

**Skull Valley Off-Center Evaluation (2007 Planting)
2008 Progress Report
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Skull Valley test site, May 2006

Introduction

Commercially available plant releases and test materials of basin wildrye, Sandberg bluegrass, bluebunch wheatgrass, Snake River wheatgrass, thickspike wheatgrass, western wheatgrass, slender wheatgrass, bottlebrush squirreltail, Indian ricegrass, selected warm season grasses, shrubs, forbs and introduced grasses are being evaluated in replicated studies at the Skull Valley, UT off-center test site, 25 miles west southwest of Tooele, UT. The trial contains 72 accessions of 23 species of native and introduced grasses, forbs and shrubs. For a full list of species and accessions tested see the appendix following this report. The goal of this trial is to evaluate the adaptability of numerous new conservation releases and potential releases in a low precipitation environment and compare their establishment, production and longevity against more traditionally used releases.

All of the species being tested are commonly used in rangeland restoration plantings in the IDPMC service area. New materials have become available from various sources. These materials have documented performance in small scale trials or in seed production conditions, but many need further testing in the arid environmental conditions commonly encountered in the Intermountain West.

The Skull Valley Off-Center Test Site (approximately 1.5 acres) is located about 1 mile east of the Ensign Ranch North Ranch headquarters in the foothills of the Stansbury Mountains. The site is located in the SE $\frac{1}{4}$, SE $\frac{1}{4}$, NW $\frac{1}{4}$ of Section 27, T3S, R8W. This test site is located on the Hiko Peak gravelly loam soil series. The typical soil profile is a very deep (>60 inch), well drained gravelly loam. The site receives an average of 8 to 12 inches of precipitation annually. Mean air temperatures range from 45 to 50° F with 100 to 150 frost free days. Elevation at the site is approximately 4600 feet. The test site is located on the ecological site 028AY215UT, which historically supported a Wyoming big sagebrush - bluebunch wheatgrass plant community. The test site is fenced to exclude livestock grazing.

Materials and Methods

The seed bed was prepared with chemical treatments of 16 oz 2, 4-D and 64 oz Roundup per acre applied on May 16, 2006, and June 26, 2007. The site was disked by the landowner in April 2007. The seedbed was very dry and just prior to seeding the site was gone over once with a packer to smooth the seedbed. The trial was planted on November 14, 2007 with a modified Tye Drill with a width of 80 inches (8 spouts at 10" spacing).

Experimental design is a randomized complete block with 3 replications. Each plot is one drill width wide (80 in) and 18 ft long. Each species was arranged into a separate block; introduced grasses, shrubs and forbs also each formed a separate block (a plot map is provided in the appendix). Seeding depths are dependent on species and are planted according to Ogle et al (2007). Species were seeded at a target rate of 20 to 30 pure live seeds (PLS) per ft² for large seeded species (<500,000 seeds per pound) and 40 to 50 PLS/ft² for smaller seeded species (>500,000 seeds/lb). PLS was determined by seed lab results or, when lab results were not available, PLS was estimated visually or the PLS from other accessions were averaged to determine unknown PLS. All seed was mixed with rice hulls as an inert carrier to ensure better seed flow according to St. John et al (2005) with the exception of fourwing saltbush and Gardner saltbush. A cover crop mix of 50% Anatone bluebunch wheatgrass, 20% Bannock thickspike wheatgrass, 20 percent Magnar basin wildrye and 10% Snake River Plains fourwing saltbush was planted in the prepared areas surrounding the trial.

The plots were evaluated for initial establishment on May 21, 2008 using a frequency grid as described by Vogel and Masters (2001). The grid measured approximately 40 x 41 inches, having four ten inch columns (to incorporate 1 drill row per column) and five rows, totaling 20 cells. The grid was placed five times within the plot giving a total of 100 evaluated cells. Counts were made of the cells that contained at least one plant.

On August 26, 2008 the site was again evaluated as described above. However, after a visual evaluation of the site it was apparent that entire blocks of species had essentially zero living plants. Thus, the August evaluations were only conducted on those species with visible and measureable stands: introduced grasses, bluebunch wheatgrass, and Snake River wheatgrass.

Data were analyzed using the Statistix 8 Analytical software and subjected to an analysis of variance with a significance level of $p < 0.05$. If significance was detected, means were separated using a Tukey HSD all pairwise comparison. The grass plots will be clipped the second and fourth year of establishment to determine air-dry forage production.



