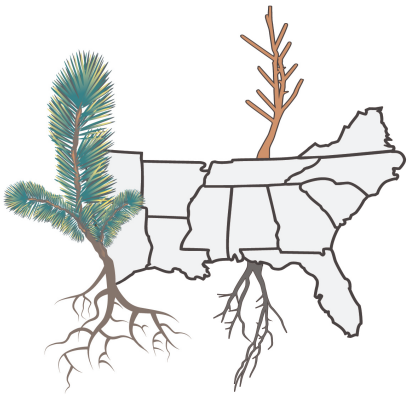

Auburn University Southern Forest Nursery Management Cooperative

RESEARCH REPORT 11-05

PINE BARK MULCH INCREASES SEED EFFICIENCY OF LOBLOLLY PINE IN A PENDIMETHALIN TRIAL

by
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INTRODUCTION

Applying pendimethalin (Pendulum® AquaCap™) to nursery beds 4 to 8 weeks after sowing has been shown to cause galls on seedlings in some nurseries (South and Hill 2009; 2010). We suspect that certain environmental factors might explain gall formation at some nurseries and not at others as trials that examined genetics were inconclusive. It has been speculated that the very few galls (14 out of 2,750 seedlings) observed on seedlings when Pendulum® AquaCap™ was applied within a week of sowing occurred when the herbicide came into contact with a newly germinated seed.

Pine bark mulch has been used for years as a soil stabilizer on seedbeds for preventing erosion, seed washing, sand splash, maintaining soil moisture, and moderating temperatures (May 1984). These added benefits of bark mulch may lead to better seed efficiency and a more uniform seedling crop (Carey and South 1998). In landscape settings, bark mulch supports the growth and survival of trees and shrubs by providing similar characteristics (Fraedrich and Ham 1982; Watson 1988; Borland 1990). Another possible benefit for bark mulch may involve mitigating the effects of certain herbicides, which has been shown with the herbicide lactofen (Cobra®) (South 1988).

In 2010, a study was installed at three nurseries using Pendulum® AquaCap™ on loblolly pine seedlings applied over pine bark at the time of sowing. The objectives of these trials were to 1) determine if pine bark mulch applied before the herbicide treatment would affect (reduce) gall formation on loblolly pine (Pinus taeda) seedlings, and 2) determine if pine bark mulch had an effect on loblolly pine seed efficiency and seedling quality.

METHODOLOGY

Herbicide trials were conducted in Camden, AL, Elberta, AL and Trenton, SC during the 2010 growing season. Treatments of Pendulum® AquaCap™ (68 oz of product per acre; 2 lb active ingredient (a.i.)/acre) and pine bark mulch were applied at time of sowing (Table 1). The herbicide was applied using a CO_2 backpack sprayer calibrated to deliver 22 gallons per acre. The bark mulch was purchased from a store and had a particle size that ranged from ¼ to ½ inches. The treatments were replicated five times with plots being one bed wide and 10 feet long. Pendulum® AquaCap™ was applied over-the-top of the pine bark treatment (Figure 1). Nylon rope was stretched in the center of each plot and secured with nails at each corner to form a 2 ft^2 perimeter to keep the pine bark from washing. Soil samples were collected from each plot to determine soil texture, pH, and organic matter levels at each nursery (Table 2). A soil stabilizer was used at all three nurseries prior to herbicide and pine bark treatments.

At the end of the growing season, all seedlings within a 3 ft^2 counting frame centered in each plot were hand lifted and transported to Auburn University. At the Nursery Cooperative laboratory, seedling densities (i.e. number of seedlings ft^2) and the number of culls (< 3.2 mm root collar diameter (RCD)) or plantable seedlings (≥ 3.2 mm RCD) was determined for each plot. Seedling height and root collar diameter were measured on 25 plantable seedlings, and oven dry weights of shoots and roots were measured for each 25-seedling sample. The overall root quality of each treatment (root dry weight ratio–RWR) was determined by dividing the root weight by the weight of the entire seedling. The seedlings were also examined for herbicide galls (i.e. swellings) along the seedling stem near the root collar. The herbicide and pine bark treatments were not evaluated for weed control. Data were analyzed using Analysis of Variance (ANOVA) and treatment differences were determined using an F-test. Significant differences between treatments used an alpha value of 0.05.

RESULTS

At the time of lifting, no herbicide galls were detected at any nursery on any of the seedlings evaluated where Pendulum® AquaCap™ was applied at sowing. Since galls did not form on any of the treatment plots (bark mulch vs. no bark mulch), this study was unable to provide a valid test to determine if bark mulch mitigated the effects of the herbicide on gall formation. The lack of herbicide galls in these trials is unfortunate and indicates a factor (other than soils, bark, or genetics) may be responsible for the appearance of galls when Pendulum® AquaCap™ is applied shortly after sowing.

