STUDY TO EVALUATE THE EFFECTS AND COSTS OF MULCHING MATERIALS IN LOBLOLLY PINE SEEDBEDS

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Abstract

A screening study of loblolly seedbed mulching materials was conducted at two North Carolina Forest Service Nurseries. Criteria used were the number of germinated seedlings and subsequent number of plantable seedlings per unit area and weeding cost. Several mulch materials performed well; however, cautions on the use of certain materials are expressed.

INTRODUCTION

Mulching material and its application is a ne9essary practice in successful operation of most forest tree nurseries.? Pine straw is the standard mulching material used in most nurseries producing Southern pines. It has become the primary mulching material because of its excellent mulching qualities, ready availability,.and low cost.

Sawdust, grain straw, and ground wood pulp mulch are also commonly used at some nurseries. Cloth materials, such as burlap, were in use in early nursery development.

The primary purpose of any mulch material is to aid the seed in germination by assisting in the maintenance of proper ground surface moisture during the first two to three weeks after seeding.

Other benefits from mulches which are not removed following germination are continued optimum surface soil condition and reduction of loss due to heat.

Some soils tend to bake and become very hard when mulch is removed, washed, or blown from seedbeds. In these soils a definite growth loss factor has been observed in the absence of mulch material which may be the result of hard soil surface, extreme heat, inhibited mycorrhizal development, and chemical changes created under these conditions.

Sandy soils may not surface harden, but during extreme heat the reflection of the sun's rays may cause fatalities to small seedlings, commonly referred to as "sun scald."

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2/ New Kent Nursery, Providence Forge, Virginia, does not use mulch material.

The economics of mulching are important. Cost of the material and its application is secondary to seedling losses caused by inadequate mulching or loss of mulch materials. Prior to germination seed and mulching media are most susceptible to being washed or beaten from the seedbeds by heavy rainstorms. The degree to which mulch will remain in place under severe weather conditions is a primary initial measurement of its value.

Much of the direct cost of mulching with pine straw, in most cases, is for labor. Labor charges are for raking, baling, hauling, chopping, and application. Several alternate media require less time and 1por. Labor costs have risen rapidly in the past decade. John P. Rhody-[1] reported a 56% increase in average wages paid in Kentucky nurseries from 1963 to 1968. Hourly labor costs have doubled in North Carolina in the period 1967-1971. All southeastern states have experienced similar increases.

Because of increased costs of labor and materials, a study of paper mulches and a latex mulch was conducted in North Carolina in 1967. The materials used at that time gave unsatisfactory performance.

Since 1968 several state and private nurseries have either tested or used the hydromulch method with varying degrees of success. In 1968, following the successful use of ground wood pulp in mulching at the St. Regis Paper Company Nursery at Lee, Florida, a test of this method was conducted in North Carolina. Heavy rainfall prior to germination caused extreme losses where this material was used for mulching forest tree nursery beds.

Tests of as many mulch materials as were readily available at reasonable costs were made in North Carolina during 1971. Several bonding agents were also tested in conjunction with materials most susceptible to removal by severe weather conditions.

Both natural and manufactured mulches were used in the studies. Primary consideration in the use of the natural mulches was given to spreading a uniform layer of approximately 1/4" over the entire bed. This permitted the seed to permeate the mulch and develop well without the necessity of mulch removal. Manufactured mulches were applied at reconuitended rates.

Two sites were selected for the studies to increase the chance of experiencing heavy rainfall following seeding.

MULCHING AND BONDING MATERIALS STUDIED

The following primary mulching materials were used:

1. Pine Straw
2. Grain Straw
3. Sawdust

1/ Proceedings, Southeastern Area Forest Nurserymen's Conference, 1968, p. 71.

