

**Orchard Display Nursery  
 Evaluation Summary (2005-2007)  
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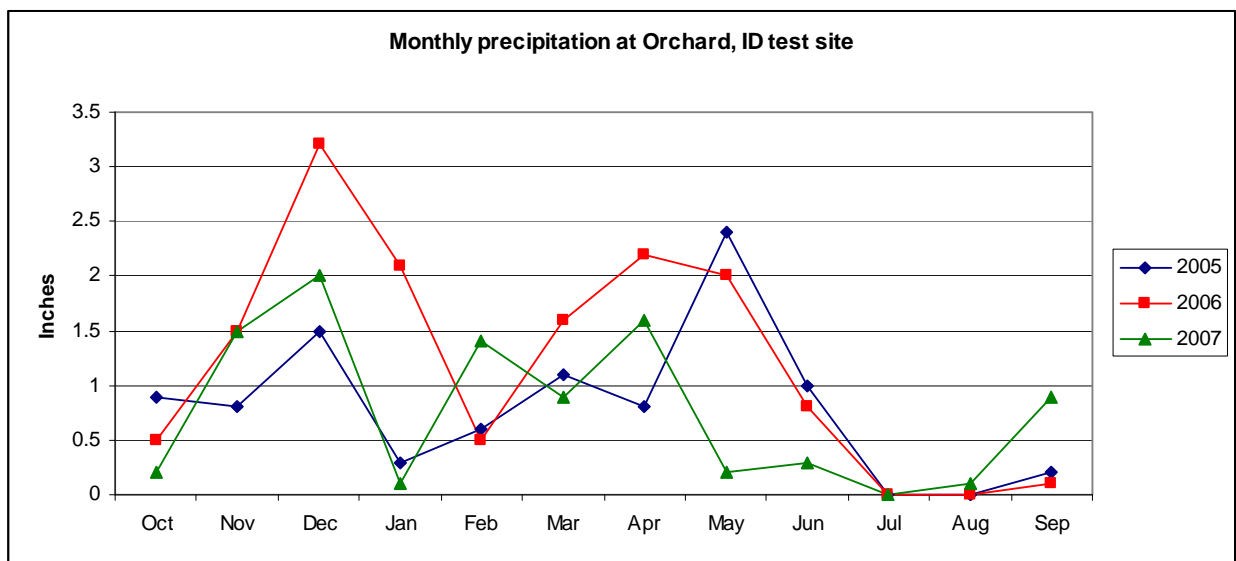
**Introduction**

The Orchard Display Nursery was planted on November 16, 2004 in cooperation with the Great Basin Native Plant Selection and Increase Project. The nursery includes 82 accessions of 27 native and introduced grass, forb and shrub species. Each accession was planted in 7 X 60 foot plots. See Tilley et al (2005) for descriptions of the species and accessions planted. The remaining area was planted to a cover crop mix of 50% Anatone bluebunch wheatgrass, 20% Bannock thickspike wheatgrass, 20% Magnar basin wildrye and 10% Snake River Plains fourwing



Orchard test site on May 16, 2007.

saltbush. The test site is located on a loamy 10-12 inch precipitation ecological site that historically supported a Wyoming big sagebrush - bluebunch wheatgrass – Thurber’s needlegrass plant community. Total precipitation at the Orchard Test Site for water year 2005 was 9.6 inches, 2006 was 14.4 inches and total accumulated precipitation for 2007 was (USDA 2007).



## Materials and Methods



Orchard display site in September 2004 prior to final mechanical seedbed preparation

The Bureau of Land Management (BLM) burned the site in the fall of 2002. The site was later sprayed by PMC staff in May 2003 and May 2004 with a Roundup/2, 4-D herbicide mix to create a weed free seedbed. Due to limited breakdown of dead grass clumps that would inhibit proper seed placement with a drill and to ensure a clean seedbed, the decision was made to cultivate the site with a culti-packer just prior to seeding. During the first evaluation most plots contained high numbers of Russian thistle (*Salsola* sp.) and moderate amounts of bur buttercup (*Ranunculus testiculatus* Crantz) plants.

