Outreach
Warnell School of Forestry & Natural Resources
UNIVERSITY OF GEORGIA

Loblolly Pine Growth Response to Herbaceous Weed Control in Stand Management

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Introduction

Stand establishment is a very critical decision-making phase in the life of a pine plantation. Site preparation (chemical, mechanical, combinations with or without burning), species selection, seedling genetics, seedling size and quality, weed control, fertilization, and spacing decisions made prior to, during, and soon after planting have long-term effects on stand survival, growth, wood yields, rotation age, and products grown. Site preparation goals include: control of competing vegetation, amelioration of soil conditions that restrict root growth, improving near-term nutrient status, minimizing near- and long-term negative site productivity impacts, and making the site easier to plant. Competition control through site preparation treatments and post-plant herbaceous weed control are intended to enhance seedling survival and growth following planting.

Herbaceous weed control

During the first three years in the life of a pine stand growth is limited mostly by herbaceous weeds (Tiarks and Haywood 1986, Miller et al. 1991). Herbaceous weed control, when using appropriate forest herbicides at the right time and dosage, can increase:

(1) pine seedling survival, especially in droughty growing seasons,
(2) early growth, and
(3) reduce rotation age (Lauer et. al. 1993).

When planning a herbaceous weed control treatment, the landowner, consultant, and applicator should consider the following to ensure maximum benefit of the forest herbicide used:

(1) Crop species (different products and rates for each pine species) and growth phase (active versus resting)
(2) Weed species and stage of weed development
(3) Application method (spot, banded, broadcast, aerial)
(4) Soils (surface texture, pH, percent organic matter, moisture, drainage)
(5) Anticipated rainfall patterns the first 6-9 months after planting (seedling and weed vigor, avoid application during droughty periods, apply early on better drained soils)

In general, loblolly pine will respond to control of herbaceous weeds control with increased height growth the first five to eight years, diameter growth divergence from untreated

stands for eight to ten years, and diameter distributions shift into larger product classes (Glover et. al. 1986, Haywood and Tiarks 1990).

Herbicides for herbaceous weed control can be applied over the top of loblolly pine either in a broadcast or banded (5 to 6 feet band is recommended) fashion. The herbicide must be labeled for use on the pine species that is planted. Specific herbicides can be applied pre-, early post, and post-emergent herbicides so timing is critical for optimizing herbicide benefit in controlling herbaceous weeds. Some herbicides such as Envoy Plus and Arrow 2EC, and Fusilade are grass control herbicides and are early post-emergent herbicides. Other herbicides are broader spectrum controlling some grasses and broadleaf weeds (Arsenal, Oust, and Velpar).

Loblolly Pine Study Findings

Nine study areas from Virginia to Mississippi

Lauer and others (1993) studied loblolly pine response to herbaceous weed control on eight sites in the southeastern U.S. (five sites in Alabama and one each in Georgia, Mississippi, and Virginia) through age 9-years. Study sites were mostly cut-over mixed pine-hardwood stands except for one Bermuda grass pasture and a failed plantation. Site preparation included shearing, raking, windrowing or piling and bedding or disking on five of eight sites and bedding, chop plus chemical or burned (Bermuda grass pasture) on the remainder of the sites. Five sites were in the Upper Coastal Plain, and one each in the Lower Coastal Plain, Piedmont and Ridge and Valley physiographic regions. Treatments were: (1) check (no herbaceous weed control), (2) 1-year banded (@ five foot band), (3) 1-year broadcast, (4) 2-year banded, and (5) 2-year broadcast.

