Zeba® Seed Coating and Soil Amendment Product Evaluation
Study Number: IDPMC-T-0801-RA
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Introduction

Zeba®, a product produced by Absorbent Technologies, Inc (ATI) is a superabsorbent cornstarch based polymer that is used as a seed coating or soil amendment. The product is designed to hold and release water for use by plants multiple times throughout the growing season. Zeba is reported to be capable of absorbing up to 400 times its original weight in water and to slowly release encapsulated moisture in response to plant root suction. The hydrogel can also rehydrate and store additional water as moisture enters the soil, a process that can be repeated numerous times before Zeba loses effectiveness. The claimed result is faster germination, quicker emergence, better plant establishment, consistent growth and higher, better-quality yields using less water. Zeba has been employed extensively in turf, nursery and other agricultural settings, but has been tested very little for rangeland restoration projects.

Trade names are used solely to provide information. Mention of a trade name does not constitute a guarantee of the product by the USDA-NRCS nor does it imply endorsement over comparable products that are not named.

To test the efficacy of Zeba for use in rangeland seeding projects, the Aberdeen PMC established a study at Skull Valley, UT, 45 mi SW of Salt Lake City, UT on the Ensign Ranch. The site is located on a west facing slope with 2 to 4% slopes. Soils at the site are a semi-desert gravelly loam. The soils are described as being approximately 60 inches deep. However during site preparation we detected a hardpan at approximately 6 to 8 inches (likely due to past uses of the site). The natural plant community is a Wyoming big sagebrush- grass- forb community consisting of approximately 45% shrubs, 45% perennial grasses and 10% forbs. Dominant grass species include bluebunch wheatgrass, Indian ricegrass and bottlebrush squirreltail. The site receives an average of 8 to 12 inches of precipitation annually. Mean air temperatures range from 45 to 50º F with 100 to 150 frost free days.

Materials and Methods

For this study two grass species native to the site were utilized. They included Anatone Germplasm bluebunch wheatgrass and ‘Nezpar’ Indian ricegrass.

Three Zeba treatments were tested in this study; two treatments were different formulations of seed coating, Zeba standard and Zeba plus an experimental compound. The third treatment was Farm, a granular soil amendment which is applied through the drill along with the seed.

For the coated seed treatments, 400 coated seeds were counted and weighed to find the number of seeds/per pound. In both coating treatments for each species there were approximately 40,000- 45,000 seeds/lb. From this it was determined that 25 lb coated

seed per acre yielded approximately 25 seeds/ft². One cup of seed from each treatment and species was then weighed to determine bushel weights which could be used to calculate rice hull mix percentages according to St. John et al (2005). Bushel weights used were: non-coated Anatone (21.7 lb/bu); Zeba coated Anatone (27.0 lb/bu); Zeba plus compound coated Anatone (28.8 lb/bu); non-coated Nezpar (56.5 lb/bu); Zeba coated Nezpar (58.7 lb/bu); Zeba plus compound coated Nezpar (59.1 lb/bu). The Farm soil amendment was mixed with seed and rice hulls and planted at a rate of 2.5 lb/ac in addition to the seed. A bushel weight of 41.0 lb/bu for the Farm amendment was used to calculate the rice hull mixture. Non-treated seed was planted at 7 lb PLS/ac (with rice hulls) for bluebunch wheatgrass and 5 lb PLS/ac (with rice hulls) for Indian ricegrass following Ogle et al (2006).

The planting site was treated in 2006 with 4.3 oz roundup and 1 oz 2,4-D/gallon at a rate of 15 gallons/acre in 2006 to reduce weed pressure. The site was then disked during mid April 2007. On June 25, 2007 the site was again sprayed with the same herbicide treatment as in 2006 to control weeds which had germinated following spring rains. The dominant weeds present were foxtail barley (*Hordeum murinum*), tansy mustard (*Descurainia sophia*) and a few patches of field bindweed (*Convolvulus arvensis*). The site was cultivated one additional time and packed just prior to planting.