Russian thistle plants were approximately two to three inches tall and the buttercup plants had already flowered. At the time of the second evaluation, there was a heavy infestation of tumble mustard (*Sisymbrium altissimum* L.). Plots were consequently sprayed again on June 9, 2005 with 16 oz. 2, 4-D and 8 oz. Clarity per acre to control the mustard.

The first evaluation of the plots for initial establishment was conducted on April 27, 2005 using a frequency grid based on that described by Vogel and Masters (2001). The grid measured approximately 40X41 inches, having four ten inch columns (to incorporate 1 drill row per column) and five rows, totaling 20 cells. The first grid was laid on the rows approximately two grid lengths (80 inches) into the plot. Counts were made of the cells that contained at least one plant. Grids were subsequently flipped and evaluated three more times giving a total of 80 evaluated cells. Total area for one grid is approximately 1m<sup>2</sup>. Total area evaluated is therefore approximately 4m<sup>2</sup>. A conservative estimate of plant density (plants/m<sup>2</sup>) is the total number of cells containing at least one plant divided by four. The second evaluation occurred on May 25, 2005. The 2006 evaluation was conducted on May 31, and the 2007 evaluation took place on May 16. The methods followed in 2006 and 2007 were the same as described above; however, the frame was evaluated five times for a total of 100 cells or 5m<sup>2</sup>. Total counts were then divided by five for approximate plants/m<sup>2</sup>. Numbers for approximate plants/m<sup>2</sup> were then divided by 10.8 to calculate approximate plants/ft<sup>2</sup>. It is important to note that because cells with plants were counted and not number of plants per cell, the best possible score is 100 hits per five frames which converts to 20 plants/m<sup>2</sup> or 1.85 plants/ft<sup>2</sup>. Actual plant density may be higher than the numbers indicated below. All tables have been arranged with accessions ranked from highest plant density to the lowest at the time of the second evaluation in 2005. Data were not analyzed for significance.

### Native Grasses

There were forty-seven accessions of native grasses planted. Overall the native grasses established well considering the limited amount of precipitation received over the winter and early spring of 2005. Especially good stands were seen in the bluebunch wheatgrass and Snake River wheatgrass plots during 2005. There was a marked decrease in plant density between the first and second evaluations with some notable exceptions. Seven of nine bluebunch wheatgrass

accessions and three of four Snake River wheatgrass accessions increased in density from the first evaluation to the second. This is possibly due to receiving 2.5 inches of precipitation during that period and/or from a lack of pressure by black grass bugs (*Labops* sp.). Most of the native grasses decreased steadily in density from 2005 to 2007.

In 2005 the best performing Indian ricegrass accession was White River, having a plant density of 0.56 plants/ft<sup>2</sup> during the first evaluation and 0.17 plants/ft<sup>2</sup> during the second evaluation. In 2006 and continuing to 2007 there were no plants of any Indian ricegrass accessions observed in the evaluation grids and very few seen within their respective plots.

In 2005 the squirreltail plots had as high as 0.54 plants/ft<sup>2</sup> with Fish Creek. In 2006 all squirreltail accessions had decreased. Fish Creek maintained the best plant density with 0.26 plants/ft<sup>2</sup>. Densities remained essentially the same in 2007.

Bannock thickspike wheatgrass had a density of 1.04 plants/ft<sup>2</sup> and stayed essentially the same at the second evaluation of 2005. In 2006 Bannock had dropped to nearly half of the original density to 0.58 plants/ft<sup>2</sup>. The 2007 evaluations showed small declines from established plots.

Revenue and San Luis slender wheatgrass both showed zero plants/ft<sup>2</sup> in 2006. Pryor slender wheatgrass similarly dropped in density but had 0.02 plants/ft<sup>2</sup>. In 2007 no slender wheatgrass plants could be found in any of the evaluated grids.

The western wheatgrass accessions had less dramatic declines in density from 2005 to 2006, but still showed poor stands with Rodan having the highest density of 0.13 plants/ft<sup>2</sup>. In 2007 all accessions had zero plants surviving.

The bluebunch wheatgrass accessions had the highest average densities of all the native grasses. All decreased slightly in density from 2005 to 2006, but still maintained good stands. P-12, Wahluke and Jim Creek all had densities over 1.00 plants/ft<sup>2</sup>. Columbia, Anatone, P-7 and P-15 had densities between 0.50 and 1.00 plants/ft<sup>2</sup> while P-5 and Goldar both shared low densities. In 2007 densities were generally slightly lower, but still higher than all other species as a whole. The highest density recorded in 2007 was Jim Creek at 1.07 plants/ft<sup>2</sup>.



