

# EFFECT OF APPLICATION TIMING ON EFFICACY OF SITE PREPARATION TREATMENTS USING CHOPPER® GEN2™

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**Abstract**—Chopper® GEN2™ is a new imazapyr product for use in forestry site preparation. A single treatment (32 ounces of Chopper® GEN2™ per acre) was applied at three timings on three sites (Louisiana, Mississippi, and Virginia) to test the effect of application timing on treatment efficacy. Hardwood control was excellent for all applications. Pine growth varied by site, but all treatments resulted in excellent pine growth. Pine stem volume was 5 to 10 times greater in treated plots as compared to untreated plots.

## INTRODUCTION

Site preparation continues to be the preeminent use of herbicides in the South. As this is typically a notable expense, it is very important that the most cost-effective applications be made. Treatment efficacy is therefore a primary concern.

Chopper® GEN2™ is the most recent formulation of imazapyr to be labeled for forestry site preparation in the South. While it contains the same active ingredient (imazapyr) as Arsenal AC or Chopper®, it is a different product and can provide different results in field applications. As is the case with most herbicides used in forestry, the timing of application can be important. Also, while short-term results are always important, long-term control and seedling growth are the true tests of site preparation.

The objectives of this study were as follows: (1) to evaluate the effect of application timing on the efficacy of Chopper® GEN2™ and (2) to evaluate the growth response of loblolly pine (*Pinus taeda* L.) seedlings following the application timing.

## STUDY SITES

The study was installed at sites near Appomattox, VA; Allen, LA; and Starkville, MS. At the Virginia site, the treatments were applied soon after harvest. The principal hardwood species present were red maple (*Acer rubrum* L.), blackgum (*Nyssa sylvatica* Marsh.), white oak (*Quercus alba* L.), yellow-poplar (*Liriodendron tulipifera* L.), black cherry (*Prunus serotina* Ehrh.), hickory (*Carya* spp.), scarlet oak (*Q. coccinia* Muench.), and *Vaccinium* spp.

The Louisiana site was bedded prior to treatment application. At the time of application, there was little hardwood competition (<4 percent cover). The principal species present were American beautyberry (*Callicarpa americana* L.) and sumac (*Rhus* spp.).

The Mississippi site had been harvested more than a year prior to treatment application. The area had heavy hardwood

cover of 2,500 to 3,000 hardwood stems per acre. The principal species present were southern red oak (*Q. falcata* Michaux), cherrybark oak (*Q. pagoda* Raf.), post oak (*Q. stellata* Wang.), blackgum, red maple, and *Rubus* spp.

## TREATMENTS

A single treatment was used in the study with three application timings. The treatment consisted of 32 ounces of Chopper® GEN2™ per acre with 1 percent v/v methylated seed oil. The three application timings were as follows: treatment #1—applied June 28 through July 1, 2006; treatment #2—applied August 13–17, 2006; and treatment #3—applied September 28–30, 2006. Total spray volume was 10 g/acre. Each site had untreated control plots in addition to the treated areas.

## EXPERIMENTAL DESIGN

Each treatment was replicated four times at each site in a randomized complete block design. Each replication plot was 91 by 91 feet (0.19 acre).

## PLANTING

All plots were planted with 1-0, bare-root loblolly pine seedlings in December 2006. Tree spacing was 6 by 11 feet. All treated plots received an herbaceous weed control treatment of 4 ounces Arsenal AC and 2 ounces Oust® XP per sprayed acre in March 2007.

## EVALUATIONS

Vegetation assessments were completed in June and August 2007. At those timings hardwood control and percent ground cover of grasses, broadleaf forbs, and vines were recorded. Pine seedlings were measured in December 2007 with total height and groundline diameter (GLD) recorded.

## RESULTS

### Competition Control

The results for competition control as recorded in August 2007, one growing season after treatment (GSAT), can

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**Table 1—Average percent cover by vegetation type in August 2007 (1GSAT), Allen, LA**

Treatment date	Woody	Herb	Vine	Total
	----- percent -----			
July 1	3 a	28 b	3 a	34 b
August 1	1 ab	26 b	3 a	29 b
September 30	1 b	28 b	2 a	31 b
None	4 a	86 a	1 a	97 a

Values in a column followed by the same letter do not differ at alpha = 0.05.

**Table 2—Average percent cover by vegetation type in August 2007 (1GSAT), Appomattox, VA**

Treatment date	Woody	Herb	Vine	Total
	----- percent -----			
July 1	2 b	12 a	0 a	17 b
August 15	2 b	20 a	0 a	20 b
September 30	3 b	18 a	0 a	21 b
None	49 a	18 a	0 a	73 a

Values in a column followed by the same letter do not differ at alpha = 0.05.

