions. The row spacing

trial and shrub testing sites were treated with Roundup (Glyphosate) at a rate of 1 quart per acre prior to seeding to control cheatgrass. Table 1 lists the accessions which were planted and shows percent pure live seed (PLS) and the source for each accession. Figure 1 is a plot map showing the layout of the test site.

All seed except the shrub and row spacing trial was mixed with rice hulls prior to seeding to plant approximately 25 seeds per square foot. A double disk drill with depth bands and press wheels was used. Plots are 6.67 feet wide X 20 feet long. Row spacing was 10 inches with the exception of basin wildrye and Russian wildrye accessions which were planted to 20 inch row spacing. Depth of seeding ranged from 0.25 - 0.75 inches dependent upon species. The shrub plots are composed of 4 rows, spaced 4 feet apart and 20 feet long, were seeded at a rate of 15 pure live seeds per row foot. The row spacing trial was seeded at a rate of approximately 25 seeds per linear foot.

Area not seeded with test plots or display plots were seeded to a cover crop seed mixture composed of the following species and rates:

'P-27' Siberian wheatgrass	1.8 #PLS/ac
'Hycrest' crested wheatgrass	1.3
'Bannock' thickspike wheatgrass	1.1

Evaluation data collected during the establishment year from the test plots included plant height, percent stand, plant density and vigor. The number of plants from the middle 2 rows were also counted in the shrub plots. The row spacing trial was evaluated for percent stand, plant height and vigor. Evaluation dates were May 17 and September 25, 1995.

The middle 2 rows of each plot are sampled for evaluation purposes. Percent stand data is collected utilizing a 20 foot rope with 1 foot increments stretched and anchored from one end of the plot to the other between the middle 2 rows. Basal cover is measured by the interception of plant parts along the rope at each 1 foot increment which are then summed to give a cover estimate recorded as a percent. The row spacing trial cover data is collected in the same manner except only from the single test row between the outside guard rows.

Plant density is measured using a row count technique at the mid point of the plot. Plants are counted from the middle 2 rows for a distance of 18.3 cm for 10 inch row spaced plots and 9.2 cm for 20 inch row spaced plots. The number of plants counted converts directly to the number of plants per square foot. Vigor is a qualitative rating based upon plant health and growth rate. A plant rated 1 would be best whereas a 9 rating is very poor. Data from the replicated plots is averaged while data from the non-replicated display plots is the actual data from that plot. Table 1 summarizes the evaluation data collected during 1995. Although the accessions which are in the replicated plots are also included in the display nursery, data was not collected from the display plots. The accessions shown in Table 1 under the display plots are not replicated in the inter-center strain trial.

The following summarizes precipitation collected during the 1995 crop year. This data was provided by the Grantsville Irrigation Company and is collected at Grantsville Reservoir located approximately 6 miles west of the test site:

Month	Precipitation (inches)
October 1994	1.58
November	1.92

December	0.48
January 1995	0.76
February	1.93
March	2.35
April	1.38
May	5.00
June	1.71
July	1.15
August	0.92
<u>September</u>	<u>0.64</u>
Total	19.82

No long term precipitation records are available, however, the site is located in a 10-12 inch precipitation zone. During the 1995 crop year precipitation was much above normal.

On October 15, 1995 the site was mowed to remove the current years' growth.

1995 EVALUATIONS AND DISCUSSION

Due to the very favorable amount and timing of precipitation just prior to seeding and during the establishment year, the majority of the stands have established. Those accessions that have not established well during the first year of growth are known to establish slowly and may show improvements in plant density and stand as time progresses. The Grantsville Off-Center Advanced Test Site is a tough site to establish plant materials primarily due to competition from cheatgrass. Although cheatgrass is still present and in some plots dominating, the test accessions are for the most part competing well.

General observations of the site on May 17 indicated heavy cheatgrass and bulbous bluegrass cover on most of the site. However, most plots had emerged and were competing with the weed cover. Some areas also had burr buttercup and volunteer crested wheatgrass.

