EFFECT OF TRUNK INJECTION OF FLURPRIMIDOL AND PACLOBUTRAZOL ON SPROUT GROWTH IN SILVER MAPLE[1]

by Geoffrey P. Arron

Abstract. A field study was initiated in 1985 to evaluate the growth retardation capabilities of potential plant growth regulators for silver maple. Twelve-year-old silver maple trees were trimmed and trunk injected with one of two application rates of EL-500 {alpha-(1-methylethyl)-alpha-[4-(tri-fluromethoxy)phenyl]-5-pyri-midine-methanol} (common name: flurprimidol) and PP 333 {(2RS, 3RS)-1-(4-chlorophenyl)-4, 4-dimethyl-2-(1,2,4-triazol-1-yl)pentan-3-ol} (common name: paclobutrazol). The high (20 g/L and low (4 g/L) application rates of both EL-500 and PP 333 resulted in significantly shorter sprouts than in the two control groups when the sprouts that had formed on single-and multi-stemmed trees were considered collectively in the fall of 1985. Both growth regulators appeared to be more effective in single- rather than multi-stemmed trees and this may be related to an uneven distribution of chemical between the two or three stems of the latter.

The trimming of problem trees under distribution lines on city streets and in rural areas is a major problem for electrical utilities. Such operations are routinely performed at intervals of one to eight years depending on the individual species growth rate and the amount of line clearance required (5, 7). Tree trimming operations, although effective, are time consuming, can be hazardous, and are often expensive for the utilities involved (3, 6). The extension of such trimming cycles would result in a substantial cost saving (7).

Much effort has been spent in developing chemicals for the horticultural industry to retard the growth of woody and herbaceous plants. Recently a group of new growth regulators was introduced which was shown to be effective in controlling the growth of trees without producing noticeable injury symptoms. Both EL-500 and PP 333 have been reported to control excessive sprout growth in a number of species when applied either as a foliar spray or as a soil drench (1, 8, 12, 15). Trunk injection of EL-500 and PP 333 into tree seedlings grown in the greenhouse (2) and of PP 333 into sapling trees in the field (13) has also resulted in a reduction in sprout growth after trimming. Trunk injection of growth regulators offers obvious advantages over other application methods. Drift is avoided, there is more precise application rate control, and the exposure of the applicator to the chemical is limited (4, 10).

In the present study the effects of trunk injection of EL-500 and PP 333 on sprout growth in somewhat older trees, 12-year-old silver maple (*Acer saccharinum*) growing at a site in southern Ontario, were investigated. The trees were trimmed immediately prior to injection.

Materials and Methods

Single- and multi-stemmed 12-year-old silver maple trees growing at Wesleyville Generating Station were trunk injected with methanolic solutions of the two growth regulators in May of 1985 using a third generation Asplundh tree injector. Injection holes were made with a hand drill fitted with a 5.5 mm (7/32 in) bit. The holes were drilled into the trunk approximately 30 cm from the soil surface, at a slight downward angle (about 5° from horizontal) and at a 30° to 45° angle to the plane of the trunk to intercept the outer sapwood. The holes were typically 6 cm in depth and were sealed with silicone grease after injection to prevent pathogen entry.

Two different application rates (20 g/L and 4 g/L) were used for each chemical. The volume of solution (and hence the amount of active ingredient) injected into each tree was determined from the diameter of the tree, using the formula: Volume per tree (mL) = $(dbh)^2 \times 0.492$. Trees with a trunk diameter of 9.5 cm or less had two injection holes while larger trees had three injection holes. Two sets of control trees were included in

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the experiment. In one set the trees received no injection (control), and in a second set the trees were injected with methanol (methanol control), the carrier in the growth regulator solutions. Prior to injection all the trees at the site were trimmed by a forestry crew, with their height being reduced by approximately one-third. After injection the trees were measured (overall height and the length and location of all laterals on the top 0.5 m of the main stem) with the aid of a bucket on a Muskeg tractor (see Figure 1). The trees were remeasured in October 1985.

Results and Discussion

As in earlier studies where growth regulators were trunk injected into either mature trees on city streets (6) or into tree seedlings grown in the greenhouse (2) it was found useful to order the sprouts that grew on the top 0.5 m of the silver maple trees into various classes by length. Such a frequency distribution for each of the treatments is given in Figure 2. With the exception of the smallest length class in the control group, the frequency distributions for both the methanol control and the control groups had a flat appearance, with sprouts ranging from 5 cm in length or less, to approximately 100 cm in length. With the high application rate of EL-500 sprouts of length 0 to 15 cm appeared to be more common than in the control groups, and this was reminiscent of the frequency distributions seen with both EL-500 and PP 333 in the earlier greenhouse study (2). In the present field study, the low application rate of EL-500 and the two application rates of PP 333 did not cause an obvious skewing of the distribution to the left and sprouts of shorter length.

Figure 1. Measuring sprout growth in the fall of 1985.

The mean lengths of the sprouts measured in 1985 on both single- and multi-stemmed trees are presented for the various treatments in Figure 3. When the data from both single- and multi-stemmed trees are presented in combination (see part A), the differences in the mean values for the various treatments are overshadowed by the fact that the standard deviations presented are extremely large. However, the number of sprouts in each treatment group was quite large, ranging from 131 to 191. An analysis of these data revealed that all four treatments resulted in significantly shorter sprouts than found in the two control groups, with the greatest reduction in growth being found in trees treated with the high application rate of EL-500. When only sprouts on single-stemmed trees were compared, an analysis of the data revealed that the high application rate of EL-500 and the low application rate of PP 333 resulted in significantly shorter sprouts than found in the two control groups (Figure 3, part B). When sprouts on multi-stemmed trees only were considered, the data were inconsistent, with no treatment group being significantly different from both the control groups (data not shown). The apparent greater effectiveness of the two growth regulators in single-stemmed rather than multi-stemmed trees may be the result of a more efficient translocation of the chemicals from the site of injection to the tree limbs. In multi-stemmed trees the points on the trunk where the injections were made would be of great importance, in that correct positioning would be needed to ensure that the two or three major stems ultimately received an appropriate proportion of the total dose applied. Uneven distribution of injected growth regulators throughout the tree has been discussed previously.

