A COMPARISON OF PETROLEUM, SAND, AND PINE STRAW MULCHES ON EUCALYPTUS SEEDBEDS

Howard L. Hoffman, Executive Director
Florida Forests Foundation
Fort Myers, Fla.

Introduction

Eucalyptus is generally a fine seeded genus, principally native to Australia, and is extensively planted in the warmer regions of the globe for reforestation and ornamental purposes.

This study was designed to determine if the Esso Reserach and Engineering Company's petroleum mulch [1] or native fine sand could be successfully substituted for pine straw mulch when growing eucalyptus seedlings in open seedbeds. This petroleum mulch is a specially formulated water emulsion of petroleum resins that is applied to soil surfaces as a spray. It coats the soil surface without penetrating it. It was reported that the mulch, when properly applied, will warm the soil, reduce evaporation, provide protection against seedbed erosion, and reduce leaching of minerals and chemicals from the growth zone.

Description of the Study

The study was conducted in Lee County, Fla., on Leon fine sand. A randomized block design with four replications was used. The plot size was a bed area 6 by 4 feet. Eucalyptus robusta was selected as the vehicle species for this study.

The following treatments were used in this study:

1. Pine straw (1/16- to 1/8-inch thick).
2. Native soil (1/8- to 1/4-inch thick).
3. Esso petroleum mulch (80, 130, 180, 230, and 280 g.p.a.) (gallons per acre).
4. Esso petroleum mulch (80, 130, 180, 230, and 280 g.p.a.) plus white fine sand applied to the surface after it had dried.

Recent research in Australia strongly indicates that most eucalyptus species have an optimum germination temperature below 90°F. Since this petroleum mulch is black, there was concern regarding the possibility of the soil temperature in the surface of the beds exceeding 90..°F., thus inhibiting germination. To overcome high temperatures, white find sand was applied over the surface of half of the petroleum mulch treatments. The seed for these treatments was sown in 1/8 to 1/4inch planting trenches and then covered with native fine sand from the seedbed to prevent direct contact with the seed. The seed for the pine straw treatments was sown on the surface of the beds. Standard laboratory thermometers were placed in the center of five treatments to a depth of 1 inch to record the soil temperature variation among the treatments.

[1] No trademark has yet been registered for this product. It is sometimes referred to as Encap.

Methods

Standard soil management, seedbed formation, and fumigation techniques for growing eucalyptus were employed.

A 2-gallon-capacity compressed air Loyalty Sprayer, with an adjustable nozzle, was used to apply the petroleum mulch. The sprayer was calibrated and was accurate when it was pumped to maximum pressure (20-30 p.s.i.) prior to application. Calibration tests were used to calculate the time needed to engage the sprayer for each treatment. The nozzle was adjusted to produce a fine spray. The shoulders as well as the surface of each plot were sprayed to prevent erosion.

The plots were mulched on the same day that the seed was sown. The petroleum mulch was allowed to dry overnight, and on the morning following application, the white fine sand was applied by hand to the respective plots. After a plot had been uniformly covered, the sand was gently rubbed into the surface of the petroleum mulch to increase its stability. This was easily done at all rates except 80 g.p.a.; this application was difficult to spread evenly and was also too thin to withstand the rubbing action.

Results and Discussion

Germination occurred in all treatments in 7 to 10 days. On March 25, a seedling density count was taken. The pine straw treatment produced the most seedlings per square foot, but there were no significant differences at the 1 percent level between it and the treatments averaging 19 or more seedlings per square foot. The mean number of seedlings per square foot for various mulching treatments were as follows:

Treatment	Seedlings
Petroleum mulch:	
230 g.p.a.	9
230 g.p.a. + fine sand	14
130 g.p.a. + fine sand	16
180 g.p.a. + fine sand	16
280 g.p.a. + fine sand	16
280 g.p.a.	19
80 g.p.a. + fine sand	19
130 g.p.a	22
80 g.p.a	25
180 g.p.a	26
Native soil	15
Pine straw mulch	27

Figure 1 shows the temperature variation between treatments under clear and cloudy conditions. On clear and partly cloudy days, the soil temperatures in the petroleum mulch treatments were much higher than those in the pine straw, native soil, or petroleum plus white fine sand treatments. On cloudy days, this temperature difference was not as great. The petroleum mulch warmed the surface inch of soil during daylight up to an average of 21^{0}F. over the air temperature; the amount of the increase depended on sky conditions.