Plant height data collected from the grass plots during the May evaluation shows 'Vavilov' Siberian wheatgrass and SL-hybrid wheatgrass to have maximum heights at 12.5 cm (Table 1). During the September evaluation, 'Hycrest' crested wheatgrass was the tallest accession averaging 63.8 cm.

Percent stand during the May evaluation ranged from 0.0 percent for 'Paloma' Indian ricegrass, 'Volga' mammoth wildrye, 9024804 Columbia needlegrass, and 9040137 Columbia needlegrass to 45.8 percent for Vavilov Siberian wheatgrass. Percent stand data collected during the September evaluation was statistically analyzed for one-way Analysis of Variance (ANOVA) and Duncan's Multiple Range Test was completed to show means separation and is also shown on Table 1. Overall, there was an increase in percent stand from the first evaluation to the second evaluation date. Paloma, Volga, 9024804, and 9040137 continued to show no measurable stand but Hycrest, 'Tetracan' Russian wildrye, Vavilov Siberian wheatgrass, and 'Nordan' crested wheatgrass had the best stands at 59.5, 56.0, 54.0, and 50.3 percent respectively.

Plant density for the grass plots during the May evaluation ranged from 0 plants per square foot to 6.8 plants per square foot for 'Ephraim' crested wheatgrass. By the September evaluation date, plant density dropped for most accessions because as seedlings establish, the weaker seedlings are crowded out and die. Vavilov Siberian wheatgrass had the best density at the fall evaluation averaging 4.5 plants per square foot.

Vigor for the grass plots during the spring evaluation ranged from 9.0 (poorest) to 1.8 (best) for Hycrest crested wheatgrass. Syn A Russian wildrye, Hycrest and Tetra-can had the best vigor during the fall evaluation.

The shrub plots were not evaluated for plant height during the May 17 evaluation because they were quite small. Plant height ranged from 22.3 cm for 9067480 fourwing saltbush to 34.8 cm for 'Wytana' fourwing saltbush during the fall evaluation. Percent stand ranged from 1.0 percent for 9067480 fourwing saltbush to 27.0 percent for Pamirian winterfat during the May evaluation. During the September evaluation, percent stand ranged from 12.3 percent for 'Hatch' winterfat to 41.3 percent for Pamirian winterfat. ANOVA and means separation was completed for the September shrub stand data and is also shown on Table 1.

The number of plants counted in the middle 2 sample rows ranged from 6.3 for 'Rincon' fourwing saltbush to 43.0 plants for 9067481 winterfat during the May evaluation. During the fall evaluation, Hatch winterfat had the least number of plants (12.5) and 9067481 winterfat had the most (37.0).

The establishment of the shrub plots is quite impressive. Past experience has shown these shrubs to be very slow in establishing when direct-seeded. It appears that pre-plant chemical weed control prior to seeding in the spring coupled with very favorable precipitation following seeding, greatly enhanced the growth and establishment of the shrub plots.

Pre-plant chemical weed control also benefited the row spacing trial. Evaluation of the trial in May indicated good emergence at each row spacing data collection point. However, ant hills and rodents damaged several plots over the summer which resulted in no collection of data from those plots in September. The following table summarizes the data collected from the row spacing trial during 1995:

Grantsville Row Spacing Trial 1995 Evaluation Summary

Row Spacing (inches)	6	12	18	24	30	36	48
Bozoisky Russian wildrye							
May 17, 1995							
Vigor	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Height (cm)	5.5	4.5	4.5	4.5	4.5	6.0	5.5
Cover (%)	20.0	12.5	25.0	12.5	12.5	25.0	10.0
September 25, 1995							
Vigor	3.5	3.0	3.0*	4.0*	3.5	3.0*	3.5
Height (cm)	9.5	18.5	16.0*	10.0*	11.5	18.0*	16.5
Cover (%)	27.5	45.0	45.0*	15.0*	32.5	45.0*	35.0
Hycrest crested wheatgrass							
May 17, 1995							
Vigor	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Height (cm)	4.0	6.0	4.0	2.5	4.5	4.0	4.5
Cover (%)	40.0	22.5	25.0	17.5	25.0	25.0	25.0
September 25, 1995							
Vigor	3.0	2.5	2.0	2.0*	2.0*	3.0*	2.5
Height (cm)	30.5	37.0	39.5	32.0*	40.0*	39.0*	41.0
Cover (%)	42.5	60.0	72.5	60.0*	85.0*	70.0*	57.5