4. Shredded Hardwood Bark
5. Coarse Pine Bark
6. Chipped Veneer
7. Conwed Pulp Fiber Mulch
8. Weyerhaeuser PFM Mulch
9. Conwed Mulchnet Blanket
10. Sand
11. Soil Guard Green latex

Bonding agents included:

1. Soil Guard Green Latex, Alco Chemical Company
2. Emulsion type asphalt, AE-5 grade, Koppers Company
3. Petroset SB Emulsion, Phillips Petroleum Company

LAYOUT OF MULCH STUDIES

A. Claridge Nursery, Goldsboro, North Carolina

1. Primary treatments - 1,200 linear feet (three 400-ft. beds)

a. Stratification of certain treatments

(1) 800 Lft. seeded with Hazard seed drill with splatter-board (broadcast)

(2) 400 Lft. seeded with Stanhay seed drill

2. Secondary treatments - 400 linear feet (one 400-ft. bed)

3. Conwed mulch blanket - 100 linear feet

4. Subplots: 6 inches by 4 feet; two random plots per 100 linear feet of seedbed. Six random subplots on Conwed mulch blanket.

B. Edwards Nursery, Morganton, North Carolina

1. Primary treatments - 700 linear feet (one 700-ft. bed)

2. Secondary treatments, including mulch blanket; a portion of one 700-ft. bed

3. Subplots: 6 inches by 4 feet; two random plots per 100 linear feet; minimum of 6 plots on secondary treatments

C. Seed, Seed Treatment and Sowing Rates

1. Claridge Nursery

a. 1967 South Coastal Plains (N.C.) medium sized seed

b. Treatment included:

(1) 30-day stratification in plastic bags

(2) Seed floated to remove faulty seed

(3) Treated with Arasan 42-S and latex

c. Sowing rate: 48 seeds per square foot (1 3/8 lbs. per 100 Lft.)

d. Seedbed count average:

(1) Broadcast: 42.36 seeds PSF

(2) Stanhay drill: 42.48 seeds PSF

e. Seeding dates: May 17-19, 1971

2. Edwards Nursery

a. 1967 Piedmont (N.C.) medium sized seed

b. Treatment (same as Claridge Nursery)

c. Sowing rate (same as Claridge Nursery)

d. Seeding dates: May 24-26, 1971

D. Germinative Weather Conditions Experienced

1. Claridge Nursery - one heavy rainfall, although only 0.65 inches of rain on eighth day after establishment

2. Edwards Nursery - no severe weather conditions

DISCUSSION OF MULCH MATERIALS AND RESULTS

Comparison of results between nurseries are not valid because of differences in soils, weather conditions, and cultural practices.

The mulches used in this study can be divided into the following categories:

1. Natural or manufactured
2. Long fibered or short fibered
3. Bonded or unbonded

General results from this study show the tank-mixed bonded manufactured mulches produced better average germination than the natural mulches. There are, however, other factors which must be considered before these materials are selected for use:

1. The Texas Forest Service reports severe losses to its 1971 crop after converting to hydromulch with 10 gallons of Petroset SB emulsion per 250 pounds of ground wood pulp.

2. At the rate of 1,500 pounds of ground wood pulp per acre and 10 gallons of Petroset SB emulsion per 250-300 pounds of pulp, the cost per acre exceeds the cost of most natural mulches.

3. Initial equipment cost of $3,500-$4,000 per hydromulch machine is high.

4. Application is relatively slow.

Spray binders (asphalt and latex) over the pulp mulches gave poor germination which varied from 62.74 to 93.24 seedlings per linear foot. The manufactured pulp mulches performed poorly with no binders (79.25 to 88.00 seedlings per linear foot at Claridge Nursery). The five gallon Petroset SB emulsion rate did not give as good results as the 10-15 gallon rates (74.74 to 107.24 seedlings per Lft. compared to 123.74 to 140.74 seedlings per Lft. at 10-15 gallon rates on broadcast seed at Claridge Nursery).

Natural mulches, including grain straw, hardwood bark, pine bark, chipped veneer and sawdust performed well in these studies. For example, pine bark produced germination of 128 seedlings per Lft. at Claridge Nursery and sawdust from 124 drilled to 132.74 broadcast. At Edwards Nursery the following germination per Lft. was obtained: chipped veneer – 173.5; hardwood bark - 164.5; grain straw – 157; pine straw 148.83. Spray bonding materials did not appear to improve the mulching ability of the natural mulches.

