

Summary of Polymer Seed Coating and Soil Amendment Evaluation Studies

February 4, 2010

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In the past few decades, researchers have developed numerous products designed to increase seedling establishment and survival for many different kinds of applications including native site restoration. Zeba, produced by Absorbent Technologies, Inc, 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 and 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.

Between 2006 and 2009 the Aberdeen Plant Materials Center (PMC) conducted three evaluation plantings of Zeba seed coating. Three Zeba treatments were tested among these studies; 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 (Figure 1).



Figure 1. Zeba Farm soil amendment (left) and used as a seed coating (right).

This report provides a summary of the data collected from trials. For detailed information on each of these studies, refer to the individual progress reports.

Trade names mentioned in this report 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.

Coffee Point, Idaho non-replicated initial evaluation

The PMC established non-replicated evaluation plots of Zeba treated Magnar basin wildrye, Goldar bluebunch wheatgrass, Appar blue flax, and Nezpar Indian ricegrass at the Coffee Point test site, 25 miles northwest of Aberdeen, Idaho. The site conditions are very dry with mean annual precipitation ranging from 8 to 12 inches. The area historically supported a Wyoming big sagebrush/bluebunch wheatgrass plant community. Soils at the site are the Splittop-Atomic complex with 2 to 8% slopes and effective rooting depth of 20 to 40 inches. The pH of the soil complex is 7.4 to 8.4. The elevation is 4,850 ft.

The plots of Zeba treated Magnar and Goldar were compared against an adjacent non-treated planting. There were no non-treated plots of Appar or Nezpar so a comparison could not be made. Observation plots were not replicated and could not be analyzed statistically. In May 2007 Zeba treated Magnar seed had a mean establishment density of 0.71 plants/ft² as compared with 0.15 plants/ft² achieved in the untreated plots. Similarly, treated Goldar bluebunch wheatgrass had an average plant density of 0.43 plants/ft² while the untreated plots averaged only 0.13 plants/ft². Zeba treated plots continued to have greater plant densities than the non-treated plots for the next two years.

Table 1. Coffee Point initial observation planting.

Treatment	May 07	Sep 07	May 08	May 09
	------(plants/ft ²)-----			
Magnar Zeba	0.71	0.24	0.30	0.11
Magnar non-treated	0.15	0.01	0.03	0.02
Goldar Zeba	0.43	0.32	0.35	0.06
Goldar non-treated	0.13	0.13	0.10	0.02

Skull Valley, Utah

In order to better evaluate the efficacy of Zeba for use in rangeland seeding projects, the PMC established a study at Skull Valley, Utah, 45 miles west of Salt Lake City, Utah. The site is a Wyoming big sagebrush- grass- forb community receiving an average of 8 to 12 inches of annual precipitation. Soils at the site are a semi-desert gravelly loam. We evaluated establishment and survival of Anatone Germplasm bluebunch wheatgrass and Nezpar Indian ricegrass when used in conjunction with Zeba standard, Zeba plus compound and Farm treatments.

No significant differences were detected between treatments at any evaluation for plant density or persistence. All Zeba treatments, however, with the exception of the Farm amendment in the bluebunch wheatgrass trial, had greater average plant densities than the

non-treated controls. 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 August evaluation the Farm treatment in the Indian ricegrass trial had a slightly greater plant density than the other Zeba treatments. The plots were evaluated again in 2009, but not enough plants were detected to conduct an analysis.

Table 2. Skull Valley replicated planting.

Treatment	Nezpar		Anatone	
	May 08	Aug 08	May 08	Aug 08
	------(plants/ft ²)-----			
Control	0.13	0.04	0.50	0.20
Farm	0.25	0.13	0.38	0.17
Zeba + compound	0.39	0.12	0.70	0.36
Zeba	0.46	0.09	0.66	0.35
P=	0.27	0.63	0.16	0.17

Native forb establishment

In 2008 a trial was established at the PMC home farm near Aberdeen, Idaho to compare establishment and survival of the forbs, Appar blue flax and Maple Grove Lewis flax, when used with Zeba technologies versus a non-treated control. The treatments evaluated were the same as in the Skull Valley study.



Figure 2. Zeba coating remained on seed coat after germination and was deposited on soil surface.

No significant differences were detected for percent stand or plant density for Appar or Maple Grove. The best rated percent stand for Appar came from the non-treated control (59%). The highest average plant density among the Appar plots was from the Zeba treated seed with 11.3 plants/ft. The best percent stand and plant densities of Maple Grove were found in the non-treated plots (54% and 10.9 plants/ft respectively).

Results of this study indicate no effect from the use of Zeba seed coating or Farm soil amendment when used with Maple Grove Lewis flax or Appar blue flax. One observation noted during the study was that the Zeba remained on the seed coat at the time of germination (Figure 2). The seed coat of many forbs is lifted above the soil surface with the cotyledons and falls shortly after to the ground. It is hard to conceive the Zeba coating providing much soil moisture retention accessible to the roots in this position.

Table 3. Evaluation of Appar and maple grove blue flax May 2009.

Treatment	Appar		Maple Grove		
	% stand	Plants/ft	% stand	Plants/ft	
Control	59	9.0	54	10.9	
Farm	46	8.6	44	7.8	
Zeba	56	11.3	42	4.5	
Farm+Zeba	55	6.8	28	3.5	
	P=	0.59	0.48	0.35	0.07

Discussion

The results from these studies indicated no significant effect from the use of Zeba formulations. However, less than average rainfall at Coffee Point and Skull Valley during establishment and beyond significantly decreased expected germination and survival. Coffee Point received less than 6 inches of precipitation during 2007 (establishment year), and Skull Valley received less than 3 inches of precipitation the establishment year. Such extreme drought conditions created an environment that was unreasonable to expect the amendment to perform as it might have under more normal conditions

Using Zeba seed coating on species which elevate the seed coat above the soil surface as in many dicotyledonous forbs appears to be ineffective. Use of the Farm soil amendment intuitively seems a better option for such species; however our results showed no conclusive evidence that using Farm aids in establishment or persistence.

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 Skull Valley 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.

Another idea that has been suggested which may be worth further testing is the use of much higher rates of Zeba Farm than the recommended rate following the assumption that the limiting factor of plant growth is available soil moisture. Increasing Farm soil amendment rates may increase soil moisture next to the planted seed and increase the overall chance of seed germination, plant establishment and long-term survival. This may be especially applicable in extreme arid conditions such as those encountered at Coffee Point and Skull Valley during these studies.