* indicates data is from one replication due to destruction of other replication

During the May 17 evaluation there was no difference in vigor for Bozoisky Russian wildrye and Hycrest crested wheatgrass at all row spacings. Generally, vigor improved for both species during the September 25 evaluation.

Plant height of Bozoisky was fairly uniform at all row spacings during the spring evaluation. During the fall evaluation, maximum plant height occurred at 12 inch row spacing and minimum plant height was at 6 inch row spacing. Percent cover was quite variable. During the spring evaluation, the least cover (10.0 percent) occurred at 48 inch row spacing and at the fall evaluation, the maximum cover was 45.0 percent at 12, 18, and 36 inch row spacing.

Plant height of Hycrest was fairly uniform at all row spacings during the May evaluation. During the September evaluation, maximum height (41.0 cm) occurred at 48 inch row spacing and the minimum height (30.5 cm) occurred at the 6 inch row spacing. Cover was fairly uniform during the spring evaluation except for the 6 inch row spacing which averaged 40.0 percent. During the fall evaluation maximum cover was achieved at the 30 inch row spacing (85.0 percent) and minimum cover was at the 6 inch row spacing (42.5 percent).

Additional years of data will need to be collected and analyzed to establish a trend from which some conclusions on optimum row spacing could be made. Weed cover between rows will also be evaluated.

Due to the very favorable amount and timing of precipitation from just prior to seeding and during the establishment year, the majority of stands have established. We plan to continue evaluations for the next four years. In addition to plant height, percent stand, plant density and vigor, forage production data will also be collected.