While we have no information on gall formation and pine bark mulch, the bark mulch treatment significantly increased seed efficiency as measured by the number of plantable seedlings in all three nurseries (Table 3). The increase in crop value ranged from 8% at the Elberta Nursery, 20% at the Camden nursery (Figure 2) to 25% at the Trenton Nursery (Table 4). The pine bark treatment reduced the root collar diameter (Table 3) but this is related to the higher stand density in mulched plots as seedling size is inversely related to seedling density (Boyer and South 1986). Samples taken from plots with pine bark mulch had 3 more seedlings per square foot (Table 4).

MANAGEMENT IMPLICATIONS

Three important points can be concluded from the results of these trials:

1) Using pine bark mulch increased seed efficiency.

Some nursery managers rely on soil stabilizers to prevent soil splash and seed washing and do not use pine bark mulch. By increasing seed efficiency in all three nurseries, the use of bark mulch increased crop value by 18%. Similarly, using bark mulch increased crop value at the Waynesboro nursery in 1986 (Carey and South 1998). An increase in 3 plantable seedlings per square foot might increase crop value by $4,300 per acre. Mulch applied to the seedling bed results in cooler and moister nursery beds, which may assist in seedling germination and quality.

2) The application of Pendulum® AquaCap™ at 68 oz/acre (2 lb a.i./acre) at the time of sowing did not produce herbicide galls on seedlings when sprayed either over-the-top of pine bark mulch or without pine bark mulch.

Since galls were not produced either with or without pine bark, it could not be determined if mulch would affect the formation of galls when Pendulum® AquaCap™ was sprayed over the nursery beds at the time of sowing.

3) The results in this report do not imply that Pendulum® AquaCap™ can be applied over-the-top of bark mulch to effectively control weeds.

These trials did not test the effects of spraying Pendulum® AquaCap™ over-the-top of bark mulch for weed control. Therefore, managers should not assume the herbicide will control prostrate spurge when sprayed over bark mulch as compared to when sprayed directly on seedbeds that have received only soil stabilizer (South and Hill 2010).

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Table 1. Date of sowing, herbicide/pine bark mulch treatment, and lifting at each nursery in 2010.

Nursery	Species	Sow date	Treatment date	Lift date
Camden	Loblolly	4/20	4/20	11/8
Elberta	Loblolly	4/22	4/26	12/1
Trenton	Loblolly	4/6	4/12	11/15

Table 2. Soil pH, texture, and organic matter (OM) content at each nursery in 2010.

			%			
Nursery	**pH**	**Texture**	**Sand**	**Silt**	**Clay**	**OM**
Camden	4.8	sandy loam	67.6	17.9	14.4	1.3
Elberta	5.3	sandy loam	77.2	16.3	6.4	2.0
Trenton	5.1	sand	88.8	8.8	2.4	1.9

Table 3. Number of culls and plantable seedlings , seedling density, height, root collar diameter (RCD), root dry weight, shoot dry weight and root dry weight ratio (RWR) for loblolly pine seedlings (mean of three nurseries).

Treatment		Culls (ft^2)	Plantable (ft^2)	Density (ft^2)	Height (cm)	RCD (mm)	Root Wt (g)	Shoot Wt (g)	RWR (%)
Herbicide		3.5	16.3	19.9	27.3	4.87	1.03	3.91	20.9
Herbicide + Pine bark		3.8	19.4	23.2	27.5	4.64	0.94	3.67	20.5
LSD*		*1.5*	*2.1*	*2.5*	*1.1*	*0.20*	*0.12*	*0.43*	*1.6*
Source	**df****				**P > F**				
Treatment	1	0.6135	0.0065	0.0127	0.7818	0.0228	0.1397	0.2438	0.5582
Location	2	0.0001	0.0003	0.0004	0.0209	0.0643	0.0001	0.0051	0.0001
Error	26								

* Least significant differences are italicized; ** Degrees of freedom

Table 4. Number of culls and plantable seedlings, seedling density, height, root collar diameter (RCD), root dry weight, shoot dry weight and root dry weight ratio (RWR) for loblolly pine seedlings (by nursery location).

