# EVALUATION OF VARIOUS MULCHING MATERIALS USED TO IMPROVE PLANTATION SURVIVAL

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## Introduction

Poor plantation survival has been a constant concern to foresters. Many factors contribute to seedling mortality. Southerly aspects below 1,500 feet elevation in southwestern Oregon present high soil surface temperatures and severe drought during the growing season, which are deterrents to conifer plantation establishment. Conversely, these factors are favorable for annual competitive grasses and weeds. Trials of mechanical scarification, scalping, and use of chemicals to reduce competition have been largely ineffective.

Mulching of pineapple fields in Hawaii has been a long established practice. It has been used, also, for other agricultural crops. Rotty[1] recently reported the use of mulch in Spain to improve forest plantation survival by placing rocks around planted trees to reduce competition, conserve moisture, and reduce temperatures.

County Extension Forester Robert Bradley and the writer established a mulching trial using Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) in the spring of 1959 (fig. 1). A kraft, asphalt interlined, building paper was used as the mulch material. Results showed a 38 percent increase in survival for the mulched trees. With this specific indication that mulching could increase significantly the initial survival of conifer plantations, two additional studies were undertaken. One by Bradley[2] again used building paper as the mulch, but varied the size of the paper squares to evaluate the effect

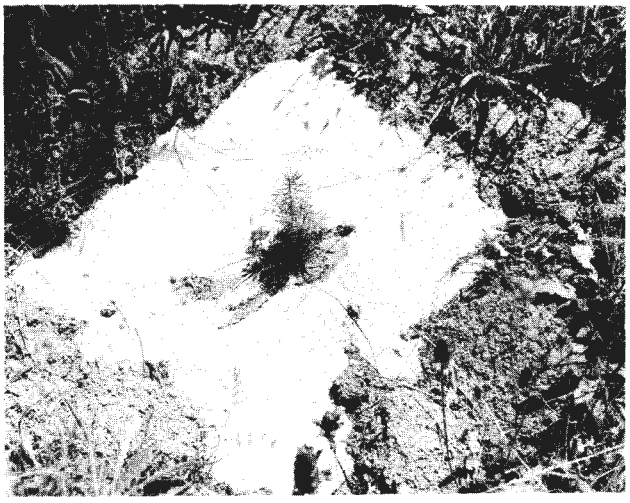

Figure 1.--Douglas-fir with 2- by 2-foot paper mulch of asphalt interlined building paper. (Oregon Forest Research Laboratory photograph)

1 Ratty, Roland. Three rocks--for better planting survival. Tree Planters' Notes 33: 3-5. 1958.

2 Bradley, Robert F. Use of the paper sheet method to increase plantation survival on severe sites. Unpublished thesis, Oregon State University. 1962.

of the area mulched. The results showed consistent improvement in initial survival with increase in size of the paper square, as shown by the following:

| Type of treatment | Survival |
|---|---|
| | *Percent* |
| Control (no mulch): | 10.4 |
| 18-inch square sheet | 40.3 |
| 27-inch square sheet | 75.5 |
| 36-inch square sheet | 78.18 |

The second study by Hermann[3] was based on Douglas-fir plantations mulched by Bureau of Land Management planting crews in the spring of 1960.[4] Briefly, his analysis indicated that:

1. Survival of seedlings was increased significantly by paper mulch on each planting site.

2. Survival of mulched seedlings was up to five times higher than those without mulch.

3. Degree of success with mulch appeared to be related to amount of precipitation and time of application, but not to steepness of site.

4. Paper lasted through the growing season, but began to disintegrate rapidly with the onset of fall rains.

The prospect of a new technique to increase initial survival raised the question of the effectiveness and durability of the mulch material applied. The kraft building paper used was a commercial weight listed as 30-30-30. It weighs 98 pounds per ream of 500 sheets of 36-inch squares, and is expensive to handle. A field trial was established in the spring of 1960 to test other mulching materials and treatments and to measure their effects on the survival of three species of 2-0 planted conifers.

## Method

The test areas were located near Winston, Oreg., in the South Umpqua River drainage at an elevation of 500 to 600 feet.[5] Topography is gently rolling, soils are loamy clays, and the climate is cool and moist in winter but dry and warm during the growing season. One block was on a south aspect, the other on a north-facing slope; both blocks were covered with a dense stand of annual grasses and weeds, primarily bromes and fescues, and such forbs as plantain and dandelion.

Three species, grand fir (Abies grandis Lindley), white fir (A. concolor (cord.) Parry), and lodgepole pine (Pinus contorta Loudon) were planted separately in rows. Ten treatments were applied randomly to the rows and every other tree in each row was left untreated as a control. The treatments applied were as follows:

| Treatment number | Material or treatment |
|---|---|
| 1 | Black heavy kraft impregnated paper. |
| 2 | Tan heavy wrapping paper (60/75), one side plastic coated. |

[3] Herman, Richard K. Paper mulch for reforestation in southwestern Oregon. Paper accepted for publication by Jour, of Forestry May 1962.