Table 1.
Grantsville Inter-Center Strain Trial
Summary of 1995 Evaluation data

Accession No.	Common Name	Scientific Name	Source	Percent PLS	Grass Plots		<u>1/</u>		Plant		<u>2/</u>	
					Height (cm)		Percent Stand		Density (per ft ²)		Vigor	
					5/17	9/25	5/17	9/25	5/17	9/25	5/17	9/25
Hycrest	Crested Wheatgrass	<i>A. cristatum</i> x <i>desertorum</i>	Aberdeen	80.1	12.3	63.8	39.8	59.5 a	5.3	4.3	1.8	1.5
Tetracan	Russian Wildrye	<i>Psathyrostachys juncea</i>	ARS	58.0*	8.8	14.3	29.0	56.0 ab	3.3	2.5	4.0	1.5
Vavilov	Siberian Wheatgrass	<i>Agropyron fragile sibiricum</i>	ARS	78.0*	12.5	57.8	45.8	54.0 ab	4.8	4.5	1.8	2.0
Nordan	Crested Wheatgrass	<i>Agropyron desertorum</i>	Commercial	81.3	10.3	58.8	39.0	50.3 abc	5.0	3.5	2.3	2.8
Syn A	Russian Wildrye	<i>Psathyrostachys juncea</i>	ARS	83.0*	11.5	18.8	27.5	48.3 abc	3.0	2.8	3.0	1.3
Ephraim	Crested Wheatgrass	<i>Agropyron cristatum</i>	Aberdeen	92.2	9.8	47.5	37.3	42.8 abcd	6.8	2.8	2.3	2.8
Mankota	Russian Wildrye	<i>Psathyrostachys juncea</i>	Bismark	83.5	9.5	19.3	32.8	42.0 bcd	5.0	2.8	2.5	2.0
Bannock	Thickspike Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Aberdeen	95.1	8.3	41.0	29.8	40.3 bcd	2.8	3.8	3.5	2.3
Douglas	Crested Wheatgrass	<i>Agropyron cristatum</i>	ARS	78.0*	9.3	41.5	34.3	36.5 cde	6.3	3.8	2.8	3.8
P-27	Siberian Wheatgrass	<i>Agropyron fragile sibiricum</i>	Aberdeen	91.6	9.8	48.8	25.8	35.8 cdef	2.0	2.0	3.8	3.3
Critana	Thickspike Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Bridger	93.6	6.8	24.8	25.8	34.8 cdef	3.0	2.8	4.3	3.3
PI-275459	Siberian Wheatgrass	<i>Agropyron sibiricum</i>	Pullman	48.7	7.3	50.5	12.0	29.5 defg	2.8	3.0	4.8	3.5
SL-hybrid		<i>Elymus</i> x <i>Pseudoroegneria</i>	ARS	89.0*	12.5	31.3	27.0	28.3 defg	3.0	3.3	3.3	3.0
Sodar	Streambank wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Aberdeen	96.6	9.0	18.8	22.0	27.8 defg	2.8	2.3	3.3	4.0
9040189	Bottlebrush Squirreltail	<i>Elymus elymoides</i>	Meeker	95.1	9.8	20.0	15.3	25.0 defgh	3.0	2.8	3.3	2.8
9019218	Bottlebrush Squirreltail	<i>Elymus elymoides</i>	Bridger	75.6*	5.8	15.3	19.0	21.5 efghi	2.5	2.0	4.3	5.5
Magnar	Basin Wildrye	<i>Leymus cinereus</i>	Aberdeen	93.7	9.8	31.0	21.3	18.5 fghij	1.5	1.3	4.5	4.3
Bozoisky	Russian Wildrye	<i>Psathyrostachys juncea</i>	Bridger	94.1	7.5	9.3	14.8	16.5 ghijk	2.0	1.3	4.0	4.5
Schwendimar	Thickspike Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Pullman	89.4	2.3	38.0	5.0	16.3 ghijk	1.0	1.8	7.8	4.0
9040187	Bottlebrush Squirreltail	<i>Elymus elymoides</i>	Meeker	80.7	3.8	24.3	4.0	14.0 ghijk	0.8	2.5	7.0	3.0
9052861	Indian Ricegrass	<i>Achnatherum hymenoides</i>	Los Lunas	92.0	3.3	20.5	9.5	8.5 hijk	2.3	1.8	6.5	5.3
9019219	Bottlebrush Squirreltail	<i>Elymus elymoides</i>	Bridger	70.2*	6.3	26.3	7.5	7.3 ijk	2.3	1.3	5.8	6.3
Trailhead	Basin Wildrye	<i>Leymus cinereus</i>	Bridger	93.3	7.5	17.5	16.5	7.0 ijk	1.3	1.0	5.3	6.8
PI-478833	Indian Ricegrass	<i>Achnatherum hymenoides</i>	Bridger	71.4	1.5	8.5	7.0	5.0 ijk	1.0	1.0	7.8	6.8
Secar	Snake River Wheatgrass	<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	Pullman	69.4	3.0	8.3	2.5	2.0 jk	0.5	0.3	8.3	7.8
Nezpar	Indian Ricegrass	<i>Achnatherum hymenoides</i>	Aberdeen	90.4	2.8	8.3	5.8	0.8 jk	0.5	0.0	8.0	8.0
9035287	Indian Ricegrass	<i>Achnatherum hymenoides</i>	Los Lunas	95.0	1.3	0.0	5.8	0.0 k	0.5	0.0	8.3	9.0
Paloma	Indian Ricegrass	<i>Achnatherum hymenoides</i>	Los Lunas	88.0	0.0	0.0	0.0	0.0 k	0.0	0.0	9.0	9.0
Volga	Mammoth Wildrye	<i>Leymus racemosus</i>	Pullman	25.7	0.0	0.0	0.0	0.0 k	0.0	0.0	9.0	9.0
9024804	Columbia Needlegrass	<i>Stipa nelsonii</i> v. <i>dorei</i>	Meeker	64.9	0.0	0.0	0.0	0.0 k	0.0	0.0	9.0	9.0
9040137	Columbia Needlegrass	<i>Stipa nelsonii</i> v. <i>dorei</i>	Meeker	69.0	0.0	0.0	0.0	0.0 k	0.0	0.0	9.0	9.0

1/ Percent stand is equal to basal cover. 9/25/95 percent stand data was analyzed utilizing Duncan's Multiple Range Test; P=0.05, CV=46.07; means followed by the same letter are not significantly different.