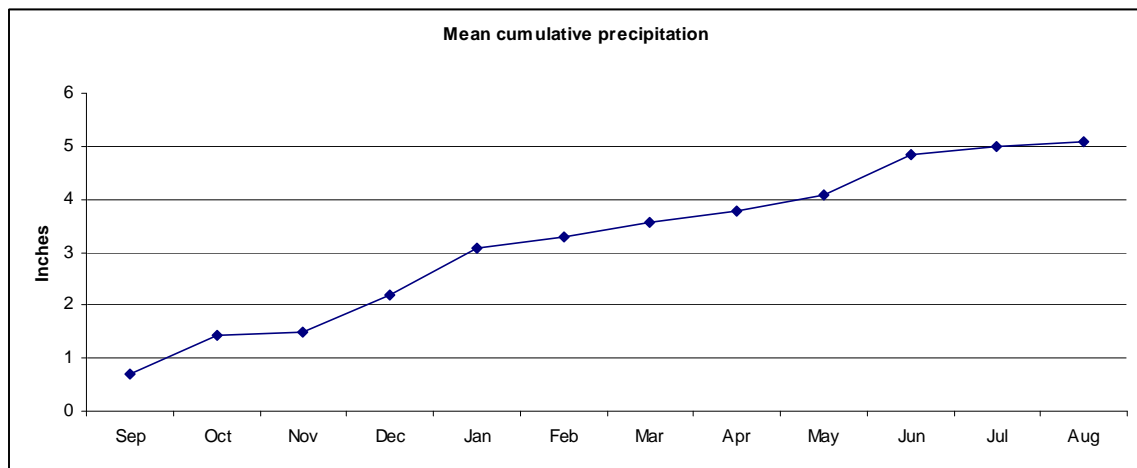
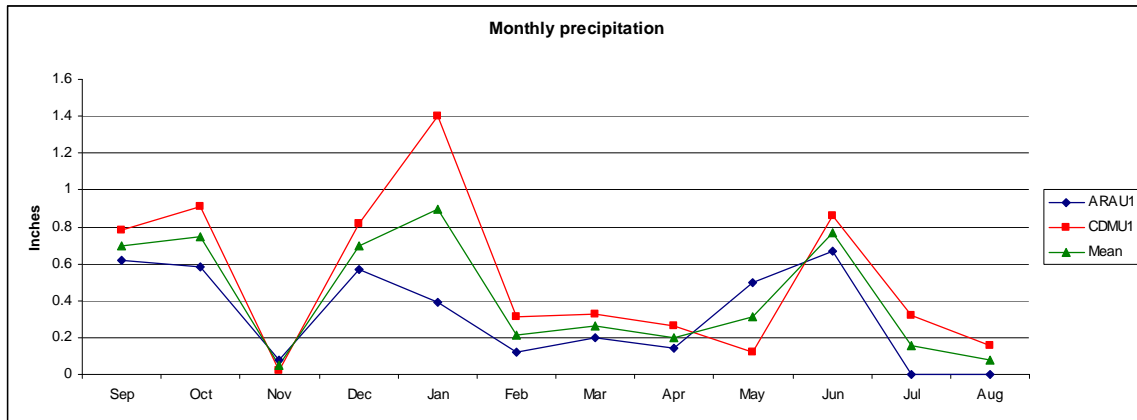
Skull Valley test site, August 2008

Weather

The two closest weather stations to the Skull Valley site are the Aragonite (ARAU1) and Cedar Mountain (CDMU1) stations. Aragonite is located 16 miles WNW of the site at 40.5983, -113.0217 degrees and 5,030' elevation. The Cedar Mountain station is approximately 15 miles S of the site at 40.3008, -112.7767 and 4,650' elevation. Monthly precipitation totals were taken from each site from September 1, 2007 through August 31, 2008. Cumulative precipitation data represents the mean precipitation of both stations. All weather data was obtained from MesoWest (2008).

Total estimated cumulative precipitation for the site from September 2007 through August of 2008 was 5.08 inches, significantly less than the 8 to 12 inches typically seen in the region. Most of the precipitation occurred as snow falling in November and December and January. The site also may have received a fair amount of rainfall in May

and June. The meager precipitation received in March and April resulted in low plant establishment densities recorded at the May evaluation.