Jim Creek bluebunch wheatgrass, 2007.

Snake River wheatgrass accessions had good densities the establishment year with three accessions having densities greater than 1.00 plants/ft<sup>2</sup>. Numbers declined slightly yet steadily over the next two years. In 2007 the best density was from SERDP with 0.70 plants/ft<sup>2</sup>.

The basin wildrye accessions densities also decreased from 2005 to 2006; U108-02 and Trailhead retained the highest densities at 0.24 and 0.26 plants/ft<sup>2</sup> respectively. By 2007 the best density was achieved by Trailhead with 0.17 plants/ft<sup>2</sup>. U108-02 and U100-01 had similar densities with 0.11 and 0.13 plants/ft<sup>2</sup> respectively.

Sheep fescue stands remained poor from 2005 to 2006 with Covar slightly increasing from 0.00 to 0.07 plants/ft<sup>2</sup>. In 2007 Covar still had 0.07 plants/ft<sup>2</sup>, and Initial Point had decreased to 0.00 plants/ft<sup>2</sup>.

Thurber's needlegrass had no plants in the evaluated grids for any year.

All five of the Sandberg bluegrass accessions increased in density from 2005 to 2006. The best stands were observed in the High Plains and Mountain Home plots with respective stands of 0.54 and 0.35 plants/ft<sup>2</sup>. In 2007 all stands had been reduced to 0.0 plants/ft<sup>2</sup>.

Species	Name or accession	4/27/05	5/25/05	5/30/06	5/16/07
		-----Plants/ft <sup>2</sup> -----			
<b>Indian ricegrass</b>	Rimrock	0.37	0.20	0.00	0.00
	White River	0.56	0.17	0.00	0.00
	Nezpar	0.42	0.17	0.00	0.00
	Ribstone	0.14	0.09	0.00	0.00
	Paloma	0.05	0.00	0.00	0.00
<b>Squirreltail</b>	Fish Creek	0.97	0.54	0.26	0.22
	Sand Hollow	0.37	0.20	0.19	0.20
	Shaniko Plateau	0.81	0.52	0.06	0.09
	Toe Jam Creek	0.58	0.17	0.00	0.00
	9019219	0.02	0.02	0.00	0.00
<b>Thickspike wheatgrass</b>	Bannock	1.04	1.07	0.58	0.43
	Schwendimar	0.69	0.52	0.39	0.24
	Critana	0.90	0.56	0.24	0.17
	Sodar	0.37	0.30	0.15	0.07
<b>Slender wheatgrass</b>	Revenue	1.00	0.93	0.00	0.00
	San Luis	0.60	0.69	0.00	0.00
	Pryor	0.30	0.30	0.02	0.00
<b>Western wheatgrass</b>	Rodan	0.28	0.35	0.13	0.00
	Rosana	0.05	0.20	0.04	0.00
	Arriba	0.16	0.15	0.06	0.00
<b>Bluebunch wheatgrass</b>	Jim Creek	0.83	1.02	1.02	1.07
	Wahluke	0.97	1.26	1.02	0.98
	P-12	1.34	1.59	1.04	0.89
	Columbia	1.30	1.23	0.84	0.83
	Anatone	0.81	1.15	0.80	0.69
	P-7	0.93	1.15	0.67	0.57
	P-15	0.60	0.93	0.54	0.50
	Goldar	0.51	0.37	0.33	0.19
	P-5	0.42	0.61	0.22	0.13
<b>Snake River wheatgrass</b>	SERDP	1.02	0.94	0.67	0.70
	Secar	1.00	1.11	0.76	0.56
	Expedition	1.27	1.44	0.54	0.41
	E-26	0.21	0.23	0.22	0.13
<b>Basin wildrye</b>	Trailhead	0.60	0.52	0.26	0.17
	U100-01	0.53	0.41	0.11	0.13
	U108-02	0.56	0.57	0.24	0.11
	Washoe	0.21	0.09	0.09	0.06
	Magnar	0.28	0.22	0.04	0.04
	U70-01	0.30	0.22	0.02	0.02
<b>Sheep fescue</b>	Covar	0.16	0.00	0.07	0.07
	Initial Point	0.21	0.04	0.02	0.00