Loblolly pine mean trees per acre, diameter, and height means were statistically significantly greater (5% alpha level) with herbaceous weed control (HWC) than the no HWC through 9-years-old on four of the eight sites. Loblolly pine mean basal area and tons per acre were statistically significantly greater with HWC than no HWC on 8 of 9 sites though age 9-years. There were no significant differences in trees per acre, dominant height, basal area, or tons per acre due to weed control method (band vs broadcast, Lauer et al. 1993). Loblolly pine trees per acre (TPA) from the one-year banded HWC treatment (535 TPA) were 11% greater than the control (483 TPA) after 9 growing seasons (Table 1). No HWC compared to HWC survival differences were greatest on the poorer sites or where weed competition was severe. Herbaceous weed control (HWC) loblolly pine heights were significantly greater than the non-HWC heights through 9-years-old on all eight sites regardless of method (banded versus broadcast) or duration (one versus two years). Loblolly pine dominant height from the one-year banded HWC treatment (31.5 feet) was greater than the control (27.9 feet) after 9 growing seasons (Table 1). Herbaceous weed control (HWC) loblolly pine stem rust incidences were significantly greater than the non-HWC stem rust incidence through 9-years-old on three of eight sites. Loblolly pine stem rust incidence from the one-year banded HWC treatment (29 percent) was greater than the control (20 percent) after 9 growing seasons (Table 1). Herbaceous weed control (HWC) loblolly pine mean diameter at breast height (dbh; measured at 4.5 above groundline) were significantly greater than the non-HWC mean dbh through 9-years-old across on seven of eight sites. Dbh from the one-year banded HWC treatment (5.4 inches) was greater than the control (4.8 inches) after 9 growing seasons (Table 2) across the eight sites. Herbaceous weed control (HWC)

loblolly pine basal area per acre were significantly greater than the non-HWC basal area per acre through 9-years-old on seven of eight sites. Loblolly pine basal area per acre from the one-year banded HWC treatment (87 ft^2 per acre) was greater than the control (61 ft^2 per acre) after 9 growing seasons (Table 2). Herbaceous weed control (HWC) loblolly pine tons per acre was significantly greater than the non-HWC volume per acre through 9-years-old on seven of eight sites. Loblolly pine tons per acre from the one-year banded HWC treatment (40 tons per acre) was greater than the control (26.5 tons per acre) after 9 growing seasons (Table 2). Loblolly pine weed control volumes were

Table 1. Loblolly pine mean trees per acre, dominant height and stem rust incidence by treatment at age 9-years-old (Lauer et al. 1993).

Stand Parameter	**Treatment**	**Treatment mean**
Trees per acre	check	483
	1-year band	535
	1-year broadcast	513
	2-year band	567
	2-year broadcast	540
Dominant height (ft)	check	27.9
	1-year band	31.0
	1-year broadcast	31.5
	2-year band	31.5
	2-year broadcast	31.4
Stem rust incidence (%)	check	20
	1-year band	29
	1-year broadcast	23
	2-year band	28
	2-year broadcast	30

9.2 to 25.3 tons per acre greater than the control by age 9-years (Table 2). One year weed control volume gains ranged from 7.6 to 10.7 tons per acre where survival was not different between the non-HWC and HWC plots to as high as 22.3 tons per acre where HWC increased survival.

Loblolly pine tons/acre growth from age 7- through 9-years was increased with weed control at six of the eight sites. The weight increase attributable to weed control ranged from 4 to 10.5 tons/acre, or 22 to 70 percent more tonnage production than the check (Lauer et al. 1993). This suggests that tonnage growth on HWC plots are continuing to diverge from control plots. The extra tons per acre production on the HWC plots is largely due to higher stand basal area due to increased TPA and dbh rather than tree height gains. Lauer et al. (1993) concluded that HWC in these eight loblolly pine stands reduced potential rotation age by 3 years.

Table 2. Loblolly pine mean d.b.h, basal area, and tons per acre by treatment at age 9-years-old (Lauer et al. 1993).

