Tree Planter's Notes, Vol. 35, No. 3 (1984)

Hydromulch Increases Seedbed Density of Some Western Conifers

Thomas D. Landis, James Lott, and Jo A. Ives

Western Nursery Specialist, USDA Forest Service, Rocky Mountain Region, Lakewood, Colo.; Mechanical Engineer, USDA Forest Service, Missoula Equipment Development Center, Missoula, Mont.; and former Nursery Studies Assistant, USDA Forest Service, Mt. Sopris Nursery, Carbondale, Colo.

Hydromulch seedbed treatments at the 1,250-pound-per-acre application rate had the highest seedling emergence after 4 weeks. Hydromulch treatments produced better second-year seedbed densities than soil covering for lodgepole pine and Engelmann spruce, but not for ponderosa pine.

Mulches have been used in seedling nurseries as a protective covering for newly sown seeds for many years. Pine needles, cone grindings, straw, sphagnum moss, burlap, sawdust, and netting have all been used to mulch seedbeds at various nurseries *(1, 3, 4).* Tree nurseries have used hydromulch as a seed covering for over 10 years in the Southeastern United States, where it helps to retard washing of seeds and soil during torrential spring rains. Hydromulch gave the best results in a test of 14 different mulching materials at a Michigan nursery *(3).* This material is not widely used in western nurseries because of the potential for impeded seedling emergence and nursery personnel's unfamiliarity with proper application methods.

There are several commercial brands of hydromulch available, but all are basically wood cellulose fibers that are sometimes mixed with a viscous sticking agent. Hydromulch is sold in compressed dry bales and then mixed with water before use. The mulch is applied to the desired area in liquid suspension through high-pressure nozzles. As the water is absorbed by the soil, the wood fibers coalesce into a cohesive mulch over the soil surface.

Nursery managers are generally agreed that seed mulches are beneficial to seedling germination and emergence. Western tree nurseries have traditionally used soil or sand for covering seeds during spring sowing and straw or sawdust mulches during fall sowing.

The purpose of this project was to test hydromulch on western conifer seedlings under western environmental conditions. The project was a joint venture of Mt. Sopris Nursery and the Missoula Equipment Development Center, both of the USDA Forest Service.

Methods

A "Finn Bantam Hydroseeder" was purchased with project funds by Missoula Equipment Development Center. This model has a standard 66-inch wheel base and specially designed attachments to spread the mulch over a standard 4-foot-wide nursery seedbed (fig. 1). Conwed hydromulch was used in these trials and is representative of commercially available mulches. Conwed hydromulch is available in both a "regular" grade and "Conwed 2000," which contains a sticker.

Three conifer species were used in this test to be representative of seedlings produced in the West: ponderosa pine (*Pinus ponderosa),* Engelmann spruce *(Picea engelmannii),* and lodgepole pine *(Pines contorta).*

Five treatments were set up to test the differences between the two kinds of hydromulch, regular and 2000, and between two typical application rates, 1,250 and 2,500 pounds per acre. The treatments were compared to the standard seed covering as a control. These treatments were randomly assigned to full (120 m) seedbeds within a standard five-bed nursery unit, using a full unit for each of the three species.

Two different types of seeders were also used in this trial. A modified Wind River drill seeder is the standard seeder at Mt. Sopris Nursery and sows seeds in an indented band, tamps the seeds into the soil, and then covers the exposed seeds with a strip of sand one row wide. The sand covering was omitted in this study because we hoped the hydromulch covering would replace the costly and tedious one-row sand cover.

A Love-Oyjord seed drill was also used. This machine actually sows seeds at a preset depth and covers the seeds with soil. Therefore, for the Wind River seeder the