<b>Thurber's needlegrass</b>	Thurber's	0.00	0.00	0.00	0.00
<b>Sandberg bluegrass</b>	High Plains	0.25	0.00	0.54	0.00
	Sherman	0.00	0.00	0.02	0.00
	Mountain Home	0.00	0.00	0.35	0.00
	Toole County, MT	0.00	0.00	0.04	0.00
	Hanford Source	0.00	0.00	0.19	0.00

### Introduced Grasses

Although many of the introduced grass accessions had fair emergence, an outbreak of black grass bugs at the time of the first evaluation in 2005 was noted. The infestation appeared limited to the introduced grass section of the nursery. Plants were covered with yellow spots making the plants appear yellow-green overall. Although most of the stands of the introduced grasses decreased from the first to the second evaluation, many stands had recovered and increased by 2006 indicating that many plants thought to be dead during the second evaluation in 2005 were still alive. However, the plants of crested wheatgrass were very small when compared to the other wheatgrasses in the nursery and still appear to be recovering from black grass bug pressure. The 2007 evaluation showed all established plots with reduced densities, many accessions dropping out completely.

In 2006 all of the crested wheatgrass accessions increased in density or remained approximately where they were in 2005. Ephraim rose from 0.28 to 1.23 plants/ft<sup>2</sup>; however, many of the plants were small in size due to the black grass bug infestation during the spring of 2005. In 2007 the best density was obtained from Nordan with 0.67 plants/ft<sup>2</sup>. Ephraim had dropped from 1.23 to 0.02 plants/ft<sup>2</sup>.

Both Siberian wheatgrass accessions similarly increased from 2005 to 2006, but decreased in 2007. In 2007 Vavilov was down to 0.26 plants/ft<sup>2</sup> and P-27 had 0.00 plants/ft<sup>2</sup>.

The three pubescent wheatgrass accessions decreased from 2005 to 2006 with the highest density in 2006 coming from Manska at 0.28 plants/ft<sup>2</sup>. Manska continued to have the best density in 2007 with 0.13 plants/ft<sup>2</sup>.

Rush intermediate wheatgrass, had 0.00 plants/ft<sup>2</sup> in 2006 and 2007.

Prairieland and Eejay Altai wildrye had zero plants in 2006. Pearl Altai wildrye had 0.02 plants/ft<sup>2</sup>. In 2007 Prairieland and Eejay again had 0.00 plants/ft<sup>2</sup> and Pearl increased slightly to 0.04 plants/ft<sup>2</sup>.

The Russian wildrye accessions all increased in density with the exception of Tetraacan which decreased slightly. The best stand was recorded in the Bozoisky Select plot with 0.58 plants/ft<sup>2</sup>. Bozoisky select had the best stand in 2007 with 0.35 plants/ft<sup>2</sup>. Bozoisky II had the next best rating with 0.26 plants/ft<sup>2</sup>.

Species	Name or accession	4/27/05	5/25/05	5/30/06	5/16/07
		-----Plants/ft <sup>2</sup> -----			
<b>Crested wheatgrass</b>	Nordan	1.30	1.19	1.10	0.67
	Roadcrest	1.30	0.07	0.52	0.19

	Hycrest	0.39	0.24	0.15	0.07
	Ephraim	0.65	0.28	1.23	0.02
	CD-II	0.56	0.24	0.20	0.00
	Douglas	0.28	0.04	0.09	0.00
<b>Siberian wheatgrass</b>	Vavilov	0.65	0.20	0.61	0.26
	P-27	0.09	0.02	0.33	0.00
<b>Pubescent wheatgrass</b>	Manska	0.69	0.65	0.28	0.13
	Greenleaf	0.60	0.59	0.15	0.09
	Luna	0.79	0.54	0.13	0.00
<b>Intermediate wheatgrass</b>	Rush	0.60	0.56	0.00	0.00
	Pearl	0.35	0.15	0.02	0.04
<b>Altai wildrye</b>	Prairieland	0.56	0.39	0.00	0.00
	Eejay	0.16	0.28	0.00	0.00
<b>Russian wildrye</b>	Bozoisky Select	0.72	0.54	0.58	0.35
	Syn-A (Bozoisky II)	0.21	0.13	0.24	0.26
	Mankota	0.46	0.28	0.32	0.19
	Tetracan	0.42	0.20	0.17	0.07

## Forbs and Shrubs



Stand of Eagle yarrow, May 2007.