Results

Skull Valley faced below average precipitation during the establishment phase of the study which severely limited germination. All species had very low establishment rates in the spring followed by even lower stand survival in late-summer. The best stand during the May evaluation came from Nordan crested wheatgrass with only 0.69 plants/ft² followed by Vavilov II and Vavilov Siberian wheatgrass with 0.65 and 0.50 plants/ft² respectively. The best performers of the native accessions were obtained by E46 Snake River wheatgrass (0.43 plants/ft²) and bottlebrush squirreltail accession 9019219 with 0.32 plants/ft². Many accessions, including entire blocks of shrubs, Sandberg bluegrass and the warm season grasses had zero germinants. By August we couldn't find enough plants in several blocks to justify evaluating with the density grids. Only the introduced grasses, bluebunch wheatgrass and Snake River wheatgrass plots were evaluated. Stands in these plots were as a rule greatly reduced, though in no case were the plants completely eliminated. No plant density means in any evaluation group could be separated statistically at $p \leq 0.05$.

Introduced grasses

The introduced grasses showed a greater ability to germinate and establish in the dry conditions encountered at the Skull Valley test site than the vast majority of the native accessions. The best initial establishment density came from Nordan crested wheatgrass (0.69 plants/ft²) followed by Vavilov II with 0.65 plants/ft². Vavilov II however appeared to have greater drought resistance after establishment by having the highest average plant density at the August evaluation with 0.40 plants/ft² compared to 0.22 plants/ft² from Nordan.

Introduced grasses		
Accession	Plants/ft ²	
	5/2008	8/2008
Nordan	0.69	0.22
Vavilov II	0.65	0.40
Vavilov	0.50	0.18
CD II	0.43	0.18
Roadcrest	0.36	0.19
Ephraim	0.27	0.06
Bozoisky II	0.24	0.05
Mustang	0.20	0.01
Bozoisky	0.11	0.01
P=	0.08	0.07

Bluebunch wheatgrass

The bluebunch wheatgrass accessions had much lower stand density values than those of the introduced grass species. The highest establishment densities of bluebunch came from Anatone (0.25 plants/ft²) and Goldar (0.21 plants/ft²). Anatone again had the best density at the time of the August evaluation with 0.11 plants/ft², while Goldar had essentially dropped to zero remaining plants (0.01 plants/ft²).

Bluebunch wheatgrass		
Accession	Plants/ft ²	
	5/2008	8/2008
Anatone	0.25	0.11
Goldar	0.21	0.01
P7	0.11	0.03
Wahluke	0.10	0.04
P32	0.09	0.09
P27	0.07	0.03
9081636	0.03	0.03
P=	0.26	0.45

Snake River wheatgrass

Mean densities of Snake River wheatgrass accessions were slightly better than those of bluebunch wheatgrass. E46 had an initial density of 0.43 plants/ft² in May and dropped to

0.18 plants/ft² at the August evaluation. Discovery also performed relatively well with 0.25 plants/ft² in May and 0.15 plants/ft² in August.

Snake River wheatgrass		
Accession	Plants/ft ²	
	5/2008	8/2008
E46	0.43	0.18
Discovery	0.25	0.15
SERDP	0.17	0.09
Secar	0.13	0.07
E49	0.06	0.02
	P=	0.09

Indian ricegrass

The Indian ricegrass accessions had poor establishment, the best density being 0.09 plants/ft² from Nezpar. No evaluation was conducted in August because no plants were observed in the plots.

Indian ricegrass	
Accession	Plants/ft ² 5/2008
Nezpar	0.09
9024739	0.07
9024741	0.07
CSU-10	0.06
Rimrock	0.03
	P=
	0.59

Bottlebrush squirreltail

The two bottlebrush squirreltail accessions had fair establishment densities with 0.32 plants/ft² and 0.24 plants/ft² from accession 9019219 and Toe Jam Creek respectively. The walk through evaluation in August yielded no plants. It is possible that surviving plants may become visible next spring.

Bottlebrush squirreltail	
Accession	Plants/ft ² 5/2008
9019219	0.32
Toe Jam Creek	0.24
	P=
	0.67

Basin wildrye

Basin wildrye establishment was low with all accessions having mean plant densities of 0.10 plants/ft² or less. No evaluation was conducted in August, because no plants were observed in the plots.

