Southern Forest
Nursery Management Cooperative

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SOIL STABILIZER TRIALS ON LOBLOLLY PINE SEEDBEDS

by
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INTRODUCTION

Agricultural soil stabilization in the U.S. has focused primarily on mechanical rather than chemical methods, as seen by the creation and practices of the Soil Erosion Service in 1933 and its successors, the Soil Conservation Service and the Natural Resources Conservation Service (NRCS). Following severe rain and wind events resulting in seed loss, forest-tree nursery managers began investigating the use of chemical soil stabilizers. Few stabilization methods or products were available from the agricultural sector, so interest in the development of chemical products for stabilization of forest-tree nursery seedbeds began in the 1980s.

The Spring 1987 SFNMC newsletter contained an article reporting on the use of GeoTech, a soil stabilizer product developed by the Borden Chemical Company. Rates, application methods, costs and benefits of GeoTech applications in a pilot study at the former MacMillan Bloedel Nursery in Pine Hill, Alabama were discussed. Another article on soil stabilization appeared in the May 1987 issue of the Southern Journal of Applied Forestry describing trials conducted in 1984 and 1985 in three Weyerhaeuser Company nurseries using GeoTech. Seventeen years later, the increased operational use of soil stabilizers in SFNMC nurseries was evident as an article in the Spring 2004 newsletter reported that of 31 nurseries surveyed, 25 routinely used soil stabilizers following sowing.

In 2004, a field trial was conducted by the SFNMC at three Cooperative member nurseries to study the effects of soil stabilizer on seed efficiency. The resulting report (RR 05-01) found that soil stabilizer is most beneficial when rain events cause seed loss, but also that the benefits of preventing seed loss with stabilizer in years without major rain events (and less seedbed damage) was still cost-effective.

As member nurseries continue to apply soil stabilizers operationally, newer products from the soil stabilization field have been developed and are available to growers. Because little is known about these new chemistries, membership requested that they be examined to determine if seedlings were tolerant to the materials (germination) and effective in soil stabilization. The objectives of this trial were to compare the effects of three soil stabilizer products on bed stability, seedling densities and growth characteristics at one nursery site.

METHODOLOGY

The study was installed at the Rayonier Nursery in Elberta, Alabama in May 2018 at the time of sowing. Samples

of DuraPro™ P-1490 and PermaFlex® 325 were procured from suppliers and shipped to the Rayonier Nursery prior to the study installation. Soiltac® was applied as the operational control product. The study was designed in four replicated blocks, each with a width of three nursery beds and lengths ranging from 160′ to 200′, depending on total bed length. A mixture of 55 gallons of product in 500 gallons of water per acre was applied over newly-sown loblolly pine seedbeds with a boom sprayer, using a cutoff valve to start and stop applications in appropriate block placements. Application of the soil stabilizer was made after sowing, watering, herbicide application and a second watering. At this nursery, bark mulch was later spread over the seedbeds.

At 8 weeks post-sowing (July 2018), seedling counts using four counting frames per treatment block were made to measure any treatment effect on seed germination. In order to quantify treatment differences at the end of the growing season, seedlings were counted and collected in October 2018 from three counting frames placed within each block treatment, for a total of 36 samples taken. Counts of seedlings were recorded by individual drill, and seedling samples were removed from the counting frames by drill and labeled for separate processing. At the SFNMC laboratory, measurements of seedling heights, root collar diameters, and shoot and root dry weights were made of all seedlings collected by drill. Measurements were compared by product to determine treatment differences. Data was analyzed and examined using Dunnett's T-test and Wilcoxon Method for Nonparametric Comparisons, all at alpha = 0.05. Information on the three products tested is included in Table 1:

RESULTS AND DISCUSSION

During the growing season, the nursery received over 37 inches of rain including Tropical Storm Alberto, so seedling bed integrity was tested. Analysis of germination counts made at 8 weeks post-sowing resulted in no significant differences between products tested (Table 2). Similarly, no differences were seen in seedling densities of outside drills, interior drills, all drills, nor of root collar diameters, shoot dry weights nor root dry weights. Analysis of shoot height measurements showed a statistically significant treatment difference between products, although the numerical range of mean heights was less than 1.5 centimeters (25.0 centimeters to 26.3 centimeters). These results are shown in Table 3.

MANAGEMENT IMPLICATIONS

- Utilization of soil stabilizer products has become operational in a majority of SFNMC member nurseries. The choice of one product over others is dependent on factors in addition to product effectiveness in providing stability to seedbeds through the growing season. Cost of product, ease of application, transportation costs, storability, market availability, and flexibility of manufacturers to tailor products to nursery specifications are taken into consideration. A change from one product to another should be preceded by a field trial at the nursery site in order to determine its suitability.

- The manufacturer of PermaFlex® 325, Tailored Chemical Products Inc., filed for registration of the AgriLock trademark in February 2019. Correspondence with a company representative included notification that the PermaFlex® 325 product tested in this study

will be relabeled for bareroot nurseries under the AgriLock brand name (Hunter Dinsmore, personal communication, March 25, 2019).

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Table 1. Soil stabilizers included in the 2018 SFNMC nursery trial.

Product	Manufacturer/Distributor	Description	Website
SoilTac	SoilWorks® LLC	vinyl copolymer emulsion	https://www.soilworks.com/products-and-services/soiltac
DuraPro P-1490	IFS Industries Inc.	polyvinyl acetate homopolymer emulsion	http://www.ifscos.com/
Permaflex 325	Tailored Chemical Products Inc.	vinyl acetate acrylic copolymer emulsion	http://www.tailoredchemical.com/

Table 2. Densities of loblolly pine seedlings at eight weeks post-sowing in beds treated with three soil stabilizer products at sowing, Elberta, AL.

Product	Density (ft^2)
Operational Control (SoilTac)	19.8
DuraPro P-1490	20.4
Permaflex 325	18.2

Table 3. Characteristics of loblolly pine seedlings grown in beds treated with three soil stabilizer products at sowing, Elberta, AL.

Product	Density of All Drills (ft^2)	Density of Outside Drills (ft^2)	Density of Inside Drills (ft^2)	Shoot Height[1] (cm)	RCD (mm)	Shoot Weight (g)	Root Weight (g)	Root Weight Ratio[2] (%)	Height: Diameter Ratio[3]
Operational Control (SoilTac)	20.4	4.9	15.5	25.4	4.06	2.76	0.40	12.59	63.9
DuraPro P-1490	22.3	5.4	16.9	**26.3**	4.02	2.57	0.36	12.42	67.1
Permaflex 325	19.8	4.9	14.9	**25.0**	4.03	2.87	0.41	12.51	64.0

[1]Bold underlined means within this column indicate a significant treatment difference from the operational control product (SoilTac) according to Chi-square test at alpha = 0.05.

[2]Root weight ratio is used as a measure of seedling quality. Target RWR as recommended by the SFNMC is >27% and is calculated by dividing the dry weight of the root by the total dry seedling weight and expressed as a percentage.

[3]Height:diameter ratio is used as a measure of seedling 'sturdiness' in seedling quality evaluations done by the SFNMC. A higher ratio is interpreted as a more 'spindly' seedling; a lower ratio is interpreted as a more 'stout' seedling. It is calculated by dividing shoot height (in mm) by RCD (in mm).