Sprouts that were measured on the silver maple trees at Wesleyville GS were categorized into two classes on the basis of their location on the branch. Terminal sprouts and lateral sprouts had formed from terminal buds and lateral buds, respectively. When only terminal sprouts found on single-stemmed trees were considered, all four treatments resulted in significantly shorter sprouts than those found on the two control tree groups (see Figure 3, part C). The number of terminal sprouts considered in such an analysis ranged from 34 to 70 in the six groups. When terminal sprouts on multi-stemmed trees were considered in isolation, none of the four treatments was significantly different from both the control groups (data not shown). Similarly, when lateral sprouts were considered either on single- or multi-stemmed trees alone, none of the four treatments caused significantly different growth from both the control groups (data not shown).

The observation that the growth regulators EL-500 and PP 333 appear to cause a greater reduction in growth in terminal sprouts rather than lateral sprouts may be attributed to the fact that both growth regulators have been observed to move upwards in the stem after trunk injection, and not downwards (9, 11, 13, 14). The inhibition of terminal growth alone has not been reported to cause an increase in lateral budbreak in pruned

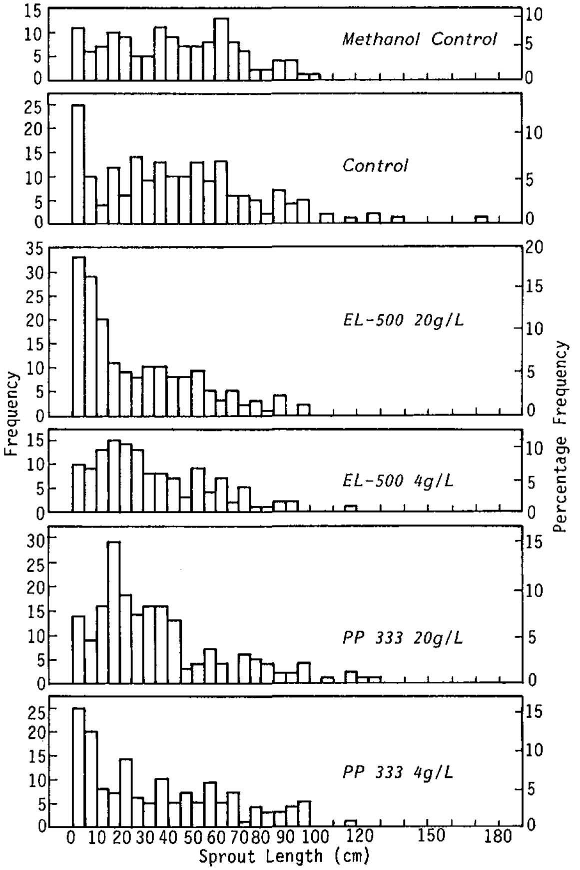

Figure 2. Effect of trunk injection of EL-500 and PP 333 on the length of sprouts formed in 1985 on silver maple trees at Wesleyville G.S. Sprouts were grouped according to length into various classes. Each class length was 5 cm, classes were 0 to 5, 5 to 10 cm, etc.

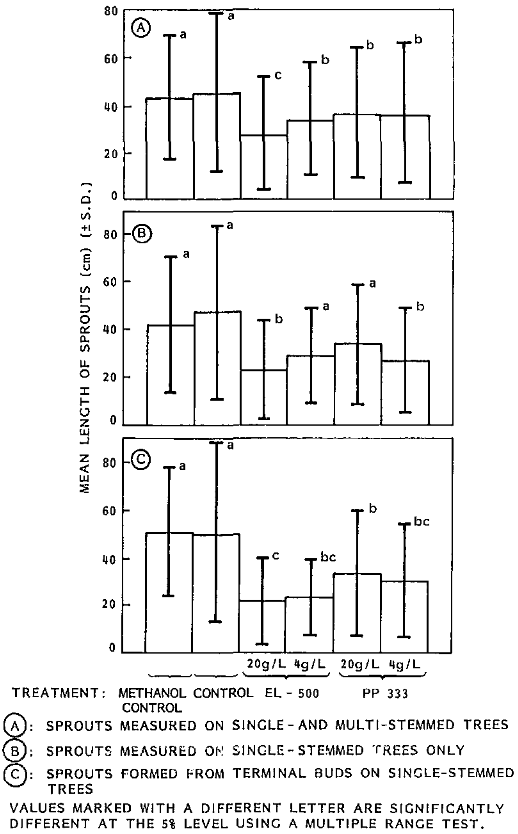

Figure 3. Effect of trunk injection of EL-500 and PP 333 on the length of sprouts formed in 1985 on silver maple trees at Wesleyville G.S.

apple seedlings (9).

The present study has demonstrated that trunk injection of the growth regulators EL-500 and PP 333 resulted in a significant reduction in the growth of sprouts produced on trimmed silver maple trees growing in the field in southern Ontario. Measurements of sprout growth that occurred in the second year after injection will be made in the fall of 1986. A previous study has suggested that the effects of PP 333 are more pronounced in the second year following injection (15).

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