PLANTING DOUGLAS-FIR SEEDLINGS IN PLASTIC TUBES

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It is difficult to establish seedlings in some areas of Oregon. A survey of the literature disclosed success in improving survival of seedlings by planting them in various containers, or with their roots still enclosed in a ball of earth.

The present report describes the first results of a study undertaken to determine whether tubed seedlings could be successfully planted in areas of Oregon where bare-root stock plantings have not been successful. Bare-rooted seedlings cost less to produce, to transport to the planting sites, and to plant. However, the use of tubes greatly reduces the physiological disturbance of plants. Where an adverse climate results in a high mortality of newly planted seedlings or where there is a severely short planting season, the planting of seedlings grown in polyethylene tubes may be desirable.

Experiment

In preliminary trials several materials were made into tubes of various sizes. At first, bare-rooted seedlings were set into large tubes; later, seedlings were grown directly from germinants in small tubes.

SURVIVAL IN LARGE TUBES

Tubes for the first trial were made of heavy sheets of plastic or veneer. The edges of the sheets were joined by wooden strips grooved on opposite sides and fastened by three steel clamps, resulting in cylinders 23 inches high and 4 inches in diameter.

Ponderosa pines were planted in the tubes after one season in the nursery, and then were placed in a greenhouse for 5 months.

Tubed seedlings were planted in May 1961 by driving a pointed steel bar in an iron sleeve about 24 inches into the ground. After removing the steel clamps, a tubed seedling was inserted into the iron sleeve. Then the wooden connector was pulled up, thereby releasing the plastic sheet or veneer, the sheet itself, and finally the iron sleeve.

The seedlings were planted in the pumice region of central Oregon. Soil on the site consisted of a 20-inch layer of coarse pumice over finer textured pumaceous material. As much as 80 percent of the pumice in the upper horizons was as large as gravel.

Survival was better than 90 percent after 2 years, and seedlings were growing vigorously. But trials with such large tubes were discontinued because costs of producing, transporting, and planting were prohibitive even for limited application. However, tube planting has certain advantages, and further efforts were directed toward finding a more economical tube.

SURVIVAL IN SMALL TUBES

Aluminum foil tubes.--Tubes used in 1962 were 12 inches long and about 1 1/4 inch in diameter. They were made of aluminum foil and filled with a fine-textured pumaceous soil.

Newly germinated seeds of ponderosa pine, with the radicle extending about 1 inch from the seedcoat, were planted in tubes. The tubed seedlings were raised in a greenhouse, and beginning in May they were planted 7, 9, 12, and 14 weeks after the seedlings had started growing in tubes. A special tool was employed for planting.

These tubed seedlings were also planted on a pumice soil in central Oregon. By watering

the tubes prior to planting, the encased soil became firm enough so that the bottoms of the tubes could be opened and slits could be made on the sides just before tubes were inserted into the planting sleeve.

Survival at the end of two growing seasons appeared to be directly related to age of seedlings before planting, and time of outplanting in the field, although this could not be verified. The trial did indicate that young seedlings raised in small tubes could be planted successfully. However, aluminum foil was expensive, and tubes could not be manufactured from it quickly enough.

Polyethylene tubes.--Experiments with polyethylene tubes were initiated. Polyethylene tubing, 1 1/2 inches in diameter, was as light as aluminum foil, but much less expensive. The tubing could be filled quickly with soil, cut to 12-inch lengths, and the bottoms closed by stapling or by using masking tape. Pumaceous soil was used in the tubes to keep their weights low. A filled tube weighed about 250 grams when the soil was moistened.

Starting in May 1963, polyethylene tubed seedlings were planted until November at ages ranging from 7 to 15 weeks after plants had begun to grow in tubes. The tool used for planting was the same as that used in the preceding year. Tubes were soaked, and the bottoms were opened prior to planting.

These tubes were tested on a dry site in southern Oregon on the western slope of the Cascades and on a similar site near Corvallis in the eastern foothills of the Coast Range. Soils in both locations were clay loams that tended to dry rapidly and to crack following the end of winter rains.

Results were similar to the trial with tubes of aluminum foil. Survival generally was higher, and the oldest seedlings outplanted latest in the year had the highest survival. However, these plantings were not designed to substantiate such a relationship.

GROWTH IN TUBES

Horizontal growth of roots was restricted while the roots remained encased in tubes (except during the first month of growth). Seedlings raised in tubes grew slightly more during the 30 days following germination than did seedlings not grown in tubes. The presence or absence of light did not affect growth.

Addition of 3 grams of magnesium ammonium phosphate to soil in the tube as a starting booster stunted the growth of roots. The adverse effect of fertilizer was still apparent in 7 1/2-month-old seedlings. At this age, a restriction of the growth of roots in tubes became noticeable, especially when compared with seedlings of the same age not grown in tubes in a nursery. The restriction was most conspicuous in the portion of the root that had been in the upper part of the tube.