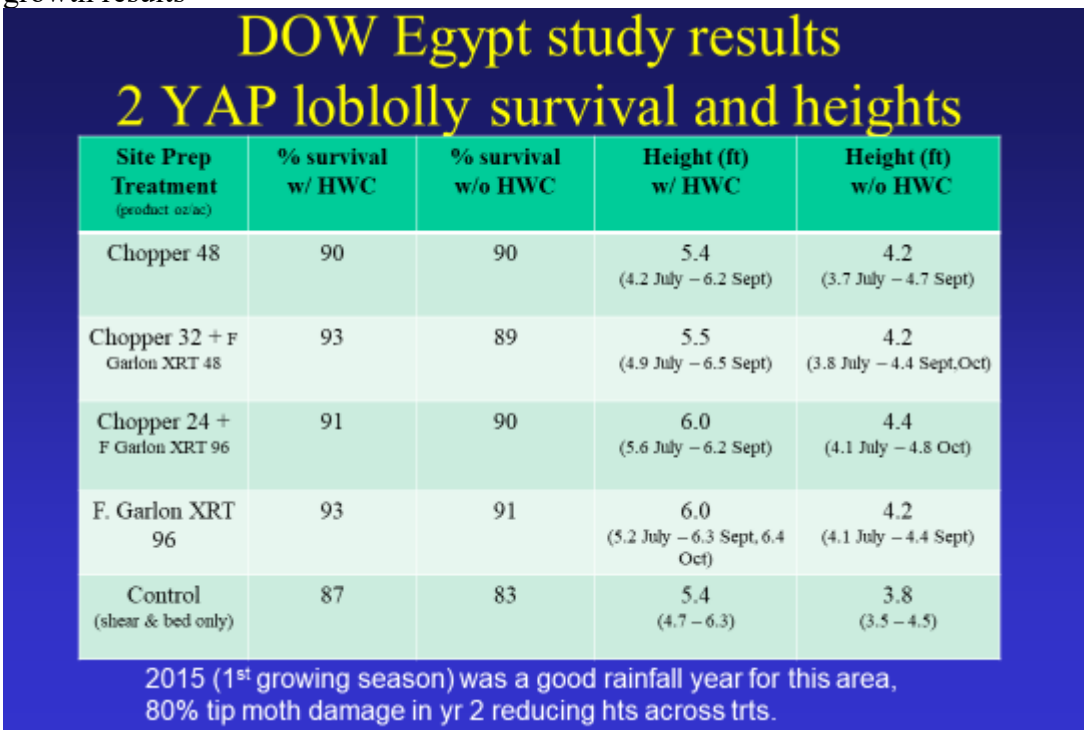
Stand parameter	**Treatment**	**Treatment mean**
d.b.h (inches)	check	4.85
	1-year band	5.40
	1-year broadcast	5.51
	2-year band	5.53
	2-year broadcast	5.58
basal area (ft^2/acre)	check	61.4
	1-year band	86.6
	1-year broadcast	86.8
	2-year band	95.7
	2-year broadcast	95.5
Weight (tons/acre)	check	26.6
	1-year band	40.0
	1-year broadcast	40.6
	2-year band	45.0
	2-year broadcast	45.3