Basin wildrye	
Accession	Plants/ft ² 5/2008
Magnar	0.10
Topinish	0.09
Trailhead	0.09
Continental	0.07
Gund	0.06
Jim Creek	0.02
Washoe	0.02
P=	0.83

Slender wheatgrass

Slender wheatgrass appeared to be poorly suited to the conditions at Skull Valley. The highest establishment density was 0.03 plants/ft² from First Strike. No plants were observed in August.

Slender wheatgrass	
Accession	Plants/ft ² 5/2008
First Strike	0.03
Pryor	0.01
San Luis	0.01
Adanac	0.00
Copperhead	0.00
P=	0.36

Thickspike wheatgrass

Critana thickspike wheatgrass had fair establishment with 0.25 plants/ft². No evaluation was conducted in August, because no plants were observed.

Thickspike wheatgrass	
Accession	Plants/ft ² 5/2008
Critana	0.25
Bannock	0.14
Sodar	0.04
P=	0.11

Western wheatgrass

All western wheatgrass accessions did poorly with Rosanna obtaining the highest average density at 0.09 plants/ft². No plants were observed in the plots in August.

Western wheatgrass	
Accession	Plants/ft ² 5/2008
Rosanna	0.09
Ariiba	0.04
DOD	0.02
9081630	0.01
P=	0.35

Forbs

None of the forbs evaluated at Skull Valley were sufficiently drought tolerant to produce any sort of stand. A few plants were detected in the Phacelia, Maple Grove Lewis flax and Antelope prairie clover in the May evaluation, but none had persisted into the summer.

Forbs	
Accession	Plants/ft ² 5/2008
Phacelia	0.03
Maple grove	0.03
Antelope	0.01
Appar	0.00
Cedar	0.00
Eagle	0.00
Great Northern	0.00
Old works	0.00
Richfield	0.00
Stillwater	0.00
P=	0.24

Sandberg bluegrass, warm season grasses and shrubs

No germinated plants were found in any plot of Sandberg bluegrass, warm season grasses or the shrubs at either the May or August evaluation.

Discussion

The extreme arid environment at the Skull Valley test site exemplifies the difficulties faced by conservationists attempting to re-vegetate disturbed rangelands in the Intermountain West. Few choices of plant materials exist that are capable of establishing and persisting under below average rainfall conditions such as those encountered during the 2008 growing season.

The best performing species of the 2008 evaluations were the introduced grass species crested wheatgrass and Siberian wheatgrass. Some accessions of the native species bluebunch wheatgrass and Snake River wheatgrass achieved fair establishment and limited persistence, but not in numbers that inspire confidence in land managers.

The plots will be evaluated for density and forage production multiple years until the conclusion of the study, scheduled for 2027.

References

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Ogle, D., St. John, L., Stannard, M. and L. Holzworth. 2007. Technical Note No. 24: Grass, grass-like, forb, legume and woody species for the Intermountain West. USDA-NRCS, Boise, ID; Bozeman, MT and Spokane, WA. ID-TN 24. 41p.

St. John, L., Ogle, D., Tilley, D., Majerus, M. and L. Holzworth. Technical Note No. 7: Mixing seed with rice hulls. USDA-NRCS, Boise, ID. ID-TN 7. 14p.

Vogel, K.P. and R.A. Masters. 2001. Frequency grid-a simple tool for measuring grassland establishment. *Journal of Range Management* 54(6): 653-655.

IDPMC Study Numbers

IDPMC-P-0802-RA	Skull Valley - Basin Wildrye Off-Center Evaluation (OCE)
IDPMC-P-0803-RA	Skull Valley - Sandberg bluegrass OCE
IDPMC-P-0804-RA	Skull Valley - Bluebunch Wheatgrass OCE
IDPMC-P-0805-RA	Skull Valley - Snake River Wheatgrass OCE
IDPMC-P-0806-RA	Skull Valley - Thickspike wheatgrass OCE
IDPMC-P-0807-RA	Skull Valley - Western Wheatgrass OCE
IDPMC-P-0808-RA	Skull Valley - Slender Wheatgrass OCE
IDPMC-P-0809-RA	Skull Valley - Bottlebrush Squirreltail OCE
IDPMC-P-0810-RA	Skull Valley - Shrubs OCE
IDPMC-P-0811-RA	Skull Valley - Forbs OCE
IDPMC-P-0812-RA	Skull Valley - Introduced Grass OCE
IDPMC-P-0813-RA	Skull Valley - Indian Ricegrass OCE
IDPMC-P-0814-RA	Skull Valley - Warm Season Grass OCE