2/ Rated 1-9 with 1 best, 9 worst.

Table 1. Continued
Grantsville Inter-Center Strain Trial
Summary of 1995 Evaluation data

Shrub Plots

Accession No.	Common Name	Scientific Name	Source	Percent PLS	Plant	3/		Number of		Vigor	
					Height (cm)	Percent	Stand	Plants/Sample	Rows	5/17	9/26
					9/26	5/17	9/26	5/17	9/26	5/17	9/26
Pamirian	Winterfat	Krascheninnikovia ceratoides	Aberdeen	91.1	33.5	27.0	41.3 a	40.8	36.8	1.8	1.8
9067481	Winterfat	Krascheninnikovia lanata	Aberdeen	68.9	34.0	19.5	34.0 ab	43.0	37.0	2.3	1.8
Wytana	Fourwing Saltbush	Atriplex canescens	Bridger	46.6	34.8	1.8	29.5 ab	4.8	24.3	3.8	1.0
9067480	Fourwing Saltbush	Atriplex canescens	Aberdeen	27.9*	22.3	1.0	29.3 ab	6.5	20.3	4.0	2.8
Rincon	Fourwing Saltbush	Atriplex canescens	Meeker	39.1	22.5	3.8	24.3 ab	6.3	19.0	4.8	2.3
9063535	Winterfat	Krascheninnikovia lanata	Bridger	81.5*	23.8	16.5	23.3 ab	22.3	23.8	2.5	2.8
Hatch	Winterfat	Krascheninnikovia lanata	Meeker	66.7	25.8	9.5	12.3 b	11.8	12.5	3.3	4.5

Non-replicated Display Plots

Accession No.	Common Name	Scientific Name	Source	Percent PLS	Plant	Percent		Plant		Vigor		
					Height (cm)	Stand	Density (per ft ²)	5/17	9/25			
					5/17	9/25	5/17	9/25	5/17	9/25	5/17	9/25
Kirk	Crested wheatgrass	Agropyron cristatum	Canada	73.0*	12	53	27.0	53.0	3	3	3	3
Parkway	Crested wheatgrass	Agropyron cristatum	Canada	78.0*	12	53	22.0	53.0	3	4	3	3
Newhy	RS Hybrid	Elytrigia x Pseudoroegneria	ARS	82.8*	11	30	20.0	25.0	4	3	4	3
Fairway	Crested wheatgrass	Agropyron cristatum	Commercial	79.6	13	50	15.0	33.0	4	1	3	4
Whitmar	Beardless wheatgrass	Pseudoroegneria spicata inermis	Bridger	89.7	12	24	10.0	33.0	6	4	2	4
Timp	Utah Sweetvetch	Hedysarum boreale	Meeker	63.0	3	0	1.0	0.0	1	0	2	9
Pryor	Slender wheatgrass	Elymus trachycaulis	Bridger	93.6	0	47	0.0	18.0	0	1	9	5
San Luis	Slender wheatgrass	Elymus trachycaulis	Meeker	30.9	0	0	0.0	0.0	0	0	9	9
Immigrant	Forage Kochia	Kochia prostrata	Los Lunas	59.7	0	0	0.0	0.0	0	0	9	9
9021471	Fringed sage	Artemisia frigida	Meeker	32.0*	0	0	0.0	0.0	0	0	9	9

* Purity and germination data was not available from source. Germination tests were completed and purity was assumed to be 90% to calculate %PLS.

3/ Percent stand is also equal to canopy cover. 9/25/95 percent stand data was analyzed utilizing Duncan's Multiple Range Test; P=0.05, CV=59.92; means followed by the same letter are not significantly different.

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