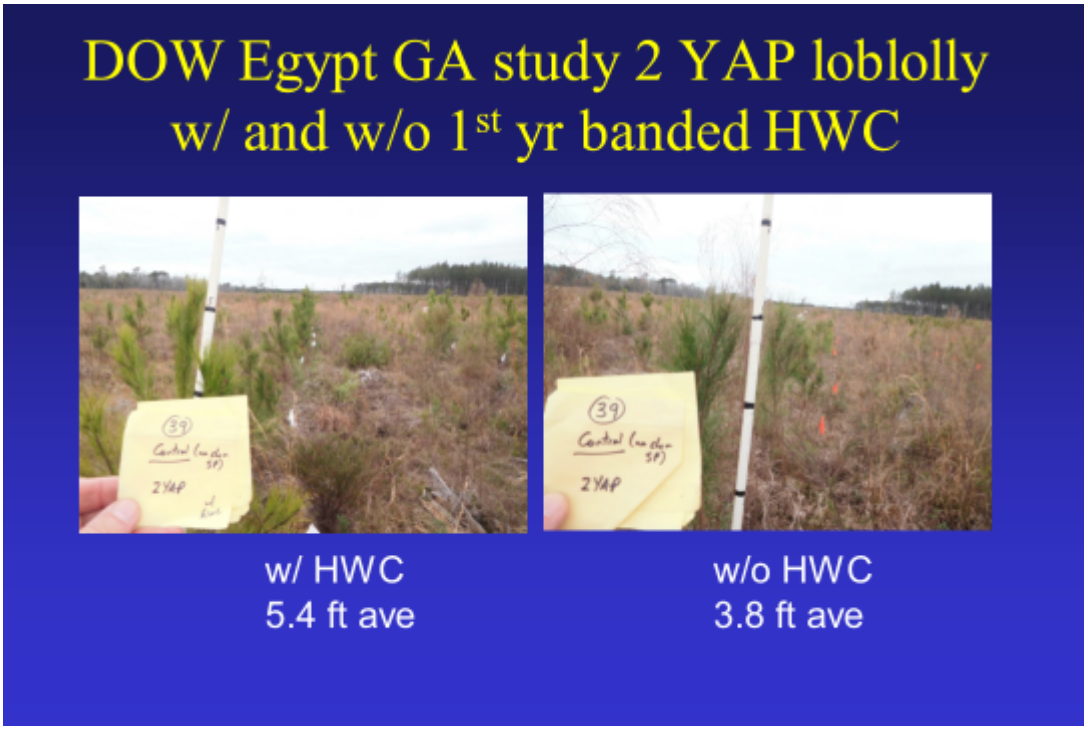
One Study area in Georgia

A DOW Agro sciences Company supported site preparation study in Effingham County addressed different rates of Chopper Gen2 with and without Forestry Garlon XRT applied at three different times (late July, mid-September and late October 2014) on cut-over, sheared (early July 2014) and bedded (early September 2014) poorly drained soils (primarily Pelham soil

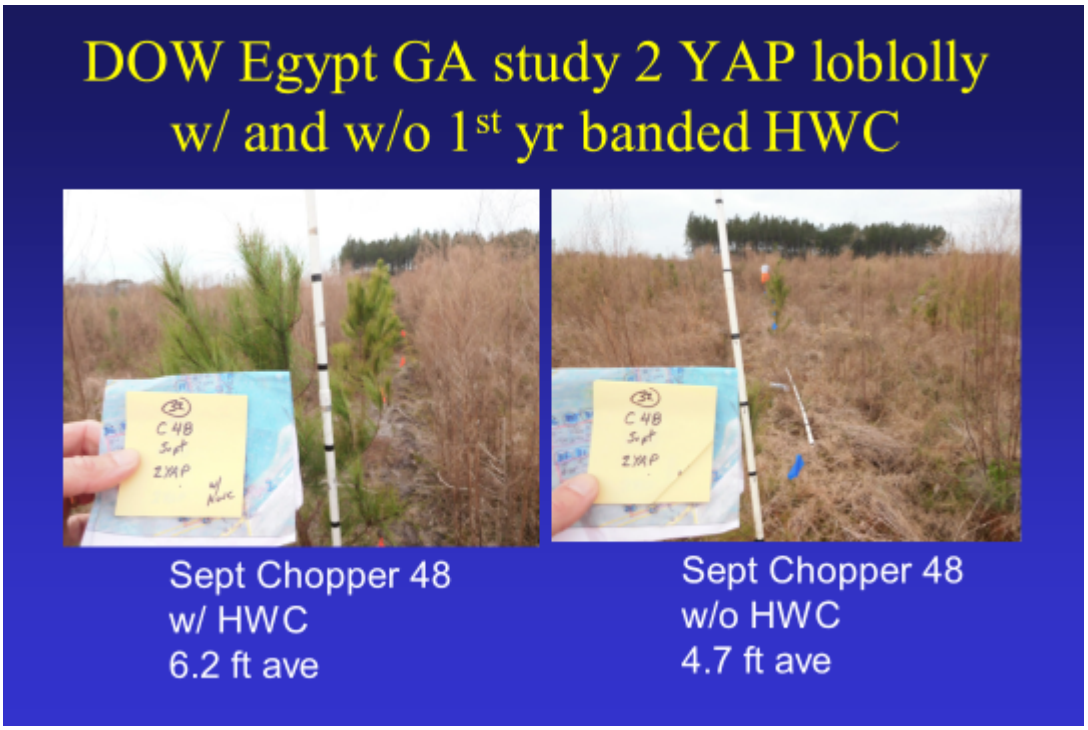
series). The study was replicated three times and included a control (shear and bed only, no chemical site prep). Loblolly pine bareroot select seedlings were planted early February 2015 @ 6x12 feet by machine. Due to plot size (120x150 feet) each plot was split with 5 rows treated the following spring (late April 2015) with 10 ounces per acre of Oustar in a 4 foot band (hand sprayed with backpacks using a 2 nozzle system over the top of the seedlings). Two year survival and height measurements found small differences in the pre-plant chemical site prep treatments. The largest 2 year loblolly pine height differences were between the no HWC and HWC treatment averaging about 1.5 feet (5.5 with HWC versus 4.2 feet without HWC) in favor of the HWC plot trees (Table 3) which equates to a 36% height gain. HWC versus no HWC 2 year loblolly pine percent survival were 0 to 4 percentage points different (Table 3), most likely due to close to normal to above normal rainfall in the first growing season in the study area.