Despite some good stands in 2005, all of the forb and shrub accessions except for Eagle yarrow had zero plants during the 2006 evaluation. Eagle had 0.07 plants/ft<sup>2</sup> in the frequency grids along with a small stand of plants at one end of the seeded plot. In 2007 more plants of Eagle had either germinated from the original seeding, or seed had spread from established plants. Plant density for Eagle in 2007 equaled 0.24 plants/ft<sup>2</sup>. Snake River Plains fourwing saltbush also had a single plant found in the plots, increasing its density from 0.00 to 0.02 plants/ft<sup>2</sup>.

Species	Name or accession	4/27/05	5/25/05	5/30/06	5/16/07
		-----Plants/ft <sup>2</sup> -----			
<b>Western yarrow</b>	Eagle	0.51	0.50	0.07	0.24
	Great Northern	0.19	0.09	0.00	0.00
<b>Utah sweetvetch</b>	Timp	0.14	0.02	0.00	0.00
<b>Firecracker penstemon</b>	Richfield Selection	0.02	0.02	0.00	0.00
<b>Scarlet globemallow</b>		0.00	0.00	0.00	0.00
<b>Lewis flax</b>	Maple Grove	0.42	0.15	0.00	0.00
<b>Blue flax</b>	Appar	0.90	0.26	0.00	0.00
<b>Wyoming big sagebrush</b>		0.02	0.02	0.00	0.00
<b>Fourwing saltbush</b>	Snake River Plains	0.00	0.00	0.00	0.02
	Wytana	0.00	0.00	0.00	0.00
	Rincon	0.00	0.00	0.00	0.00

<b>Gardner's saltbush</b>	9016134	0.00	0.00	0.00	0.00
<b>Winterfat</b>	Hatch	0.28	0.17	0.00	0.00
	Northern Cold Desert	0.00	0.00	0.00	0.00
	Open Range	0.00	0.00	0.00	0.00
<b>Forage kochia</b>	Immigrant	0.00	0.00	0.00	0.00

### Cover Crop

The cover crop consisted of a four species mix which contained: 50% Anatone bluebunch wheatgrass, 20% Bannock thickspike wheatgrass, 20% Magnar basin wildrye and 10% Snake River Plains fourwing saltbush. Four grids were examined during the first evaluation in 2005, one on each side of the nursery, and five grids were evaluated at the time of the second evaluation in 2005 and the 2006 evaluation. Total plant density was estimated at 0.37 plants/ft<sup>2</sup> at the first evaluation and 0.57 plants/ft<sup>2</sup> at the second evaluation. In 2006 the cover crop density was 0.13 plants/ft<sup>2</sup>. Cover crop densities increased in 2007 up to 0.20 plants/ft<sup>2</sup>.

### Discussion

Despite large amounts of Russian thistle, native and introduced grasses had fair to good emergence and plant density during the establishment year. Germination and emergence might have been increased with more precipitation during March and April, 2005 but emergence was good with the rain that was received. The majority of the plots showed decreased stands from 2005 to 2006 and again into 2007. The low precipitation at the site, especially the lack of moisture in July and August every year seems to have eliminated many of the less drought tolerant accessions. One concern is the effect of black grass bugs on the introduced grasses. Plants subjected to black grass bug are normally affected by decreased seed yield and a reduction in palatability. Infestations rarely result in the death of established plants, but in low water years establishing plants may be under enough stress to kill the establishing seedlings (Hammon and Peairs 2001). The second evaluation in 2005 indicated a loss in plant densities; however it appears that many of the plants survived, although stunted, through 2006. In 2007 many more plants had died out leaving poor or no stands in many plots. Snake River and blue bunch wheatgrass had consistently good stands from essentially all accessions. Introduced species like crested wheatgrass and Russian wildrye also had good performers such as Nordan and Bozoisky select.

Future evaluations will provide more information on plant establishment, persistence and longevity. The PMC staff will continue to evaluate plant performance at the site.

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