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RESEARCH REPORT 00-9

A COMPARISON OF EIGHT FERTILIZERS FOR THE PRODUCTION OF LOBLOLLY PINE SEEDLINGS

by
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INTRODUCTION

The "standard" fertilization regime for producing loblolly pine seedlings in the South is the application of approximately 500 kg/ha of ammonium nitrate (165 kg/ha elemental N) split into 5 applications top-dressed during June through August. This regime has been used for a number of years and is widely employed by nursery managers. Even so, this application regime has several disadvantages: (1) it is dry weather dependent, (2) moisture on needle surfaces from either dew or light rain can capture fertilizer pellets and burn the foliage, (3) labor and machine time are required at a busy time of the nursery year, and (4) multiple tractor passes can increase soil compaction. In addition, nitrate may be leached from the soil profile possibly resulting in groundwater contamination.

In an effort to evaluate alternative fertilizers, an experiment testing eight fertilizer types was installed at an Alabama Coastal Plain nursery. The objective was to compare the performance of these alternatives in terms of seedling morphological quality.

METHODOLOGY

The soil at the selected nursery is a Blanton/Bonify series sandy loam (0-2% slope, CEC 4.8 meq/100g soil, pH 6.2, and 3.0% organic matter). Loblolly pine was sown on April 24, with a target of 20 seedlings per square foot. Seedlings were undercut to a 15cm depth in early August, top pruned to a 33 cm height in mid-September, and lateral pruned in mid-October. Routine weed and other pest control measures were followed.

A randomized complete block was used to compare eight fertilizers at one equivalent elemental N

rate of 150 lb/acre. The 8 treatments were blocked 6 times over 4 nursery beds. Each treatment plot was 40 feet long. Supplemental P, K, and S from granular sulfur, triple superphosphate, and potassium chloride were applied when necessary to equalize all treatments relative to fertilizer applications (Table 1). Seedlings fertilized with ammonium nitrate, urea, and Coron were irrigated following each application to remove fertilizer from the foliage and prevent foliar injury.

Table 1. Fertilizer types and application technique.

Fertilizer Type	% Nitrogen	Application / Timing
Ammonium nitrate	33%	Top dress summer, 5 applications
Urea	43%	Top dress summer, 5 applications
Slow Release Fertilizers		
Nutricote 13-13-13 Polymer Coated Urea	13	Spring plowdown, 180 day N release
Nutricote 18-6-8 Polymer Coated Urea	18	Spring plowdown, 270 day N release
Meister 21-7-14 Polymer Coated Urea	21	Spring plowdown, 270 day N release
Scott's Resin Coated Urea (RCU)	40	Spring plowdown
Scott's Polymer Coated Urea (PCU)	40	Spring plowdown
Coron 12-0-12 Liquid (6% uncoated slow release, 6% urea)	12	12 applications weekly, June 4 - Aug 20

To follow seedling morphological development, seedling samples were taken from each plot on or about August 1, November 1, and February 1. Twenty-five seedlings were sampled from drills 2-7 at random in the middle 10 feet of each treatment, leaving 3 feet between sample points. The seedlings were placed in plastic bags, transported in an ice chest after harvesting, and frozen in the laboratory until measured for shoot length, root collar diameter, shoot oven-dry weight and root oven-dry weight. The oven-dried needles were ground for N content analysis at the Auburn University Soil Testing Laboratory.

RESULTS

Urea and Ammonium Nitrate

Urea produced seedlings of quality comparable to the "standard" ammonium nitrate (AN) fertilization (Table 2). Although urea fertilized seedlings were significantly larger at the August sampling, AN fertilized seedlings had achieved the same size by the November sampling and remained virtually the same in size through February. Both treatments also had no statistical difference in the number of culls and grade 1 seedlings produced (Table 3).

Nutricote and Meister

These formulations are polymer coated slow release granular fertilizers and were applied only at the time of plowdown. Even though their release rates varied from 180 to 270 days, there were no apparent differences between the three fertilizers for seedling morphological development from August to February. In other words, there was no evidence that the 270 day release made N available

at a slower rate than the 180 day release, although the 180 day formulation may have grown less from November to February.

Table 2. Loblolly pine root collar diameter and dry weights morphology at three sample times after fertilization with eight different fertilizer types.