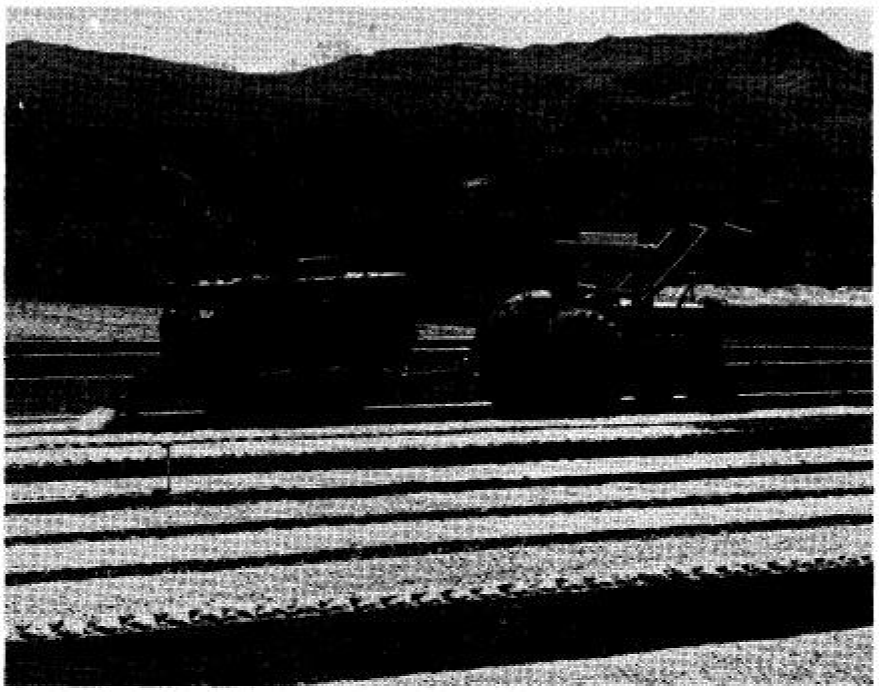

Figure 1—*Application of hydromulch over nursery seedbed immediately after sowing.*

control treatment was sand and for the Love-Oyjord drill it was soil The same seed sources and sowing density were used for each tree species to allow for comparisons of seeders.

The final study design consisted of five treatments, three tree species, and two seeders, using 30 nursery seedbeds. Sampling plots were randomly established within the treatment seedbeds at a sampling intensity of four 6-inch bed-width plots per seedbed. Measurements were taken weekly during early growth and at the end of the first and second growing seasons. Recorded data included seedling emergence rate, seedling size, and stand density and observations on soil moisture and temperature, mulch durability, and bird predation.

Results and Discussion

During the installation of the hydromulch treatments using the Wind River drill, problems with seed covering became obvious. Because the seeds were partially exposed, the pressure of the hydromulch application dislodged many sown seeds from the seed row and left them on top of the soil. Ponderosa pine was the most severely affected because of its larger seed size; the smaller seeded lodgepole pine and Engelmann spruce were least affected. Most of the displaced seeds either did not survive the germination period or were eaten by birds. This portion of the experiment was terminated because of this unforeseen development and the remainder of the study was concentrated on 15 seedbeds sown by the Love-Oyjord seed drill. The remainder of this article deals with these treatments.

Seedling emergence began about 2 weeks after sowing. The emergence pattern for Engelmann spruce is given in figure 2 and is typical for all three seedling species. The soil-covered control beds showed an initial lead in the rate of emergence, but all mulch treatments soon surpassed the control. This pattern of seedling emergence is probably related to the surface soil temperatures in the seedbed. The control bed had the best initial emergence because the dark soil absorbed more solar insolation than the light-colored hydromulch treatments. The hydromulch also provided an insulating layer, which lowered seedbed temperatures and slowed seedling emergence.

The soil control achieved maximum emergence at 3 weeks and then declined in seedling density compared to the mulched beds, which continued to increase in density until 4 weeks after sowing. (fig. 2). Of the hydromulch treat-