The soil temperature in the petroleum mulch treatments was reduced by applying a thin layer of white fine sand after it has dried. The average noon temperature for the petroleum mulch at 130 g.p.a. was 97.5^{0} F. When white fine sand was applied after application of the mulch at this rate, the average soil temperature was reduced to 83^{0} F. However, another material, possibly aluminum paint, will have to be used because heavy rains and

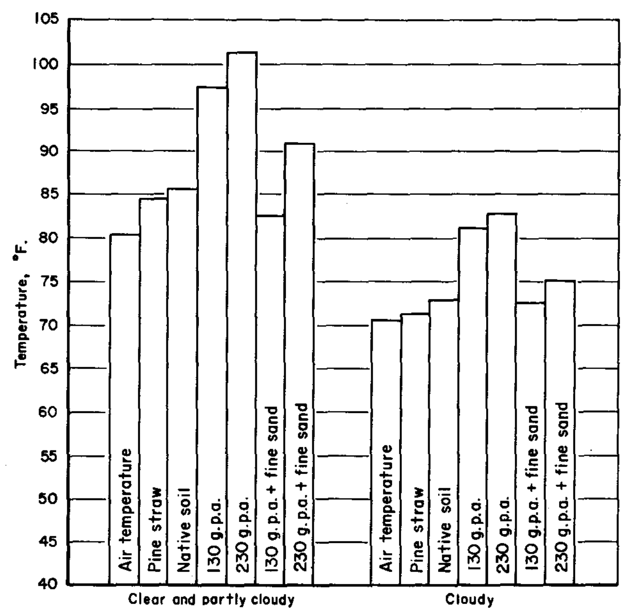

Figure 1.--Noon temperature in the surface inch of soil as affected by sky conditions.

regular use of the overhead irrigation system washed most of the sand away by the end of March.

During April, the study plots were thinned so there were no more than eight seedlings per square foot. The thinning was done to equalize the seedlings in each treatment so the growth data would reflect mulch effects and not seedbed density effects. On May 24, the heights were recorded for all the seedlings in the study. The seedlings in the pine straw treatment were the shortest, with an average height of 9.24 inches; the tallest seedings in the study, 14.88 inches high, were growing in the 80 g.p.a. plus fine sand treatment. However, an analysis of variance failed to reveal any significant differences among treatments in average height.

On May 20, the soil moisture conditions were sampled from a depth of 0 to 8 inches. No rain had fallen, and the experimental area had not been irrigated during the 2 days preceding sampling. The moisture percentage of the -soil in each treatment was computed on a dry weight basis. The data again revealed that there were no significant differences in soil moisture conditions among the treatments.

The petroleum mulch at rates above 80 g. p. a. provided excellent erosion control on the. surface of the beds as well as on the shoulders at the end of 5 months. As anticipated, the native soil mulch provided little or no protection against erosion. The pine straw was still in place on the surface of the beds at the end of the study, but it did not prevent erosion of the shoulders as did the petroleum mulch at the medium and high application rates.

Soil samples from a depth of 0 to 8 inches were taken 35 and 141 days after fertilization for the following treatments: Pine straw, native soil, and petroleum mulch at 130 and 230 g.p.a. These samples were analyzed for pH and pounds per acre of available CaO, MgO, P205, and K_20. During the period between samplings, the pH in all treatments increased from 6.6 to 7.15. The soil tests indicated that none of the mulches tested appreciably reduced leaching of soil nutrients from the 0- to 8-inch soil zone during the period between samplings.

Conclusions

The petroleum mulch evidently can be successfully substituted for pine straw mulch when growing eucalyptus seedlings in open seedbeds. However, results obtained using native soil mulch did not compare favorably with those obtained with the pine straw mulch.

The petroleum mulch effectively warmed the soil and provided protection against seedbed erosion, but it did not significantly reduce evaporation or leaching of nutrients.

A reflective coating is effective in reducing soil temperature under the petroleum mulch, although it tended to reduce seedling numbers. However, it was not stable during a hard rain and under normal use of the overhead irrigation system.