Table 3. Effingham County DOW Agro sciences site prep study – 2 year survival and height growth results

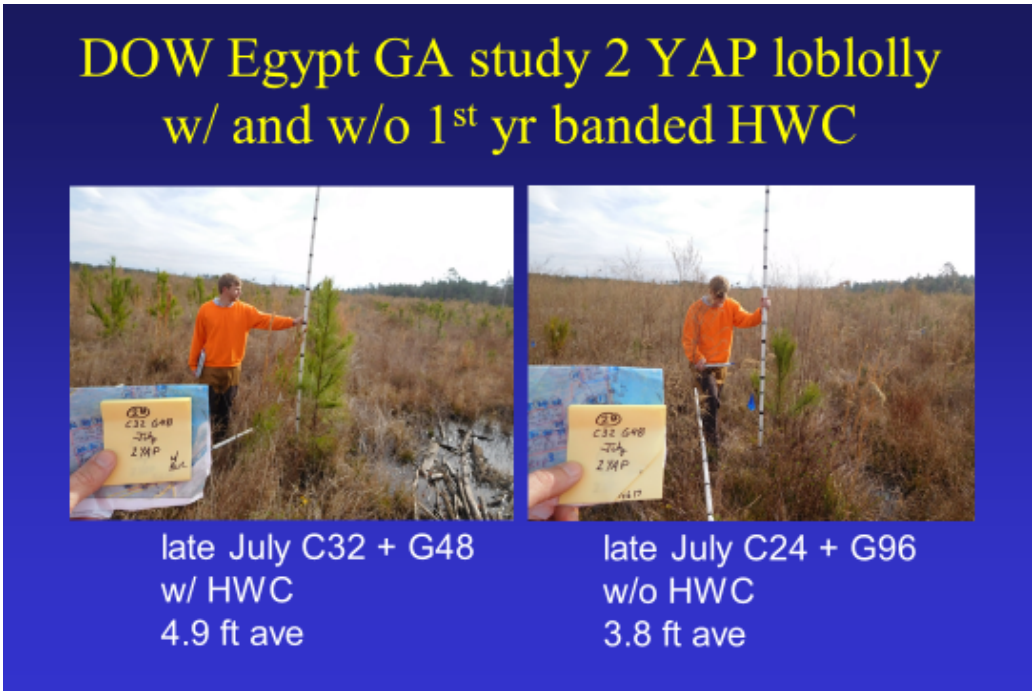




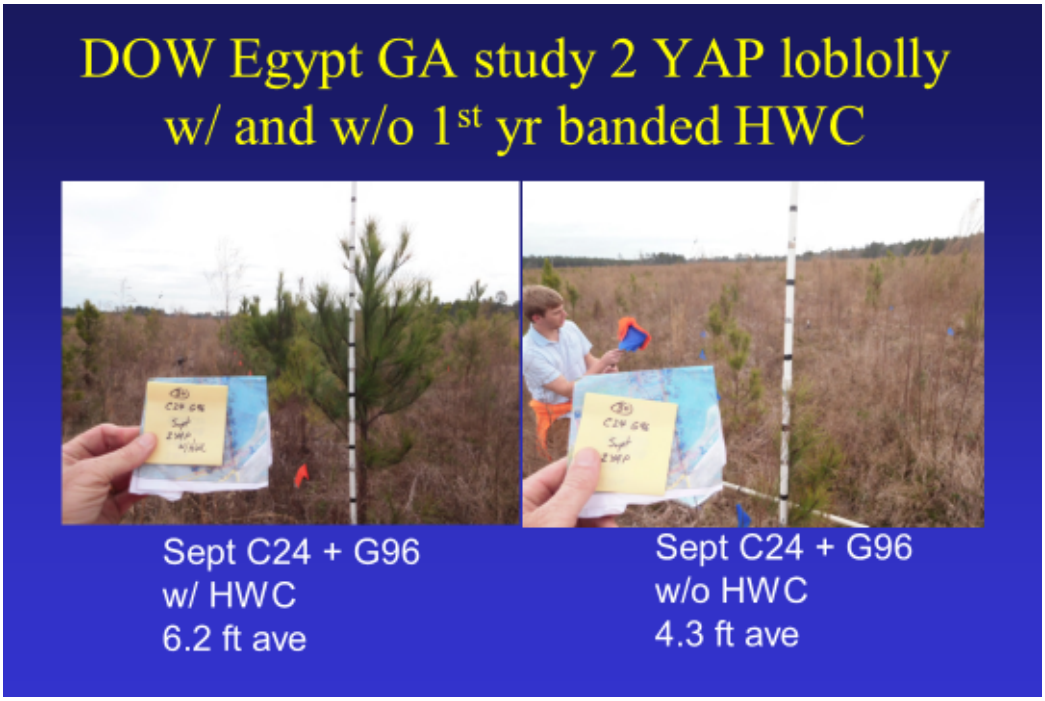
Photos 1 and 2. The control (shear and bed only, no pre-plant chemical site prep) heights with (left photo) and without (right photo) a banded over the top 10 oz/acre Oustar