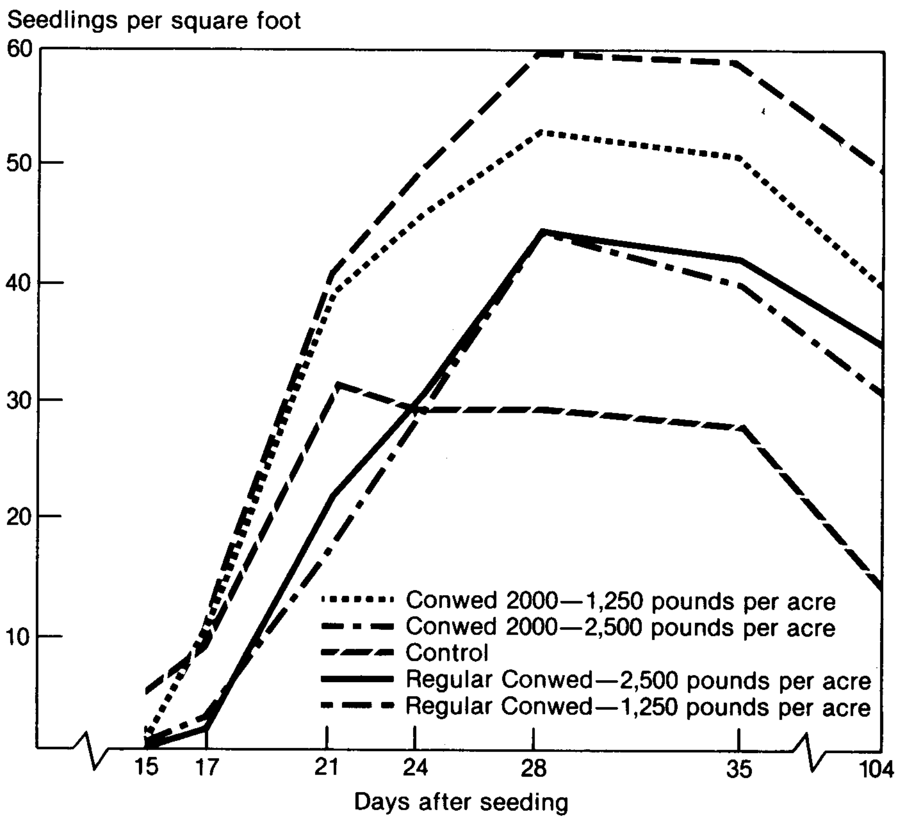

Figure 2—*Emergence rate for Engelmann spruce.*

ments, the 1,250-pound-per-acre treatment had faster emergence rates than the heavier 2,500 pound-per-acre rate; the greater insulating effect of the heavier mulch probably delayed germination and emergence (fig. 2). The two types of hydromulch, regular and Conwed 2000, had remarkably similar results indicating little difference between the products. Maximum seedling emergence for all treatments was reached at 4 weeks after sowing; and after that time, all treatments showed a decline in seedling density (fig. 2). This attrition was probably caused by the natural thinning out of weaker seedlings and is typical of first-year seedbeds at Mt. Sopris Nursery.

Seedling density at the end of the second growing season varied with tree species (fig. 3). The hydromulch treatments produced greater seedbed densities than no-mulch controls for lodgepole pine and Engelmann spruce, but the reverse was true for ponderosa pine (fig. 3). A one-way analysis of variance and Duncan's multiple range test run on these data indicated that the control treatment was significantly different at the 1-percent level from all hydromulch treatments for lodgepole pine and Engelman n spruce For ponderosa pine, the control had significantly higher seedbed density than hydromulch treatments using Conwed 2000, but not than those using Regular Conwed hydromulch. These tests indicate that hydromulch is more effective for small-seeded conifer species than for larger seeded ponderosa pine. Because of the variety of conifer seedlings produced in the West, hydromulch will have to be tested on other species and under the environmental conditions unique to each nursery.

There appears to be little difference between the two types of hydromulch or the two application rates based on the results for all three species (fig. 3). Although there was variation between the treatments for the different species, no one hydromulch treatment was consistently superior. There was no obvious advantage to the hydromulch containing the sticker (Conwed 2000), especially when considering the higher cost. The heavier 2,500-pound-per-acre rate did not prove to have an advantage over the standard 1,250 pound rate. This is contrary to the

