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MASTER

COMPARISON OF SLUDGE AND FERTILIZER APPLICATIONS ON ESTABLISHMENT AND GROWTH OF SEEDLINGS OF TWO SWEETGUM ECOTYPES ENDOMYCORRHIZAL WITH GLOMUS MOSSEAE AND G. ETUNICATUS

Establishment and Progress Report

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ABSTRACT

Half-sib progeny from two sweetgum (Liquidambar styraciflua) mother trees endomycorrhizal with Glomus etunicatus and G. mosseae were grown in the Forest Service'e experimental nursery located near Athens, Georgia, and outplanted on SRP, at Aiken, South Carolina, in late February 1978. Sludge and fertilizer treatments were applied to the plots several weeks prior to planting. Nutrient equivalence to the 1/4" sludge standard was approximated with the addition of diammonium phosphate, ammonium nitrate and hydrated lime. Two soil moisture lysimeters (one at an effective sampling depth of 38" and one at 10") were installed in the middle of each plot after planting of seedlingsto follow nutrient cycling on site. Soil moisture will be monitored monthly during the growing season and nitrogen equivalence among the sludge and fertilizer treatments will be maintained by adding ammonium nitrate to half of the fertilizer plots when such adjustments are needed as determined in the laboratory. A first-year progress report will be prepared after field data is collected in December 1978.

COMPARISON OF SLUDGE AND FERTILIZER APPLICATIONS ON ESTABLISHMENT AND GROWTH OF SEEDLINGS OF TWO SWEETGUM ECOTYPES ENDOMYCORRHIZAL WITH GLOMUS MOSSEAE AND GLOMUS ETUNICATUS

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ESTABLISHMENT REPORT

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As part of a large borrow pit reclamation study installed in 1976 at the Savannah River Plant at Aiken, South Carolina, sludge was used as a soil amendment for establishing sweetgum seedlings (Liquidambar styraciflua L.) endomycorrhizal with Glomus mosseae. In spite of the adversity of the site, height growth of from 1 to 2 meters was common after 2 years on most surviving seedlings in the sludge amended plots. This degree of early height growth is unusual for sweetgum even on the better upland sites. It was not possible to compare the performance of sweetgum seedlings planted with commercial fertilizers to seedlings in the sludge amended plots, or to ascertain if something other than the nutrient content of the sludge was contributing to the outstanding growth of these seedlings.

The purpose of this experiment is to compare the establishment and growth of sweetgum seedlings on an upland site amended with either one-fourth inch sludge or amounts of commercial fertilizer that is equal in nutrients to the sludge.

Half-sib seedlings from a bottomland and an upland sweetgum mother tree were grown in nursery beds heavily infested with a mixture of Glomus mosseae and Glomus etunicatus at the Whitehall Experimental Forest in Athens, Georgia. Seedlings were planted on a prepared upland site on the Savannah River Plant, Aiken, SC, in February 1978. Figure 1 shows the plot layout.

One-fourth inch of sludge was applied to randomly selected plots in January and disked into the soil before seedlings were planted. This ratio is equivalent to 1466 pounds of sludge pet plot, resulting in the following nutrient content (lbs.) per plot:

16.9	TKN	1.8	calcium
0.18	nitrate nitrogen	.08	magnesium
11.5	Total P	.51	iron
0.8	extractable P	.03	manganese
0.11	potassium	.20	zinc.

Each replicate of eight plots contains 2 sludge, 4 fertilizer, and two control plots. The control plots received no fertilizer and will receive none for the duration of the study. Initially, the fertilizer plots received amounts equivalent in nutrients to that found in the sludge. This was approximated by the addition of the following fertilizers (lbs.) per plot: 57.65 diammonium phosphate, 19.7 ammonium nitrate, and 3.3 hydrated lime.

Two soil lysimeters were installed in the center of each plot - one at an effective depth of 38 inches, the other at approximately 8 inches. The lysimeters will be used to follow soil-water nutrient levels throughout the study and will provide data needed to adjust the nutrient status of two of the four fertilizer plots in each replicate at later dates. Whenever the nutrient status of water from either lysimeter indicates a nutritional deficit between the sludge and fertilizer plots, adjustments will be made in two of the fertilizer plots. It is essential to determine how long the seedlings will respond to the sludge and to determine how much commercial fertilizer will have to be added for seedlings to equal this response. This will also give us considerable insight into the fate of the nitrates and phosphates moving through the soil profile.

Soil-water samples will be taken monthly during the growing season as long as there is sufficient moisture in the soil to permit sampling. Two dormant season samples will be made each year. However, if nutrient deficits are evident during the dormant season, adjustments will not be attempted until budbreak is imminent.

