Auburn University
Southern Forest Nursery Management Cooperative

RESEARCH REPORT 08-06

EVALUATION OF SOIL MOIST™ AND ZEBA™ AS NURSERY SOIL AMENDMENTS ON SEEDLING GROWTH AND SURVIVAL

by
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INTRODUCTION

Polyacrylamides (PAM) are extensively used in many applications (Ajwa and Trout 2006). The wide range of molecular weights alters the physical and chemical properties and thus how polyacrylamides are used. The largest use of PAM is in water treatment where they are used as a flocculator (Wong, et.al. 2006) which aids in the separation of suspended solids from liquids. PAMs are also frequently mixed with mulch and straw and sprayed on construction sites to prevent erosion.

One of the physical properties that horticulturalists/soil scientists have focused on is the ability of PAM to absorb many times its weight in water (McLaughlin and Bartholomew 2007). Therefore, they have been used as a soil/medium amendment in the horticultural market for many years to reduce plant watering and soil compaction. Soil Moist™, produced by JRM Chemical, Inc., Cleveland, OH is an example of a synthetic acrylic polyacrylamide with a potassium salt base that is specifically designed for the horticultural and agricultural market. Soil Moist™ reportedly will absorb over two hundred times its weight in water and then release its water reserve as the soil dries down. The material is soil-effective for 3-5 years. (http://www.soilmoist.com/forms/Form_145_1_4.pdf) JRM Chemical, Inc., Cleveland, OH also manufactures another polyacrylamide product that is commonly used in forest tree nurseries as a root gel sprayed on the tree roots during packing and shipping.

Another product, Zeba™, produced by Absorbent Technologies, Inc., Beaverton, OR is a product marketed as a soil/medium amendment and as a root dip. Zeba™ is a hydrolyzed starch based polymer reported to hold 400 times its weight in water and then slowly releases the water upon plant demand through the root. The material is soil-effective for one to several years. (http://www.zeba.com/pdfs/linked/20011_White_Paper.pdf)

The impetus for this study came from several member nurseries within the Nursery Cooperative who had requested that we evaluate these products under nursery conditions.

METHODOLOGY

In April of 2007, two identical studies were established at the Rayonier nursery in Glennville, GA and at the Plum Creek nursery in Jesup, GA. At both nurseries, first year fumigated land was used. For the study, Soil Moist™ and Zeba™ were supplied by the manufacturer which also provided the recommended rates of material to be applied in this study. Soil Moist™ was applied at the rate of 5 lbs/1000 sq ft. Zeba™ was applied at the rate of 1 lb/1000 sq ft. A Gandy® cam gauge row applicator was attached to a nursery tractor and used to apply the product (Figure 1). Applications were made just before final bed formation and sowing with loblolly pine.

This study was laid out as a randomized complete block design with four replications. Treatments (Soil Moist™, Zeba™ and a control) were randomly assigned to one riser section using beds 1, 3, 5 and 7. Each treatment was 80' long with a 20' buffer between treatments. Only the middle 40' of each bed was sampled. Since the Gandy® cam gauge row applicator could not spread the Soil Moist™ rate of 5 lbs/1000 sq ft in one pass, the rate was divided into three passes. After Soil Moist™ and Zeba™ were broadcast on the bed surface (Figures 2 & 3), they were roto-tilled to a depth of six to eight inches and the final bed formation was completed with a Fobro® Bed Shaper for sowing. At each sampling period, four subplots were sampled from each treatment and replication. The dates and information collected from each nursery is listed in Table 1. Only the data from 28 weeks post-sowing are presented in this paper. The data from the other two sampling times did not differ from week 28 for each nursery.

Table 1. Dates and information collected at each nursery

No. of Weeks Post-Sowing	Seedling Density	RCD	Height	Root/Shoot Biomass	Soil Bulk Density	Root Morphology
5	Yes	Yes	Yes	Yes	Yes	No
15	Yes	Yes	Yes	Yes	Yes	No
28	Yes	Yes	Yes	Yes	Yes	Yes

RESULTS

The addition of either Soil Moist™ or Zeba™ had no effect on any of the seedling characteristics or soil bulk density measure when compared to the control plots in either of the two nurseries (Tables 2 & 3). While Soil Moist™ was observed adhering to the seedling roots sampled (Figure 4), there were no differences in seedling appearance/growth/characteristics observed in the treatment plots.