Fertilizer Type	August	November	February
Mean RCD (mm)†			
Ammonium Nitrate 34-0-0	2.69 b	4.33 ab	4.87 ab
Urea 46-0-0	3.03 a	4.12 ab	4.85 ab
Nutricote 13-13-13	2.96 a	4.32 ab	4.63 b
Nutricote 18-6-8	2.89 ab	4.36 ab	4.76 ab
Meister 21-7-14	2.94 ab	4.34 ab	4.61 b
Scotts RCU 40-0-0	2.88 ab	4.15 ab	5.03 a
Scotts PCU 40-0-0	2.86 ab	4.06 b	4.52 b
Coron Plus 12-0-12	2.81 ab	4.45 a	4.55 b
Mean Seedling Dry Weight (g) †			
Ammonium Nitrate 34-0-0	1.95 d	3.38	4.39 a
Urea 46-0-0	2.18 bcd	3.08 ns	4.32 a
Nutricote 13-13-13	2.34 ab	3.31	3.91 ab
Nutricote 18-6-8	2.47 a	3.31	4.21 ab
Meister 21-7-14	2.28 abc	3.45	4.08 ab
Scotts RCU 40-0-0	1.68 e	3.12	4.40 a
Scotts PCU 40-0-0	2.05 cd	2.99	3.75 b
Coron Plus 12-0-12	1.94 de	3.47	3.93 ab

† Means followed by the same letters within a variable are not significantly different at the 0.05 level using Duncan's Multiple Range Test.

When comparing these three slow release granular formulations, we conclude that none performed equally to the standard AN fertilization. This is supported by the drop-off in seedling dry weight accumulation from November to February, the lower average of number 1 grade seedlings, and the higher average number of culls

Scotts Polymer and Resin Coated Ureas

The Scott's polymer coated urea (PCU) formulation did not produce a seedling of the same quality as AN. Not only did it average the lowest RCD and seedling dry weight for both the November and February samples, but it averaged the fewest number of grade 1 seedlings. This same formulation had performed poorly in a test with slash pine at another nursery the previous year.

The resin coated urea formulation (RCU) on the other hand, was one of the best treatments in terms of seedling size and grade. It averaged the highest number of grade 1 seedlings and the most dry weight in the February sampling. The RCU produced seedlings that averaged a larger RCD, dry

weight, and number of grade 1 seedlings than did the standard AN fertilization.

Table 3. Percentage of grade 1 and cull seedlings produced by treatment when sampled on February 1.

Fertilizer Type	Grade 1 Seedlings † percent	Cull Seedlings percent
Ammonium Nitrate 34-0-0	65.0 ab	1.7 ns
Urea 46-0-0	70.8 ab	1.7
Nutricote 13-13-13	55.8 ab	2.5
Nutricote 18-6-8	64.2 ab	5.0
Meister 21-7-14	55.8 ab	5.8
Scotts RCU 40-0-0	83.3 a	1.7
Scotts PCU 40-0-0	43.3 b	2.5
Coron Plus 12-0-12	45.8 b	5.0

† Means followed by the same letters within a variable are not significantly different at the 0.05 level using Duncan's Multiple Range Test. ns denotes non-significance.

Liquid

The liquid fertilizer, Coron, developed morphologically the same as the AN treatment during the summer as the August and November samples indicated comparable sizes. By the February sample, however, the liquid fertilized treatments produced the fewest number of grade 1 seedlings and averaged one of the smallest DRCs and dry weights. One could expect that because of the high solubility of liquid fertilizers, very little N remained available through the lifting season, even though half the N (6%) is formulated as a slow release.

MANAGEMENT IMPLICATIONS

Urea appears to be a viable alternative to ammonium nitrate when comparing on the basis of seedling morphological development. Seedling size developed equally between these two nitrogen types during this experiment. Urea, however, does not resolve any of the problems associated with top dressing ammonium nitrate, i.e. dry weather dependent, possible foliage burn, and manpower and machine usage.

Of the slow release formulations tested here, we believe the Scott's resin coated urea has be highest potential for nursery managers seeking a slow release alternative to ammonium nitrate. Based on previous experience with slow release formulations, nursery managers considering a test of this product should do so on only a section of their nursery and over a period of several years. Those considering this alternative should also remember that slow release fertilizers are substantially more expensive than standard granular fertilizers.