application in late April of the first growing season.



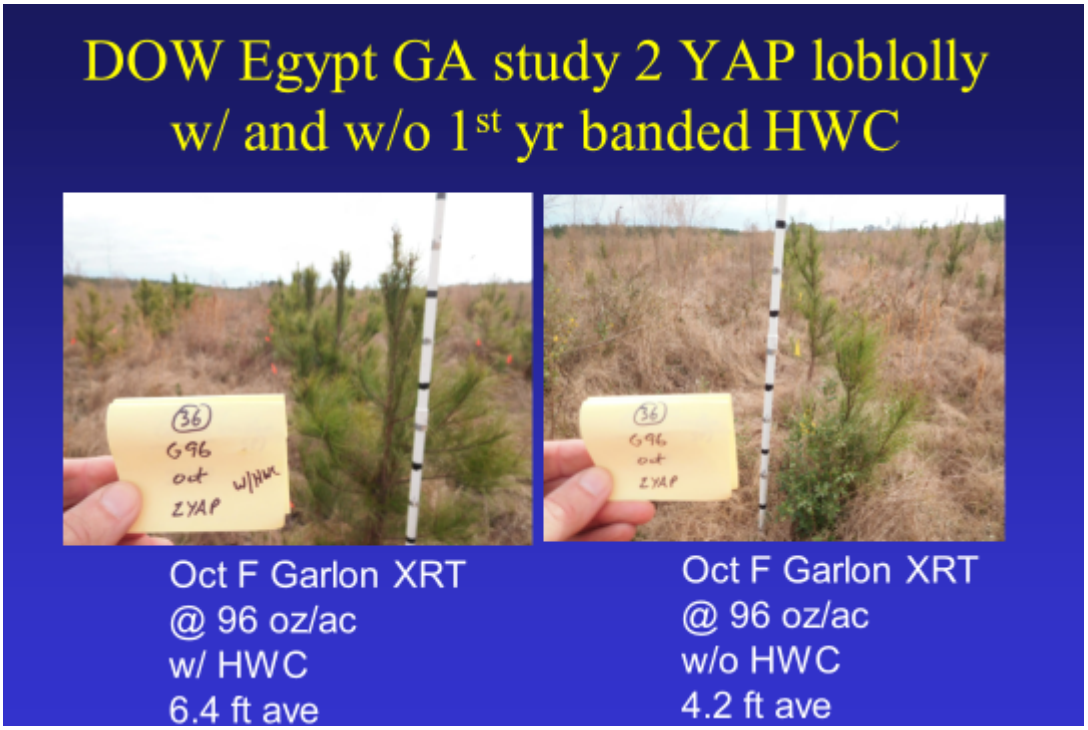
Photos 3 and 4. The mid-September Chopper Gen2 treatment (after shearing in early July and bedding in early September) heights with (left photo) and without (right photo) a banded over the top 10 oz/acre Oustar application in late April of the first growing season.