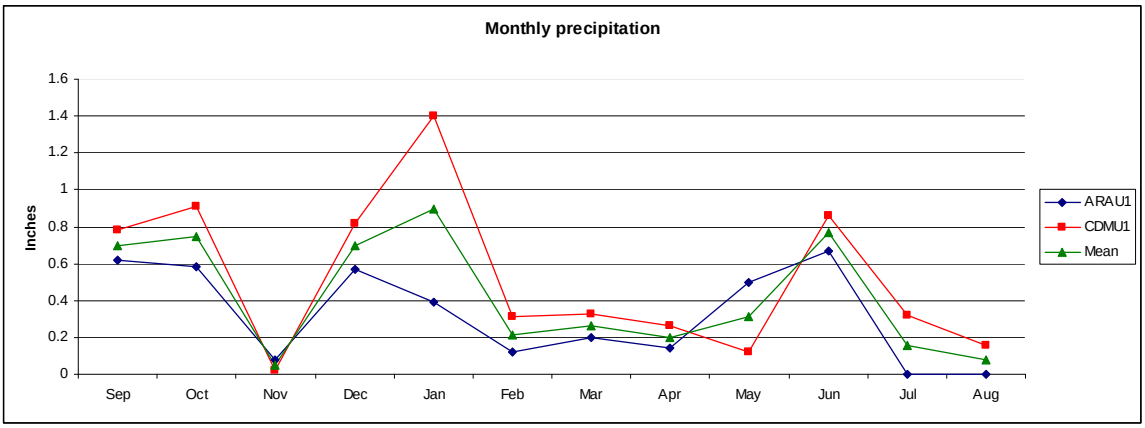
Plots were planted on November 14, 2007 into 7 x 20 foot plots in a randomized complete block design with four replications. Plots were seeded with 10 inch row spacing using a modified Tye drill. Bluebunch wheatgrass was seeded to a depth of about 0.5 inch and Indian ricegrass was seeded to a depth of approximately 1.0 inch.

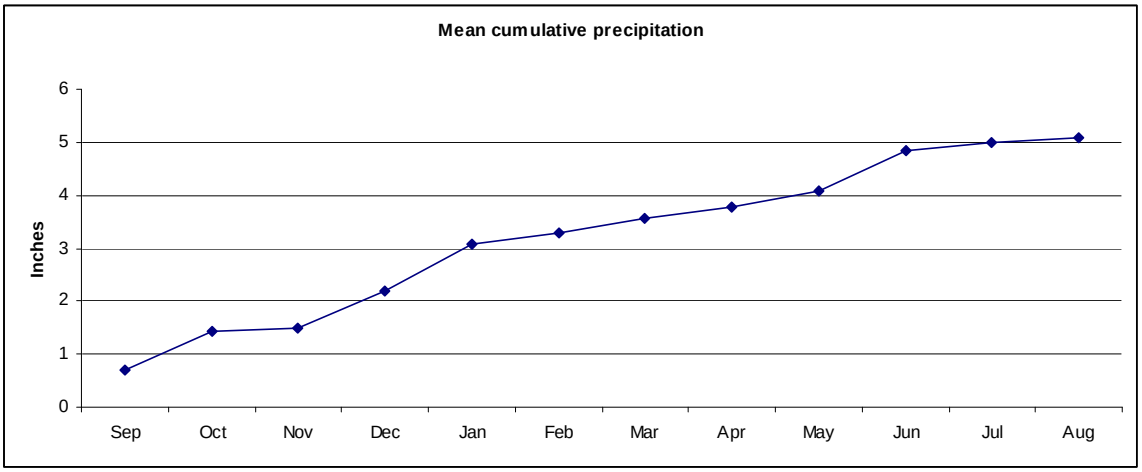
The plots were evaluated for initial establishment on May 21, 2008 and again on August 26, 2008 to determine season long persistence. Evaluations were conducted using a frequency grid as described by Vogel and Masters (2001). The grid measured approximately 40 x 41 inches, having four ten inch columns (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. Decrease in stand densities was conducted on a per plot basis. Plots which contained zero plants in the spring and had zero plants in the fall were omitted from the data set, and not counted as “no change in density.” 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.