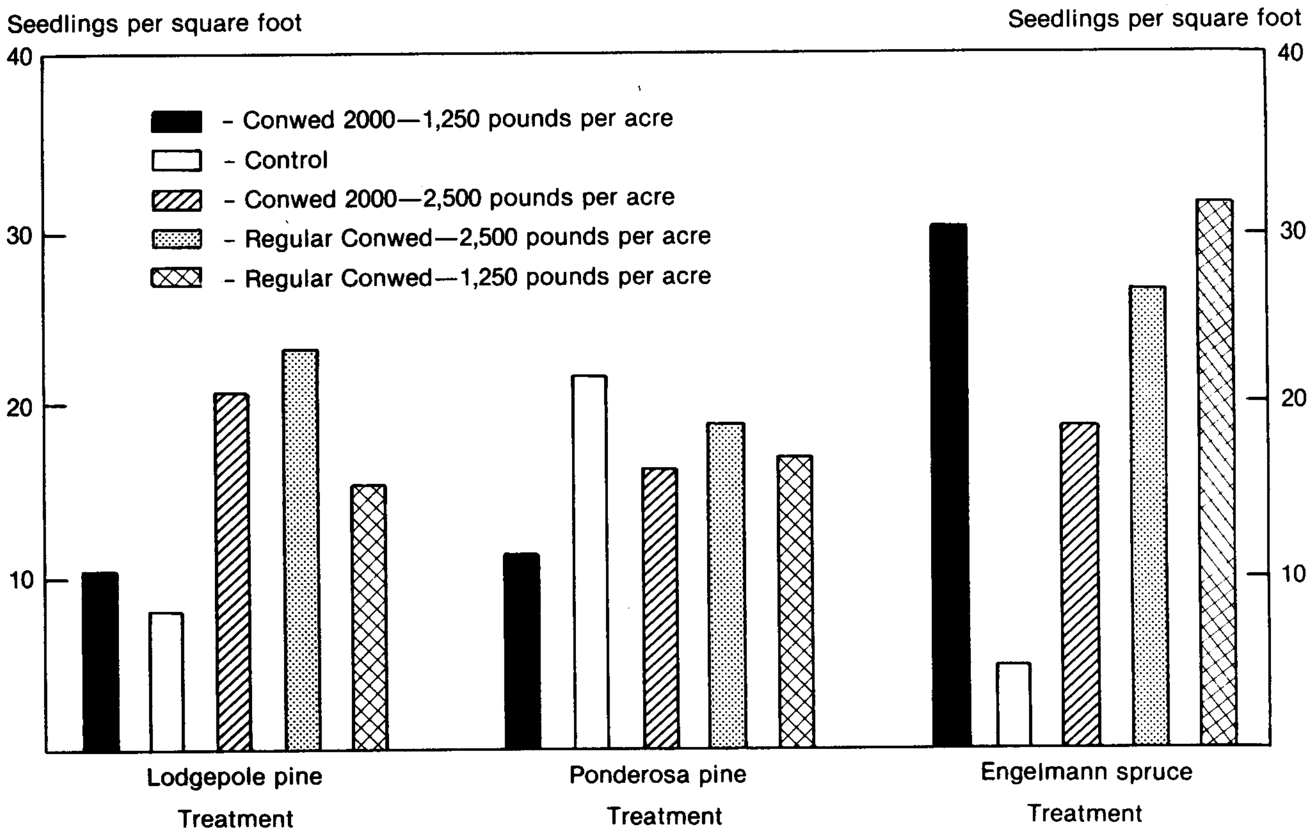

Figure 3—*Seedling density after second year.*

results of Barham (2), who found that a 2,600-pound-per-acre rate was more effective than a 1,300 pound rate for sweetgum on a silty-loam soil. This again emphasizes the need for additional tests on other species of tree seedlings.

Observations on the influence of the hydromulch seed covering on the seedbed environment revealed some interesting facts. Surface soil temperatures were consistently lower and soil moisture higher under the mulch cover. Hydromulch may reduce bird predation of sown seeds. In semi-arid climates, hydromulch may reduce the wicking effect of soluble salts to the soil surface. We did not observe any adverse effects of the hydromulch except some splash erosion onto small seedlings during a heavy rain. This occurrence did not affect seedling growth or restrict seedling emergence in any of the hydromulch treatments.

Conclusions

Hydromulch proved to be an effective seedbed mulch covering when used with a seeding machine that covers the sown seeds. Exposed seeds may be forcibly displaced by the pressure of the hydromulch application.

The hydromulch treatments initially delayed seedling emergence compared to the soil control, but this trend was reversed by the end of the germination period. We observed no inhibition of seedling emergence in any of the hydromulch treatments.

Final seedbed densities of the hydromulch treatments were significantly higher for small-seeded Engelmann spruce and lodgepole pine; ponderosa pine did not benefit from the hydromulch covering.

The standard application rate of 1,250 pounds per acre was as effective as a 2,500-pound rate, and there was no apparent advantage to a hydromulch that includes a sticking agent.

Literature Cited

1. Armson, K. A.; Sadreika, V. Forest tree nursery soil management and related practices. Toronto, ON: Ontario Ministry of Natural Resources, Division of Forests; 1979. 175 p.
2. Barham, R. O. Nursery-grown sweetgum production improved by hydromulching. Tree Plant. Notes. 31: 28-30;1980.
3. Clifford, E. D.; Massello, J. W. Mulching materials for nursery seedbeds. Tree Plant. Notes. 72: 18-22; 1965.
4. Lantz, P. M. Uniformity in seedbed mulching using chemical mulch. Tree Plant. Notes. 20: 8-9; 1969.