



Auburn University Southern Forest Nursery Management Cooperative

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PRELIMINARY STUDY ON THE WINTER FERTILIZATION OF LOBLOLLY PINE

by
Curtis VanderSchaaf and Ken McNabb

INTRODUCTION

Fertilization in the fall or winter of the year of lifting often results in increases in foliar N (Margolis and Waring 1986, Gleason et. al. 1990, Sung et. al. 1997). In some studies little or no effect on seedling morphology occurs when fertilization is conducted just before lifting (Timmer and Munson 1991, South and Donald 2002). Since it has been shown that N amounts at the time of lifting is related to field growth (Larsen et. al. 1988, Irwin et. al. 1998), it is believed that the increase in N prior to lifting helps planted seedlings grow new roots thereby increasing survival and growth. Survival increases due to nutrient loading is thought to be greater on high stress sites (Birchler et. al. 2001). Fall fertilization with N enhanced outplanted growth of Douglas-fir (Anderson and Gessel 1966, Margolis and Waring 1986), and slash pine (Irwin et. al. 1998) but other studies found no effect on Douglas-fir (Birchler et. al. 2001), ponderosa pine (Gleason et. al. 1990), and loblolly pine (South and Donald 2002). However, outside of Irwin et. al. (1998), few studies have looked at the effects of winter fertilization of N on seedling growth of any species. This study was initiated to gain some initial insight as to whether winter fertilization in the nursery might result in faster growth after outplanting loblolly pine seedlings.

METHODOLOGY

A randomized complete block design with 4 blocks was used to test winter application of N in a central Alabama nursery. The three rates of elemental N were 0, 50, and 100 kg/ha (0, 44.5, and 89 lbs/ac). The 50 and 100 kg rates were applied using a perforated can in split applications of 25 kg/ha and 50 kg/ha on December 1 and January 15 using a perforated can. Treatment plots were 2.7 m (9 feet) long and 1 bed wide.

Within each treatment, 7 sample plots were established (each 4 drills deep and 1 foot wide). The 7

sample plots were harvested biweekly at 0 to 12 weeks after the initial fertilization. All seedlings within the sample area were removed by shovels and care was taken to obtain as much of the root system as possible. Each of the 7 samplings per treatment plot were brought back to Auburn University (AU) and analyzed. Total plot dry weight for shoots and roots were determined as well as number of seedlings. During this 12 week period the nursery received a total of 24.6 mm (9.7") of rainfall.

An eighth sample plot was sampled at the lifting (February 23, 2000 – week 12) for outplanting. Thirty seedlings were taken at random from this plot and outplanted (February 24 or 25) into sand pits at Auburn University. Total seedling height and diameter was determined for all seedlings at the time of outplanting and at 3 and 9 months after planting. An Analysis of Covariance was used to analysis the outplanted height and diameter data. The total seedling height and seedling diameter at time-of-planting were used as covariates for the total seedling height and seedling diameter after planting analyses; respectively. Linear and quadratic models were used to test the statistical validity of trends among fertilizer rates.

RESULTS

Samples taken in the nursery did not show a treatment influence on plot dry weights or average dry weight per seedling. Nor did seedling height or diameter vary by treatment at the time of lifting, although seedling diameter at lifting was 4.6, 4.9, and 5.0 mm root collar diameter for the check, 50 and 100 kg N/ha treatments, respectively. Seedlings typically grow little in height during the winter, but may put on significant diameter and root growth. The lack of seedling height growth might therefore be expected. And, whereas the diameter differences show the expected trend of increasing diameter with increased fertilizer application, seedlings did not apparently have enough time to develop statistically significant diameter growth differences in 12 weeks.

There were significant differences in height at three months and height growth at nine months after outplanting. At nine months the check averaged 13.9 cm and the 100 kg N/ha treatment averaged 15.7 cm (13% larger). As a result, although not significant, total seedling height at 9 months was higher for the fertilized seedlings than for the check seedlings (42.5, 44.0, and 44.9 cm for the 0, 50, and 100 kg N/ha treatments, respectively). Because height differences were observable at 3 months, the differences observed at 9 months may have been caused by treatment impact on initial spring flush. Height response across fertilizer levels was generally best modeled using a linear regression indicating seedling height response was non-asymptotic. Although there were no differences in diameter growth, it remains to be seen if the increased height growth, and presumably larger needle volume would translate into more diameter growth during the winter.

Table 1. Height and root collar diameter growth of loblolly pine at 3 months after outplanting winter fertilized nursery seedlings. (N=12)

Three months

Treatment		<u>Height (cm)</u>		<u>Diameter (mm)</u>		
<u>kgN/ha</u>	<u>at planting</u>	<u>3 months</u>	<u>Growth</u>	<u>at planting</u>	<u>3 months</u>	<u>Growth</u>
0	28.5	38.5	10.0	4.6	5.6	1.0
50	30.4	40.1	9.8	4.9	6.1	1.2
100	29.2	40.6	11.4	5.0	6.1	1.2

Probability > F-value

Linear	0.4768	0.0490	0.0609	0.0651	0.3045	0.3058
Quadratic	0.0994	0.3575	0.4152	0.5277	0.2888	0.2871

Nine months

Treatment		<u>Height (cm)</u>		<u>Diameter (mm)</u>		
<u>kgN/ha</u>	<u>at planting</u>	<u>9 months</u>	<u>Growth</u>	<u>at planting</u>	<u>9 months</u>	<u>Growth</u>
0	28.5	42.5	13.9	4.6	7.6	3.0
50	30.4	44.0	13.8	4.9	7.9	3.0
100	29.2	44.9	15.7	5.0	7.9	2.9

Probability > F-value

Linear	0.0673	0.0526	0.7219	0.7320
Quadratic	0.0857	0.1260	0.9375	0.9785

MANAGEMENT IMPLICATIONS

This preliminary study indicates that post outplanting growth may be enhanced by winter fertilization. Further investigation is necessary to determine if this effect is consistent, and if so, what would be the best fertilizer timing and levels. It is too early at this point to determine if winter fertilization will impact standard nursery management.

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