Product information for both Soil Moist™ and Zeba™ states that once the product has absorbed water in the soil, it is available to be released back to the plant in times of drought. Rainfall at Glennville totaled 25.0" during the test period and 30.5" at Jesup. Normal nursery irrigation supplemented the rainfall. The distribution of rainfall throughout the test period for both nurseries is shown in Figures 5 & 6. At both nurseries, the rainfall in April and May was significantly below average. It is unknown whether sufficient material was in the root zone to be of any benefit to the seedlings. Since the water management of the Soil Moist™ and Zeba™ plots were identical to adjacent control (non-treated) plots, any advantage that either Soil Moist™ or Zeba™ may have provided in a drought situation could not be verified. To effectively test these materials and their reported properties, nurseries would have to either forgo or significantly reduce irrigation in the treated sections to determine any treatment efficacy.

During April 2007, Glennville nursery had high winds shortly after sowing which resulted in less than optimum plant density. This resulted in larger seedlings at this nursery compared to Jesup nursery (Tables 2 & 3).

MANAGEMENT IMPLICATIONS

The recommended method of broadcasting the material on the bed surface and then roto-tilling it into the soil resulted in material being distributed throughout the top 6-8" of soil. The Zeba™ used in this study was $9.00/lb and the Soil Moist™ was $4.00/lb. After observing Soil Moist™ adhering to the roots, we can speculate that perhaps the rates used in this study for both materials should have been higher to observe any treatment differences. I see no economic advantage to irrigated forest tree nurseries amending their soils with these products, rates or application methods similar to those tested in this study. Increasing the organic matter may be a more cost effective alternative which will last longer in the soil profile.

REFERENCES

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Table 2. Seedling quality and soil data at Glennville, GA.

				Dry Weight (gm)			Root Morphology			Seedling Grade (#/sq ft)		
TRT	Seedling Density (Sq ft)	RCD (mm)	HT (cm)	Root	Shoot	Bulk Density (g/cm3)	Length (cm)	Surface Area (cm^2)	# of Tips	1	2	Culls
Control	19.3	5.4	32.4	0.82	5.33	1.66	389.7	136.0	889.9	13.5	5.2	0.6
Soil Moist	16.6	5.5	31.4	0.94	5.97	1.66	402.1	145.1	936.3	12.0	4.3	0.3
Zeba	15.9	5.8	31.0	0.99	6.49	1.67	402.2	136.0	926.8	12.4	3.3	0.2
$lsd_{0.05}$	4.32	0.44	1.49	0.17	0.95	0.05	46.3	20.9	126.7			

Table 3. Seedling quality and soil data at Jesup, GA.

				Dry Weight (gm)			Root Morphology			Seedling Grade (#/sq ft)		
TRT	Seedling Density (Sq ft)	RCD (mm)	HT (cm)	Root	Shoot	Bulk Density (g/cm^3)	Length (cm)	Surface Area $(cm)^2$	# of Tips	1	2	Culls
Control	21.8	4.3	31.5	0.48	3.17	1.39	269.8	68.2	705.1	3.9	17.7	0.2
Soil Moist	20.3	4.4	31.8	0.55	3.30	1.39	250.5	66.9	650.6	5.1	15.0	0.2
Zeba	20.7	4.2	31.5	0.51	3.13	1.42	274.5	68.6	727.8	3.5	16.6	0.6
$lsd_{0.05}$	2.2	0.2	0.7	0.04	0.24	0.04	26.4	6.8	79.1			

Figure 1. Tractor mounted Gandy spreader

Figure 2. Zeba on seedling beds @ 1 lb/1000 sq. ft.

Figure 3. Soil Moist™ on seedling beds @ 5 lb/1000 sq. ft.

Figure 4. Soil Moist™ adhering on seedling roots.

Figure 5. Rainfall distribution at Glennville, GA

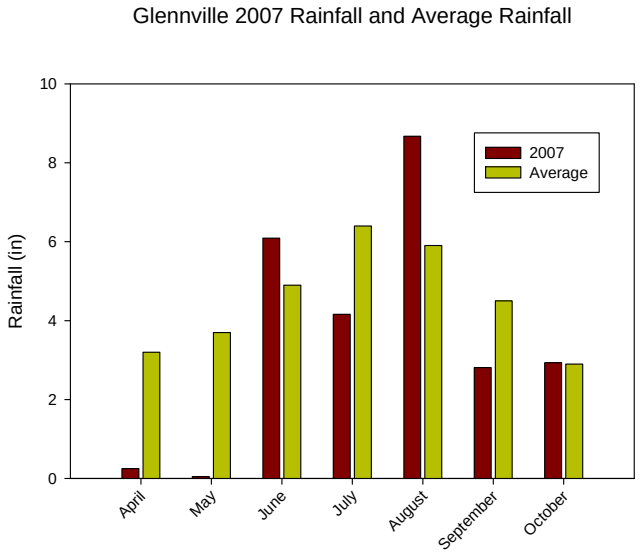

Figure 6. Rainfall distribution at Jesup, GA