List of species and accessions

Species	Accession	Source
Basin wildrye	Magnar	ID PMC
Basin wildrye	Washoe	MT PMC
Basin wildrye	Trailhead	MT PMC
Basin wildrye	Gund	NV DWR
Basin wildrye	Topinish	BFI
Basin wildrye	Jim creek	BFI
Basin wildrye	Continental	ARS Logan
Bluebunch WG	Wahluke	BFI
Bluebunch WG	P-27	ARS Logan
Bluebunch WG	P-32	ARS Logan
Bluebunch WG	Anatone	ID PMC
Bluebunch WG	P-7	ARS Logan
Bluebunch WG	Goldar	ID PMC
Bluebunch WG	9081636	MT PMC
Snake River WG	Secar	WA PMC
Snake River WG	SERDP	ARS Logan
Snake River WG	E-46	ARS Logan
Snake River WG	Discovery	ARS Logan
Snake River WG	E-49	ARS Logan
Slender WG	San Luis	NM PMC
Slender WG	Revenue	Canada
Slender WG	First Strike	DOD
Slender WG	Copperhead	MT PMC
Slender WG	Pryor	MT PMC
Thickspike WG	Bannock	ID PMC
Thickspike WG	Sodar	ID PMC
Thickspike WG	Critana	MT PMC
Indian Ricegrass	CSU-10	NM PMC
Indian Ricegrass	9024741	UCEPC
Indian Ricegrass	9024715	UCEPC
Indian Ricegrass	9024739	UCEPC
Indian Ricegrass	Nezpar	ID PMC
Indian Ricegrass	Rimrock	MT PMC
Blue grama	Hachita	NM PMC
Blue grama	Alma	NM PMC
Galletta	Viva	NM PMC
Sandberg bluegrass	Duffy Creek	BFI
Sandberg bluegrass	Mountain Home	FS
Sandberg bluegrass	High Plains	MT PMC
Sandberg bluegrass	9081633, big blue	MT PMC
Sandberg bluegrass	Wallowa	BFI
Sandberg bluegrass	Sherman	WA PMC
Sandberg bluegrass	Duffy Creek	BFI
Sandberg bluegrass	Wallowa	BFI
Squirreltail	9019219	MT PMC
Squirreltail	Toe Jam Creek	ARS Logan

Western WG	DOD	ID PMC
Western WG	Rosana	MT PMC
Western WG	9081630	MT PMC
Western WG	Arriba	CO PMC
Introduced Grasses	CD II	ARS Logan
Introduced Grasses	Roadcrest CWG	ARS Logan
Introduced Grasses	Ephraim CWG	ID PMC
Introduced Grasses	Nordan CWG	ND PMC
Introduced Grasses	Bozoisky Russian WR	ARS Logan
Introduced Grasses	Mustang Altai WR	ARS Logan
Introduced Grasses	Vavilov Siberian WG	ARS Logan
Introduced Grasses	Vavilov II Siberian WG	ID PMC
Introduced Grasses	Bozoisky II Russian WR	ARS Logan
Shrubs	Wytana Fourwing Saltbush	MT PMC
Shrubs	Open Range Winterfat	MT PMC
Shrubs	Wyoming big sagebrush	Commercial
Shrubs	SRP Fourwing Saltbush	ID PMC
Shrubs	NCD Winterfat	ID PMC
Forbs	Old Works Penstemon	MT PMC
Forbs	Maple Grove Lewis Flax	ID PMC
Forbs	Appar Blue Flax	ID PMC
Forbs	Richfield Eaton's Penstemon	ID PMC
Forbs	Cedar Palmer Penstemon	NM PMC
Forbs	Phacelia	MT PMC
Forbs	Antelope Prairie Clover	MT PMC
Forbs	Stillwater Prairie Coneflower	MT PMC
Forbs	Eagle Western Yarrow	Geertson Seed Farms
Forbs	Great Northern Western Yarrow	MT PMC

N ↑

Skull Valley, UT
14 Nov, 2007

Zebra evaluation

R4
R3
R2
R1

Multiple species AEP

Forbs	Shrubs	ELWA	Intro		
Western	ELEL	Thick	POSE	Warm	ACHY
ELTR	ELWA	PSSP	LECI		

