Auburn University
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Nursery Management
Cooperative

RESEARCH REPORT 02-2

MORPHOLOGICAL RESPONSE OF LOBLOLLY PINE SEEDLINGS TO FOLIAR APPLICATIONS OF GS48™ (GREEN SOL)

by
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INTRODUCTION

Growth regulators have the potential to improve the morphological quality of loblolly pine seedlings including greater leaf area, root growth, and diameter growth. GS48™ is a growth regulator that contains kinetin and gibberellic acid (G_3) in an 8% nitrogen, 20% P_2O_5, and 20% K_2O water soluble fertilizer base. Trace elements in the growth regulator include boron, copper, iron, manganese, molybdenum, and zinc. It is labeled for use in many crops including cotton, soybeans, wheat, rice, and corn. The objective of this study was to determine if foliar applications of the commercially available product GS48™ results in morphological changes in loblolly pine.

METHODOLOGY

The study was conducted at the Alliance Forest Products Nursery in Verbena, Alabama and the Mississippi Forestry Commission Nursery at Waynesboro, Mississippi. Each study was installed as a randomized complete block design with four replications. Plot size was 20-feet long and one bed (4 feet) wide, with a 4-foot buffer located on both ends of all plots. All subsequent seedling samples were pulled from this inner 12 foot plot. Each study included three GS48™ treatments (4, 8 and 16 oz/ac) plus an untreated control (no Green-Sol). All plots, including the control, received the standard fertilizer regime for that nursery. Seedlings at both nurseries were treated with GS48™ on two separate applications. For the Verbena nursery, the application dates were June 11th (7 weeks after sowing on April 23) and July 16th (12 weeks after sowing), and the application dates at the Waynesboro nursery were on June 14th (9 weeks after sowing on April10) and July 18th (14 weeks

after sowing). Solutions of the GS48™ formulation were applied using a tractor mounted CO_2 spray tank calibrated to apply 28.19 gallons per acre.

Seedlings were sampled at the Verbena Nursery on August 6th and November 5th, and seedlings were sampled at the Waynesboro Nursery on August 8th and November 7th. Seedling densities (i.e. number of seedlings per square foot) were recorded using a 1' x 4' counting frame. Two separate samples using the counting frame were collected from each replication treatment plot for each sampling date. The counting frame locations were randomly selected from within the 12-foot measurement area. Seedlings were hand-lifted from the counting frames and transported to Auburn for analysis. All seedlings from each treatment plot sample were counted and then mixed. Every fourth seedling from the total of each plot was measured up to a total of 40. Total height and root-collar diameter was obtained for all 40 seedlings of each plot. Five seedlings from each plot sample of 40 were randomly selected and digitally scanned to determine the root surface area, root length, and leaf areas of individual seedlings. All 40 sample seedlings were then bulked to obtain a plot oven-dry weight of shoots and of roots. When F-values for treatment effects were significant (0.05 level), means were separated using Duncan's Multiple Range Test.

RESULTS

Results of the Verbena trial are presented in Tables 1 and 2, while those of Waynesboro are presented in Tables 3 and 4. In no case did the application of GS48™ appear to improve seedling morphological characteristics. This was true for both the August and November samples at both nurseries and all morphological measurements. The only statistical separations encountered were for individual root and shoot weights in the August sampling at the Waynesboro nursery (Table 3), where the check seedlings were larger than all GreenSol treatments. These differences had disappeared by the November sampling, however (Table 4).

Table 1. Morphological characteristics for loblolly pine seedlings lifted in August at the Verbena Nursery. All values except density are on an individual seedling basis.

GS48™ Rate oz/acre	Density (#/sq.ft.)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)	Root area (cm^2)	Leaf area (cm^2)	Root/Shoot Ratio
0	18.8	2.1	15.1	0.84	0.08	3.72	31.61	0.097
4	16.1	2.2	15.9	0.78	0.09	4.00	37.49	0.115
8	19.8	2.2	16.1	0.85	0.09	3.72	34.82	0.103
16	20.8	2.1	15.6	0.76	0.07	3.98	32.29	0.096
P > F-value	*0.15*	*0.56*	*0.28*	*0.63*	*0.11*	*0.81*	*0.51*	*0.09*
(LSD)	*4.3*	*0.19*	*1.2*	*0.17*	*0.013*	*0.881*	*9.440*	*0.016*

Table 2. Morphological characteristics for loblolly pine seedlings lifted in November at the Verbena Nursery. All values except density are on an individual seedling basis.

GS48™ Rate oz/acre	Density (#/sq.ft.)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)	Root area (cm^2)	Leaf area (cm^2)	Root/Shoot Ratio
0	18.3	5.2	28.7	4.18	0.85	15.08	76.36	0.205
4	18.6	4.8	28.5	3.70	0.71	11.49	78.82	0.195
8	19.9	4.8	28.1	3.70	0.79	13.13	89.70	0.215
16	18.5	4.9	28.2	3.80	0.72	14.14	86.06	0.195
P > F-value	*0.25*	*0.22*	*0.72*	*0.45*	*0.60*	*0.27*	*0.60*	*0.59*
(LSD)	*1.8*	*0.42*	*1.3*	*0.75*	*0.266*	*3.945*	*24.700*	*0.037*

Table 3. Morphological characteristics for loblolly pine seedlings lifted in August at the Waynesboro Nursery. All values except density are on an individual seedling basis.

GS48™ Rate oz/acre	Density (#/sq.ft.)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)	Root area (cm^2)	Leaf area (cm^2)	Root/Shoot Ratio
0	33.2	2.5a	18.0	1.11a	0.09a	11.74	40.33	0.083
4	33.7	2.4b	17.8	0.87b	0.07b	9.95	36.60	0.081
8	33.1	2.4b	17.9	0.87b	0.07b	10.44	35.72	0.084
16	32.1	2.4b	17.6	0.88b	0.07b	10.39	37.21	0.080
P > F-value	*0.76*	*0.00*	*0.95*	*0.00*	*0.01*	*0.54*	*0.67*	*0.84*
(LSD)	*3.5*	*0.09*	*1.4*	*0.11*	*0.012*	*2.801*	*8.731*	*0.009*

Table 4. Morphological characteristics for loblolly pine seedlings lifted in November at the Waynesboro Nursery. All values except density are on an individual seedling basis.

GS48™ Rate oz/acre	Density (#/sq.ft.)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)	Root area (cm^2)	Leaf area (cm^2)	Root/Shoot Ratio
0	31.5	4.4	29.3	3.26	0.58	8.75	78.28	0.177
4	34.8	4.2	29.4	2.98	0.51	9.40	80.95	0.171
8	33.7	4.3	29.4	3.18	0.53	10.79	85.15	0.168
16	31.9	4.1	29.0	2.87	0.49	9.21	79.27	0.170
P > F-value	*0.61*	*0.12*	*0.57*	*0.18*	*0.25*	*0.51*	*0.78*	*0.51*
(LSD)	*6.3*	*0.24*	*0.8*	*0.40*	*0.095*	*3.076*	*16.170*	*0.014*

MANAGEMENT IMPLICATIONS

There is no evidence that foliar applications of GS48™ in the nursery affects loblolly pine seedling morphological development.