Seedlings of ponderosa pine planted in tubes grew well in 1963 (fig. 1). Forty-eight percent of the seedlings planted by July 15 near Corvallis had grown their second set of needles, at an average age of 33 weeks.

Discussion

Several problems still need consideration. One is the suitability of various species for tube planting. Findings reported here are based on work with ponderosa pine and may not apply to other species. While there is no reason to believe that Douglas-fir, for example, will perform poorly when planted in tubes, modification of techniques may be necessary. For instance, roots of Douglas-fir elongate more slowly than do roots of ponderosa pine; therefore, it may be necessary to grow Douglas-fir in tubes for a longer period.

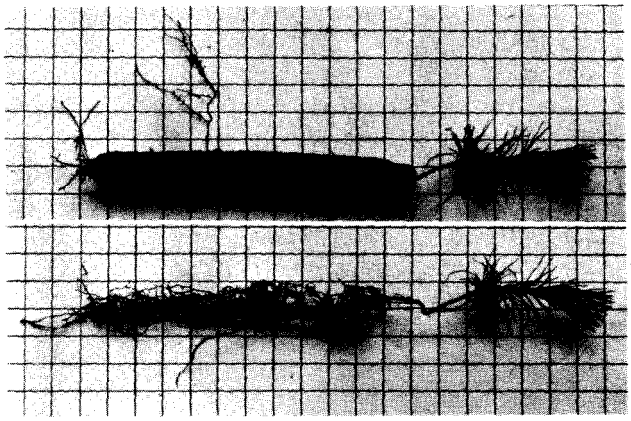

Figure 1.--This ponderosa pine seedling, shown with and without polyethylene tube and soil, was grown from a seed that germinated April 22, 1963, was outplanted in its tube, and was dug on June 11, 1964.

Determination of the best age to outplant seedlings should be another objective. If attempts are made to extend planting of tubed stock throughout the entire growing season, adjustments in age of stock may be necessary.

A third important problem involves the question whether development of roots becomes seriously limited by tubes when seedlings grow older. Growth of roots in tubes must be studied considerably more, and if the answer is yes, a solution must be found.

Fourth, to make planting in tubes economically feasible, efforts should be directed toward finding low-cost methods of producing and transporting tubed seedlings (fig. 2).

However, the increased cost of planting in tubes may be offset by several advantages. In addition to increasing the percentage of seedlings surviving, seedlings in tubes can be planted much of the year, so the crew can be small, permanent, and experienced. Tubes conserve moisture, so planting can be done on droughty sites. In addition, seedlings in tubes have roots about 12 inches long; thus, they may be better able to reach moist soil. Roots are not cut before planting nor bent during planting, and the tubes protect them from drying during transporting and planting.

Time in the nursery is short, so the duration of the planting program for the current year must be regulated. Seedlings for planting in early spring might benefit from the protection of a greenhouse, but other plantings could be grown in a nursery in any convenient location. Almost no weeding is necessary for seedlings in tubes, and not much other care is needed in the nursery.

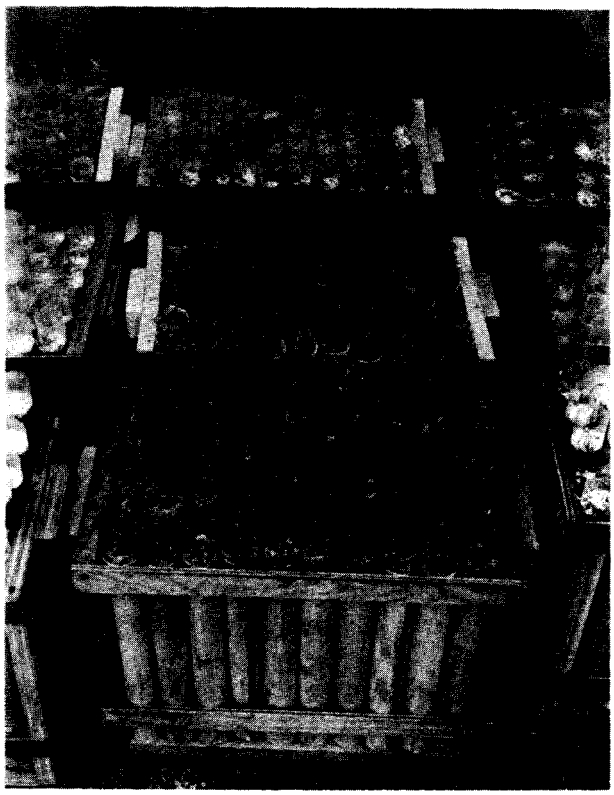

Figure 2.--Seedlings in these polyethylene tubes are held upright by stiffeners of metal or wire mesh. To permit easy transport, 60 tubes are placed in each case.