[4] Newton, Michael. Mulch papers for improving plantation survival. Unpublished paper presented to Reforestation Conference of the Bureau of Land Management in western Oregon. 1961.

[5] Sudworth, George B. Forest trees of the Pacific Slope. Forest Service, U.S. Department of Agriculture. 1908.

| Treatment number | Material or treatment |
|---|---|
| 3. | Waxide 35/42 PE, dark impregnated paper, locally called pineapple paper. |
| 4. | Kraft waxing B 40/45, tan lightweight wrapping paper coated with plastic on one side. |
| 5. | Standard kraft asphalt interlined building paper. |
| 6. | Cultivated (2 by 2 feet square). |
| 7. | Common newspaper. |
| 8. | Scalped and sawdust. |
| 9. | Clear plastic sheet |
| 10. | Heavy black polyethelene plastic sheet. |

All treatments were 2 by 2 feet square except the newspaper, which was 23 by 32.5 inches, and the clear plastic, which varied slightly in shape but approximated 4 square feet. A small cross was cut in the center of the mulch paper or plastic squares to allow the material to be slipped down over the seedling. Edges were weighted down with turned over sod clumps or dirt. Survival counts were made during the growing season, and a final one was made on October 26, well after fall rains had started. Appraisal of the condition and effectiveness of the mulch or planting spot treatment was made concurrently with the survival counts.

## Results

All tree seedlings but one broke buds and grew during the early part of the growing season. No damage from insects, disease, or wildlife was detected. Thus, mortality was assumed to be caused by those factors which the treatments were designed to overcome, namely: moisture stress caused by competing vegetation, evaporation, and high surface soil temperatures.

Ecotypic characteristics are known to vary widely among the three species used. To have each species represented in each treatment was not possible. Thus, only gross survival statistics between mulched and unmulched and north and south aspects are meaningful. These results are shown in figure 2.

A detailed inspection of the materials was made on January 31, 1962. Treatment 10 was most durable followed by numbers 8, 7 **(six** sheets), 2 and 4 (plastic coated side down), 1, 5, 3, 9, and 6. The only costs available for material were 1-1 cents per sheet for the kraft building paper and 20 cents for the black polyethylene.

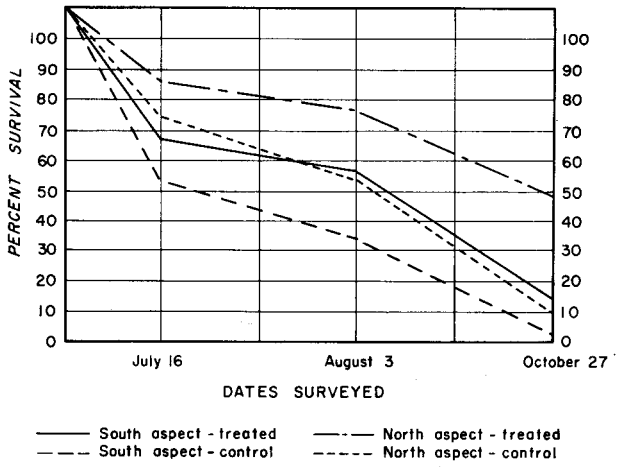


**Figure 2.--Comparison of survival by north and south aspects, and treatments and control.**

## Conclusions and Discussion

The most obvious conclusion is that any opaque mulch material at least 2 feet square that shades out the grass and weeds is effective in increasing initial plantation survival. An already well-established fact also was demonstrated that survival under arid conditions is better on northerly aspects than on southerly ones. Mulch treatment on south facing slopes produced slightly better tree survival than did unmulched northerly slopes. Cultivation by itself failed to improve initial survival significantly on either aspect.

Since mulching improves initial plantation survival significantly, the question arises as to its economic feasibility. Planting contract costs average $35 per thousand for 8-by 8-foot spacing. Using Bradley's survival figure of 10.4 percent for unmulched trees of Douglas-fir, the region's most planted species, the cost per surviving tree becomes about 33 1/2 cents. Adding mulching material and application costs of 1 1/2 and 14 cents respectively, to the 3 1/3-cent planting cost per tree, we find that the 513 surviving seedlings (75.5 percent survival using a 27-inch paper square) cost 23.2 cents each. Obviously, the 10.4 percent survival of unmulched trees provides inadequate stocking, and the area would need replanting.

Based upon this analysis, the significant increase in initial plantation survival appears to well justify the use of paper mulch on severe sites covered with herbaceous vegetation. Mulching must be completed before soil moisture is depleted which in southwest Oregon is generally prior to June first.

The writer expresses his appreciation to Crown Zellerbach Corp. for supplying some of the special papers, and to Charles McCord, Dillard, Oreg., for providing one of the planting sites and assisting in establishing this field test.