Nursery	Treatment	Culls (ft^2)	Plantable (ft^2)	Density (ft^2)	Height (cm)	RCD (mm)	Root Wt (g)	Shoot Wt (g)	RWR (%)
Camden	No bark	5.7	15.1	20.7	27.5	4.96	0.97	4.47	18.1
Camden	Bark mulch	7.9	18.1	26.1	28.6	4.67	0.83	4.10	17.1
Elberta	No bark	2.4	14.9	17.3	26.3	4.65	0.88	3.41	20.5
Elberta	Bark mulch	1.5	16.2	17.7	26.2	4.53	0.84	3.42	19.6
Trenton	No bark	2.3	18.9	21.7	28.2	5.00	1.24	3.86	24.2
Trenton	Bark mulch	2.1	23.7	25.8	27.6	4.72	1.15	3.50	24.8

Figure 1. Bark plot at the Trenton Nursery before the application of herbicides.

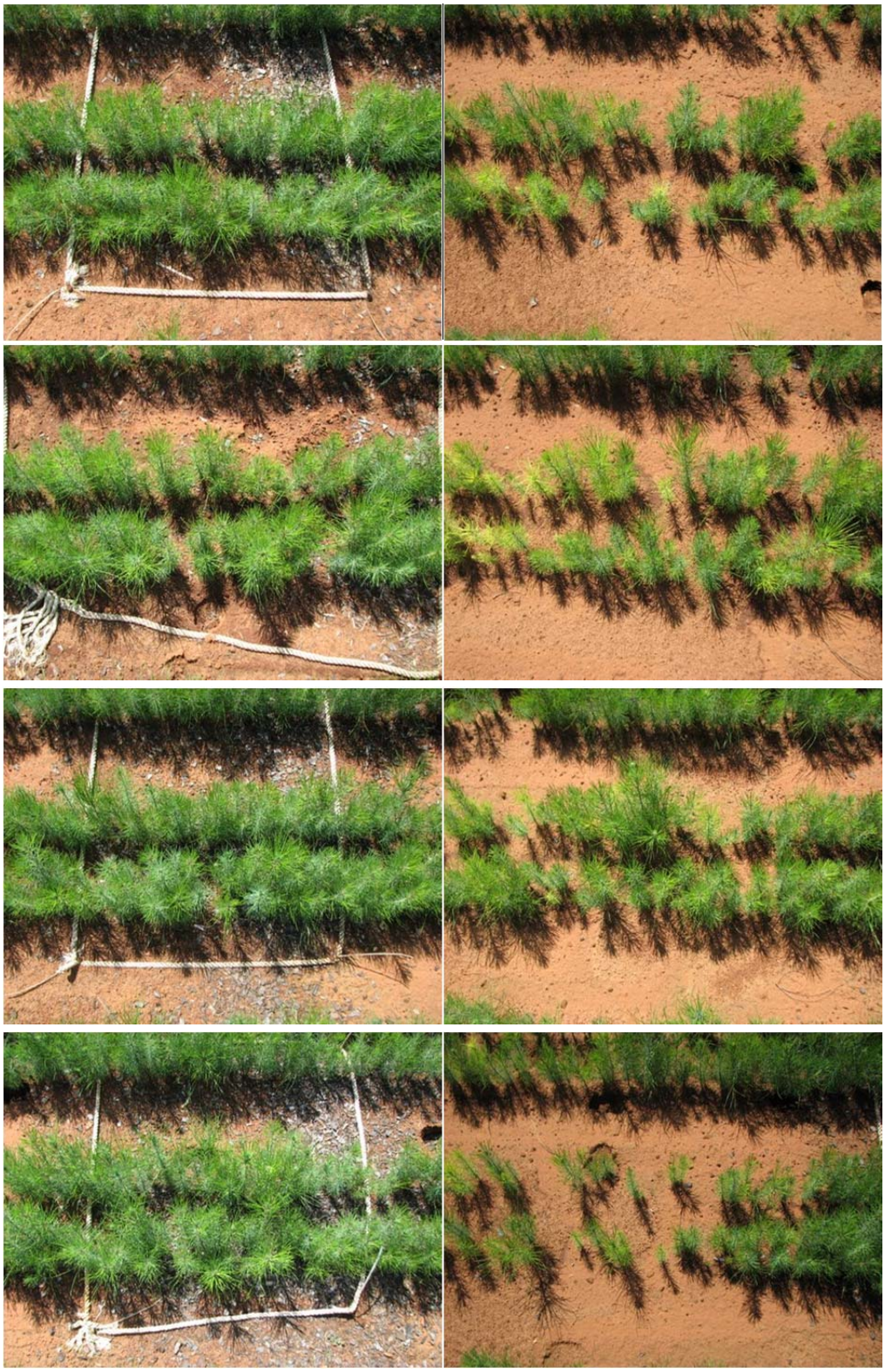

Figure 2. Bark plots (left) paired with control plots (right) at Camden on August 12, 2010.