Photos 5 and 6. The late July Chopper Gen2 + Forestry Garlon XRT treatment (after shearing in early July and bedding in early September) heights with (left photo) and without (right photo) a banded over the top 10 oz/acre Oustar application in late April of the first growing season.



Photos 7 and 8. The mid-September Chopper Gen2 + Forestry Garlon XRT treatment (after shearing in early July and bedding in early September) heights with (left photo) and without (right photo) a banded over the top 10 oz/acre Oustar application in late April of the first growing season.



Photos 9 and 10. The late October Forestry Garlon XRT treatment (after shearing in early July and bedding in early September) heights with (left photo) and without (right photo) a banded over the top 10 oz/acre Oustar application in late April of the first growing season.

Summary

Spring of the first year post plant banded (4, 5 or 6 foot band) application of a labeled herbicide(s) for loblolly pine when properly applied at the right dose and the right time can provide large (1) survival and growth benefits in droughty spring of the first growing season years, or (2) growth (but not so much survival) in normal first growing season spring into summer rainfall years. Work by Lauer and others illustrate that the diameter and tons per acre growth benefits last at least through the first 9 years when using HWC versus no HWC. He also showed that a banded application gave similar growth benefits as a broadcast application, saving landowners herbicide costs (a 2x to 3x savings in herbicide costs) for loblolly pine though 9 years. The use of a labeled forest herbicide applied over loblolly pine to minimize herbaceous competition in the first year allows the seedlings to uptake available nutrients and more importantly water can provide large benefits for a low cost (as of 2018 $25 to $40 per acre).

Literature Cited

Dickens, E.D. 2018. DOW Agro sciences two year summary report. 2 p. UGA Warnell School of Forestry and Natural Resources. Athens, GA.

Glover, G.R, Creighton, J.L., and D.H. Gjerstad. 1986. Vegetation control significantly increases loblolly pine growth for ten years. Auburn Univ. Silvi. Herb. Coop., Auburn Ala. Res. Note 86-6.

Haywood, J.D. and A.E. Tiarks. 1990. Eleventh-year results of fertilization, herbaceous, and woody control in a loblolly pine plantation. SJAF 14(4):173-177.

Lauer, D.K., G.R. Glover, and D.H. Gjerstad. 1993. Comparison of duration and method of herbaceous weed control on loblolly pine response through mid-rotation. Can. J. For. Res. 23:2116-2125.

Miller, J.H., B.R. Zutter, S.M. Zedaker, M.B. Edwards, J.D. Haywood, and R.A. Newbold. 1991. A regional study on the influence of woody and herbaceous competition on early loblolly pine growth. SJAF 15(4):169-179.

Miller, J.H., B.R. Zutter, S.M. Zedaker, M.B. Edwards, J.D. Haywood, and R.A. Newbold. 1991. Response of loblolly pine to complete woody and herbaceous control: projected yields and economic outcomes - The COMP project. In the 8th Biennial So. Silvi. Res. Conf. Nov 1-3, 1994. Auburn, AL.

Peinaar, L.V. and J.W. Rheney. 1996. Potential productivity of intensively managed pine plantations. GA Consortium for Tech. Competitiveness in Pulp and Paper Final Report. 41 p.

Tiarks, A.E. and J.D. Haywood. 1086. *Pinus taeda* L. Response to fertilization, herbaceous plant control, and woody plant control. For. Ecol. Manage. 14:103-112.