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

Indian ricegrass

All Zeba treatments provided greater mean plant densities than the control in the Indian ricegrass plots, however, no significant differences could be detected in the initial establishment evaluation ($p=0.28$). Zeba gave the highest densities in the Indian ricegrass plots with 0.46 plants/ft² (table 1), which was 3.5 times greater density than the control plots (0.13 plants/ft²). Zeba plus compound had the second highest density (0.40 plants/ft²), then the Farm amendment followed by control with 0.25 and 0.13 plants/ft² respectively. Two of the four plots in the Zeba plus compound treatments had essentially no seedlings, while the other two replications had very high densities. This added a large

amount of error to the statistical analysis, not allowing means to be separated. However, if the Zeba plus compound data are removed from the analysis, the Zeba treatment has significantly greater plant density than the control treatments (p=0.01).

The fall evaluation again revealed no statistical significance (p=0.75), but all treatments still had higher plant densities than the control. The greatest density came from the Farm treatment with 0.13 plants/ft². The Zeba plus compound and Zeba treatments both had densities of 0.10 plants/ft² while the control had only 0.03 plants/ft².

All treatments decreased in stand densities between the spring and fall evaluation, however no significant differences were detected between treatments (p=0.55). The control, Zeba plus compound and Zeba plots all had a decrease of 80% or greater. The Farm treated plots however had only a 56.3% decrease.

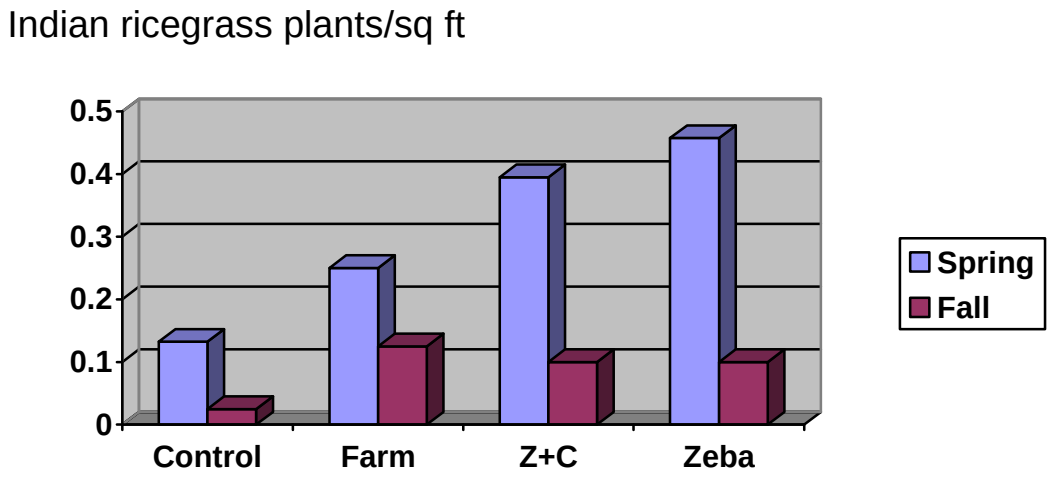


Table 1. Indian ricegrass

Treatment	Plant density (plants/ft²) Spring	Fall	% decrease
Control	0.13	0.03	88.1
Farm	0.25	0.13	56.3
Zeba + compound	0.40	0.10	83.4
Zeba	0.46	0.10	80.0

Bluebunch wheatgrass

In the bluebunch wheatgrass trial there was again no statistical significance between treatments in the spring or fall evaluation (p=0.36 and 0.17 respectively). The two seed coating treatments however had greater average establishment densities than the control in the spring evaluation. The Zeba plus compound treatment had slightly better average densities than Zeba (0.70 plants/ft² versus 0.66 plants/ft²). The control plots had an average plant density of 0.50 plants/ft², while the Farm amendment had a mean density of 0.38 plants/ft².

In the fall evaluation the Zeba plus compound and Zeba treatments still had the highest plant densities with 0.35 and 0.38 plants/ft² respectively. The Farm amendment and control plots each had a mean density of 0.20 plants/ft².

As with the Indian ricegrass trail, all bluebunch densities decreased from spring to fall. The greatest decrease in density was observed in the control plots (60.0%). The smallest decrease came from the Zeba treatment with 42.4% decrease from spring to fall. The Zeba plus compound and Farm treatments had similar decreases with 50.0 and 47.4% decrease respectively. No significant differences in percent decrease were detected between treatments (p=0.64).