The site will be kept clean of competing herbaceous vegetation by disking for as long as it is deemed necessary.

Dormant season measurement of tree growth will be obtained yearly for 5 years, or longer if beneficial responses to the initial sludge application are still being observed.

Appropriate ANOVA will be made on the data to permit assessment of fertility variables as well as the effect of ecotype on seedling development.

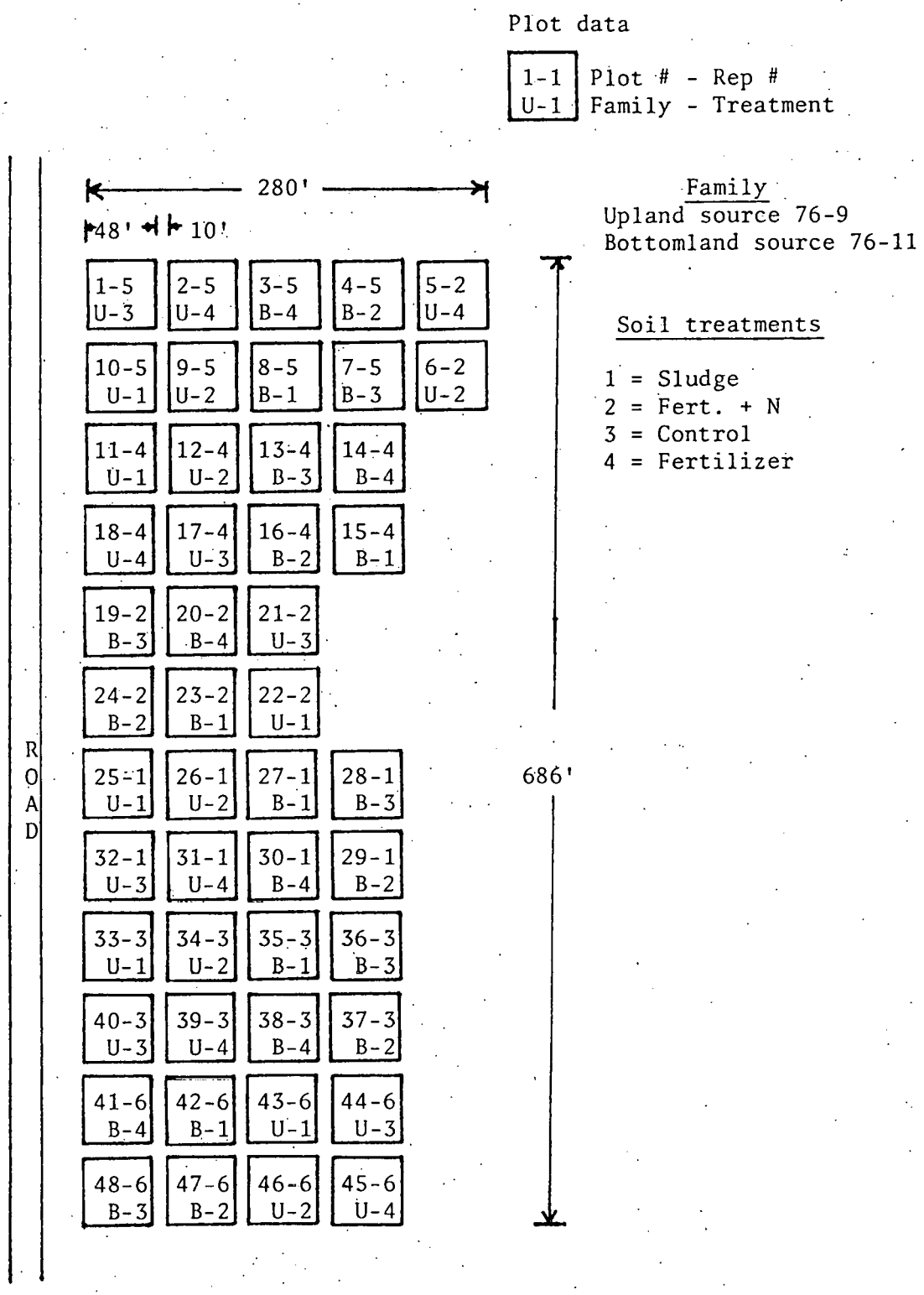

Figure 1. Comparison of sludge and fertilizer applications on the establishment and growth of seedlings of two sweetgum ecotypes endomycorrhizal with Glomus mosseae. Field plots at SRP, Aiken, S.C.