STIMULATING ROOT REGENERATION OF LANDSCAPE-SIZE RED OAK WITH AUXIN ROOT SPRAYS

by Glen P. Lumis

Abstract. Sprays of 3000 ppm indole-3-butyric acid (IBA) and napthaleneacetic acid (NAA), applied to freshly cut roots of 250-300 cm tall red oaks (*Quercus rubra* L.) dug by tree spade, increased the number of roots regenerated from medium (5-15 mm) and large (15-25 mm) diameter roots. IBA stimulated more new roots than NAA on large roots only. As root diameter increased there was a trend to more regenerated roots. The root spray method may be more practical than others recommended and may be commercially feasible.

Survival and growth of newly planted landscape trees is dependent on the regeneration of new roots and their subsequent exploration of the soil to supply water and nutrients (5). Root regeneration of woody plants is related to physiological parameters such as root carbohydrate level (7, 8) and vegetative growth (2), environmental factors such as soil and air temperature (6) media acidity and aeration (9), and cultural factors such as root pruning practices (1). Attempts to stimulate root regeneration with exogenously applied chemicals have had mixed results. Several workers have successfully stimulated root regeneration (2, 4, 11, 12, 13) while others found commercially prepared root stimulators to be of no benefit (3, 14).

Most previous studies have utilized small plants such as seedings or transplants. The objective of this study was to determine if exogenously applied IBA and NAA could stimulate root regeneration of large, landscape-size red oak using a treatment method compatible with conventional nursery practice.

Materials and Methods

In late April 1979, 12 uniform, 35 mm diameter, 2½-3 m tall, nursery-grown red oak trees were dug with a tree spade and placed in 75 cm wire baskets. All roots between 2 and 25 mm diameter which extended to the edge of the soil ball were grouped into 3 size classes: less than 5 mm; 5-15 mm; and 15-25 mm diameter, tagged and their ends flush-cut with hand shears. Treatment solutions (3000 ppm IBA, 3000 ppm NAA, both in 50% ethanol and distilled water as a control) were sprayed onto the cut surface of at least 3 roots per size class per tree. After application the tree baskets were covered with burlap, transported 40 km and planted into raised beds of sphagnum peat. Trees were staked and watered as required through the growing season. Water soluble 20-20-20 (20N-9P-17K) including micronutrients was used every fourth watering at 200 ppm N.

In mid October the peat was removed and the roots originating within 35 mm of the cut surface of the original root were counted. Data were analyzed as a blocked design with at least 3 observations per root class per tree.

Results and Discussion

Medium (5-15 mm) and large (15-15 mm) diameter roots treated with IBA or NAA regenerated more new roots than untreated roots (Table 1). IBA stimulated more new roots than NAA on large diameter roots. There was no difference between IBA and the control in regeneration from roots less than 5 mm in diameter. Trees treated with NAA had too few small diameter roots (< 5 mm) to provide a valid sample. As root diameter increased there was a trend to a greater number of regenerated roots. This is in contrast to a study with rose root segments where there was an inverse relationship between the number of regenerated roots and the diameter of the old root segment from 1 to 4 mm (10).

All new roots arose at or within 35 mm of the cut surface indicating that there was little movement of auxin into the root or that conditions within the soil ball were less conducive to root regeneration. Moser (13) found that root regeneration occurs at the point of auxin application on the root. Although optimum concentration was not determined in this study, previously published rates for pin oak (Q.

Table 1. Average number of red oak roots regenerated from treated roots of 3 size classes.

Treatment	Root diameter (mm)		
	< 5 (small)	5-15 (medium)	15-25 (large)
IBA	7.0a[z]	18.6a	45.8a
NAA	—	20.2a	24.3b
Control	3.1a	4.9b	13.8c

[z]Mean separation in columns by Duncan's multiple range test, 5% level. Values are an average of at least 3 observations per root class per replicate.

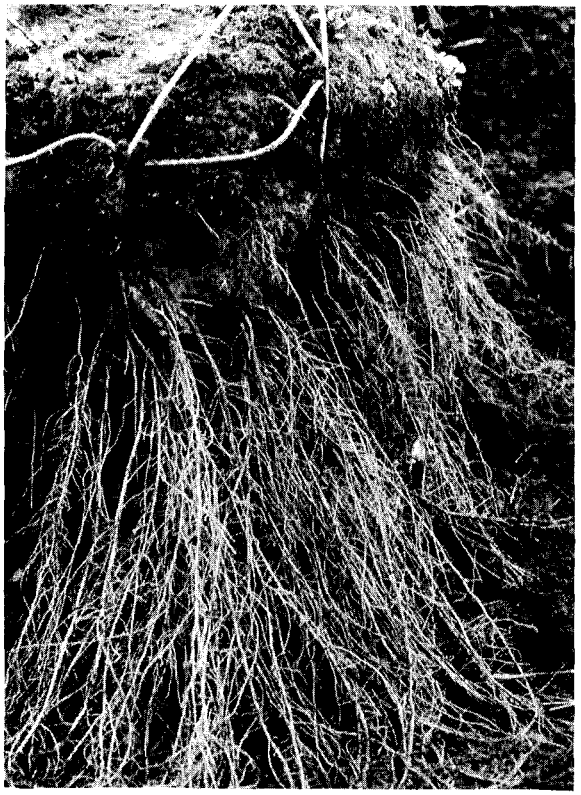

Fig. 1. Extensive growth of red oak roots into peat backfill, control tree.

palustrus) seedlings (13) may be pertinent to larger plants. Further studies are needed to determine optimum concentrations and efficacy of such applications on other genera of landscape trees.

Root growth during the experiment was very extensive for all treatments (Fig. 1). The extensive root growth seemed to be associated with the long root regeneration period (6 months) and the limited depth of the raised beds of well aerated sphagnum peat. Physical conditions of the soil at planting time could affect tree establishment, the number of roots regenerated and their subsequent growth.

The root spray method used here may be more practical than some of those recommended by other workers (13) and could be adapted easily into nursery practice. Moser (13) indicated that a root dip was more effective than a spray but was more wasteful of solution. Dip treatment of large trees would not be practical.

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Department of Horticultural Science,
University of Guelph,
Guelph, Ontario, Canada