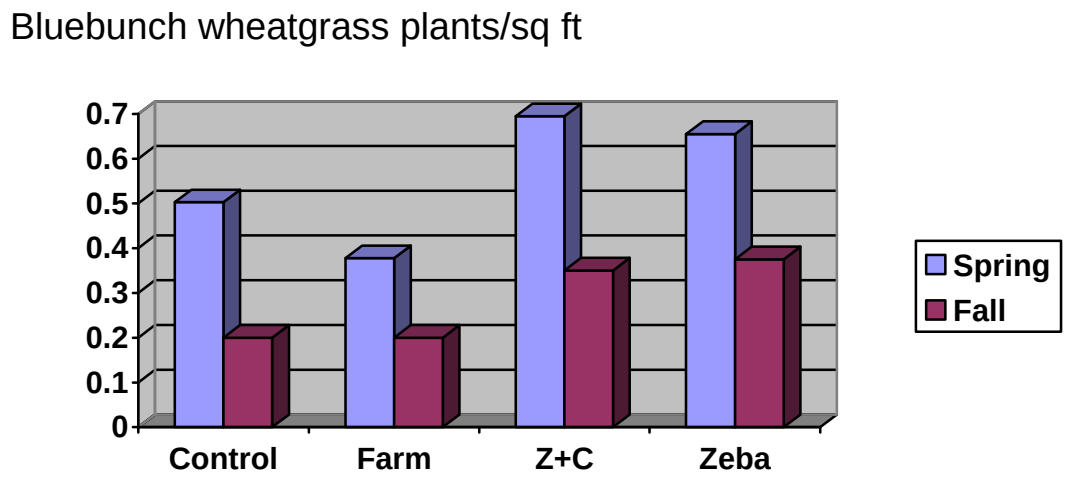


Table 2. Bluebunch wheatgrass

	Plant density		
Treatment	Spring	Fall	% decrease
Control	0.50	0.20	60.0
Farm	0.38	0.20	47.4
Zeba + compound	0.70	0.35	50.0
Zeba	0.66	0.38	42.4

Discussion

Limited precipitation during the winter and establishment period at Skull Valley resulted in low establishment densities. All Zeba treatments, with the exception of the Farm amendment in the bluebunch wheatgrass trial, had greater average plant densities than the non-treated control. Among both species the Zeba plus compound and Zeba seed coating treatments had greater plant densities than the control and Farm treatment in the initial establishment evaluation. At the fall evaluation the Farm treatment in the Indian ricegrass trial had a slightly greater plant density than the other Zeba treatments. It is conceivable under the low water conditions at the site that seed coating treatments (Zeba and Zeba plus compound) provided immediate water availability and improved germination.

The Farm soil amendment mixed in the row is thought to provide moisture to elongated roots following establishment, but not necessarily immediate water for germination. The smaller percent decrease in the farm treated plots of Indian ricegrass versus other treatments may reflect this hypothesis. If it is true, Farm treatment may provide better long-term survival than the control or coated treatments. However, quicker germination induced by the improved moisture surrounding the seed coat in the case of coated seed may allow roots to grow longer and deeper providing access to additional soil moisture later in the season. A combination of coated seed mixed with the Farm treatment may provide the benefits of both products. Further evaluations are needed to verify this.

The cost of using Zeba may also be a factor in range restoration plantings. The price of Zeba seed coating varies significantly, subject to the type of seed, volume and market. For the purpose of this trial, the cost for coating the seed with Zeba was $0.64/coated pound, including $0.30/lb for materials and $0.34/lb for processing, while retail cost for the Farm amendment runs around $8.00/lb or approximately $20.00 per acre at the trial use rate of 2.5 lb/ac. Zeba coating costs are based on coating 100 lb of seed.

The data gathered from this initial evaluation are encouraging and warrant additional testing of these products.

References

MesoWest. 2008. University of Utah. SLC, UT. http://www.met.utah.edu/mesowest/. Accessed September 23, 2008.

Ogle, D., St. John, L., Stannard, M. and L. Holzworth. 2006. Technical Note 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. 2005. Technical Note 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.