**Table 3—Average percent cover by vegetation type in August 2007 (1GSAT), Starkville, MS**

Treatment date	Woody	Herb	<i>Rubus</i>	Total
	----- percent -----			
July 1	3 bc	43 a	25 a	72 b
August 15	1 c	44 a	16 ab	61 bc
September 30	5 b	23 a	15 ab	48 c
None	40 a	41 a	3 b	99 a

Values in a column followed by the same letter do not differ at alpha = 0.05.

be found in tables 1, 2, and 3. Control of hardwoods was excellent at all three sites. While the Louisiana site did not have much woody competition, the Mississippi and Virginia sites both had 40 percent or more coverage by woody species and the treatments resulted in significant reductions (1 to 5 percent cover). Treatment timing had no significant effect on hardwood control at Virginia or Louisiana, but the

August application timing was significantly better than the late September timing in Mississippi, but the difference was only 1 percent vs. 5 percent coverage (both treatments provided excellent control).

Herbaceous control at the August 2007 evaluations did not differ significantly between untreated and treated plots in Virginia or Mississippi, although the late September application timing plots had about 20 percentage points less herbaceous cover than the other treatments in Mississippi. This lack of difference in herbaceous weed control is not surprising as the evaluation date is almost 1 year after all treatments. The plots did have some residual weed control earlier in the growing season which was important to a seedling establishing a root system, but the control was diminished by August. As 2007 was an especially droughty year across much of the South, competition control was very important. The significant difference in the treated vs. untreated plots in Louisiana at the August evaluation can be attributed more to the intense herbaceous pressure on the site (86 percent cover in untreated areas) than to a total lack of herbaceous cover in treated plots (26 to 28 percent).

Vines were not a problem at the Virginia or Louisiana sites (zero to 3 percent cover). However, *Rubus* was a significant component of cover at the Mississippi site. By controlling the hardwoods and herbaceous (short-term) competition, *Rubus* was released to increase ground coverage.

**Pine Response**

The pines in this study will be measured for a prolonged period, and this paper presents only the initial results. Pine survival data is found in table 4. Pines survived well at all sites and the only significant difference was the survival of pines planted in the August treatment plots in Mississippi. We have no explanation for this as all the trees were planted at the same time by the same personnel at each respective site, and no microsite or other differences could be identified.

Pine heights are reported in table 5. Heights varied among sites, but trees were generally significantly taller in treated plots in Mississippi and Louisiana as compared to untreated plots. The lack of statistical difference was not surprising

**Table 4—Percent pine survival by site and treatment (all reps)**

Treatment date	Louisiana	Virginia	Mississippi
	----- percent -----		
July 1	86 a	89 a	86 a
August 15	86 a	85 a	63 b
September 30	90 a	86 a	89 a
None	77 a	82 a	76 ab

Values followed by the same letter do not differ at alpha = 0.05.

**Table 5—Average total height by site and treatment (all reps)**

Treatment date	Louisiana	Virginia	Mississippi
	----- <i>feet</i> -----		
July 1	2.8 a	1.3 a	1.6 ab
August 15	2.6 a	1.2 a	1.5 b
September 30	2.5 a	1.3 a	1.9 a
None	1.7 b	1.1 a	1.3 b

Values in a column followed by the same letter do not differ at alpha = 0.05.

in Virginia given the more northern site with associated expectation of less growth during the first growing season. Overall, there was very little significant difference among treatment dates at any of the sites.

Pine GLD also varied by site (table 6). The trees on the Louisiana site grew extremely well which could be attributed to the mechanical site preparation and growing season precipitation as compared to the other sites. Overall, pines in treated plots had significantly larger GLD than those in untreated plots at all locations. There was no difference among treatment dates at Louisiana or Virginia and only one difference (late September) in Mississippi.

One last measure of pine growth was to examine pine stem volume (table 7). This evaluation involves both height and diameter. The results were striking. After only one growing season, the trees in treated plots in Virginia and Mississippi were 5 times larger than trees in untreated plots, and in Louisiana, trees in treated plots were 10 times larger.

**Table 6—Average groundline diameter by site and treatment (all reps)**

Treatment date	Louisiana	Virginia	Mississippi
	----- <i>inches</i> -----		
July 1	0.77 a	0.42 a	0.28 b
August 15	0.67 a	0.37 a	0.28 b
September 30	0.68 a	0.40 a	0.36 a
None	0.29 b	0.21 b	0.17 c

Values in a column followed by the same letter do not differ at alpha = 0.05.

**Table 7—Stem volume on treated vs. untreated plots**

Site	Untreated	Treated	Ratio
Virginia	0.17	0.82	5X
Louisiana	0.54	5.36	10X
Mississippi	0.13	0.65	5X

**SUMMARY**

Overall, pines responded well to Chopper® GEN2™ site preparation and herbaceous weed control as evidenced by the 5X- to 10X-volume increases. There was no consistent trend in the response to site prep timing in Virginia. In Louisiana, survival improved by 9 percentage points and pine growth was best in the earliest site prep timing. In Mississippi, pine response was best for the latest site prep timing which is thought to be due to the lower herbaceous cover during the growing season after application.