The hardwood bark used in the studies was shredded at the mill. Fiber length varied from sawdust size to about 4 inches. The material spread easily and uniformly from the standard spike toothed manure spreader.

Pine bark was unscreened with particles up to several inches in diameter. Although results were good, there is the probability that seed under larger pieces of bark could not penetrate to the surface or would form basal crooks in seeking light. Seedling vigor on the beds mulched with pine bark was best in the Claridge Nursery study.

Sawdust performed well in these tests. Caution is suggested in the use of sawdust mulch if severe weather conditions are experienced. The short fibers of sawdust make it extremely susceptible to washing from the seedbeds during heavy rains.

Grain straw is a good mulching material if frequent early applications of mineral spirits are used to kill the newly germinated grain seed which in usually present in the straw. Grain is difficult to eliminate if permitted to get well established in the seedling beds. No difficulty was experienced in the study since timely solvent applications were made.

The longer fibered materials are preferred because of their resistance to disturbance by weather elements.

COST CONSIDERATIONS IN SELECTING MULCH MATERIALS

Three primary cost considerations in selecting mulch materials are:

1. Seed cost – germinating and producing the most seedlings per unit of seed.

2. Cost of securing, processing, and applying the mulch material.

3. Weeding costs.

Scientific nursery management requires use of seed in a manner which will yield the most plantable seedlings per pound of seed. Seed costs are increasing, and each seed is becoming more valuable as seed orchards develop and labor costs increase. The correlation between seed usage, mulch material, actual germination, and plantable seedlings is an important cost factor in nursery production.

Excellent facilities are available for testing the Southern pine seed at the Eastern Tree Seed Laboratory. Sizing of seed and use of improved seeding equipment affords the opportunity to sow the seed accurately for the proper density to produce the most plantable seedlings with a minimum cull factor. Selection of a mulch that may increase seed yield is an important economic factor.

The cost of securing and applying the mulch material, while perhaps secondary to production per unit of seed, is an annual direct cost of most nurseries. Based on 1971 wage rates, the cost of mulch, processing, and application may vary from less than $150 per acre to more than $300 per acre. This direct cost must be considered in the selection of a mulch material.

Weeding costs in this study varied according to mulch material. It has been known or suspected that weed seed is brought into the nursery in pine straw. In this study the hand weeding time expended on the seedling beds mulched with pine straw was significantly higher than the time expended on beds mulched with the other natural and manufactured materials. Studies in effect in the South may approve herbicides that reduce the significance of this cost factor.

SUMMARY AND RECOMMENDATIONS

The mulch studies in North Carolina were made on an operational basis with subplots used for data collection. Weeding time studies were made on a bed length basis. These were intended as screening studies, and no attempt has been made to determine statistical evaluations of the data.

Location, climate, soil, seed, and cultural practices vary between individual nurseries to the extent that no blanket recommendations will be made from this study. However, each nursery which questions present mulching methods should not change either its method or materials without adequately testing substitute materials under local conditions.

There are several mulch materials that performed well in these tests. Cautions on the use of certain of the materials are expressed in this report. Mulch performance was satisfactory for the following materials:

1. Pine Straw
2. Grain Straw
3. Pine Bark
4. Hardwood Bark
5. Chipped Veneer
6. Sawdust
7. Ground Wood Pulp with 10-15 gallons of bonding material

Spray binders (asphalt and latex) did not improve mulch material performance.

Ground wood pulp did not perform as well as other materials when applied with no bonding agent, too little bonding agent or too much bonding agent.

In general, seedling vigor, color, and size were better where natural mulch materials were used.

Weeding costs in beds mulched with pine straw were significantly higher than in beds mulched with other materials.

Note: A full report on the study can be obtained from Bill Bland. Ask for Forestry Note No. 3. His address is:

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