Chemical Pinching of ‘Hetzi’ Holly with EHPP

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Abstract. Ethyl hydrogen 1-propylphosphonate (EHPP) applied to Ilex crenata, Thunb. ‘Hetzi’ increased the number of branches. The optimum concentration for branching was 4000 ppm. Higher concentrations reduced branching, produced phytotoxicity, and delayed regrowth. Plant dry weight was inversely proportional to concentration at rates above 2000 ppm.

Pinching and pruning ornamental crops generally results in a more desirable plant by increasing axillary bud development. With the exception of azaleas (1, 3, 6), this is presently a manual operation. Chemical pinching materials show promise in reducing the production costs of nursery crops. These materials, which inhibit or destroy apical buds, are distinguished from growth retarding chemicals which slow cell division and elongation in shoot tissues without formative effects (4).

In 1949, sprays of maleic hydrazide (MH) were reported to injure or destroy the apical meristem of tomato plants, resulting in the breakdown of apical dominance (9). Later, MH applications were reported to increase axillary branching of some woody plants (7).

Cytokinins release the apical dominance exerted on lateral buds by an intact apex (8). Recently, rose axillary shoot growth has been increased by applications of 9-(2-tetrahydropyran)-9 H-purine and benzyladenine (2).

Alkyl esters of C9 to C12 fatty acids inhibit the growth of axillary buds when applied to tobacco plants with excised apical meristems (10). Lower alkyl esters of the C8 to C12 fatty acids and C8 to C10 fatty alcohols are effective in selectively killing the terminal meristems of many species without damaging the axillary meristems, foliage, or stem tissues (5).

Furuta (6) found several methyl esters effective in chemically pinching azaleas, but reported concn to be extremely critical. Concns below the critical point may injure the bud scales rather than destroy the bud, whereas high concns may destroy the bud but also cause excessive foliar injury and stunting.

The purpose of this research was to evaluate EHPP3 as a chemical pinching agent for ‘Hetzi’ holly, an important nursery crop in the Southeastern U.S. When container grown in partial shade, ‘Hetzi’ holly produces an open loosely branched plant (Fig. 1) that requires periodic pruning to achieve the desired form.

One year old plants grown under lathe in 4 liter (1 gal) containers were sprayed on April 20, 1973. Plants were sprayed to the drip point at concns from 2000 to 12000 ppm with a hand operated compression sprayer. Spreader Sticker4 (.03%) was used as a surfactant in all treatments. Each treatment had 5 plants and treatments were completely randomized. The plants had few new shoots over 2.5 cm long. Temp at application was 16.7°C and remained relatively constant for several hr following treatment.

The condition of the buds was examined following treatment to determine the extent of damage. The no. of branches present at the end of the growing season was used as a parameter for evaluating the effectiveness of the chemical. On Dec. 3, the plants were cut at ground level, branches counted, and oven dried 2 weeks for dry wt.

Almost total necrosis of apical buds occurred at concn above 2000 ppm. At 2000 ppm, injury was largely confined to the bud scales. Bud necrosis and foliar damage were observed within approx 10 days at concn above 4000 ppm. Bud necrosis and scale damage at 2000 and 4000 ppm took as long as 3 weeks to develop; no foliar damage was observed at these concns.

The max no. of branches occurred from the 4000 ppm application (Fig. 2).

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3 NIA 10637 (water miscible formulation containing 960 g/liter) was donated by Niagara Chemical Co., Middleport, NY. NIA 10637 is not registered.
4 E.I. duPont de Nemours and Co. (Inc.), Wilmington, Del.

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Fig. 1. ‘Hetzi’ holly treated with 4000 ppm EHPP (right) compared with a control (left).

Fig. 2. Effect of EHPP on no. of branches of ‘Hetzi’ holly.
Abstract. Internodal and stem lengths of new growth and plant diameter of dwarf Japanese holly (Ilex crenata Thunb. cv. Helleri) were significantly increased by sprays of 100, 200, or 400 ppm gibberellic acid 4+7 (GA4+7). GA3 was less effective than GA4+7, but also significantly increased stem length and plant diameter. Leaf size was decreased by GA3 and GA4+7 applications.

GA3 overcomes dwarfism in a number of plant species (1, 2, 6, 8, 10). The dwarf habit of 'Helleri' holly is characterized by a more horizontal growth, shorter internodes and smaller leaves than the larger and faster growing cultivars of Ilex crenata. This holly is also one of the most widely grown species in nurseries of the Southeast. It seems feasible, therefore to use gibberellins (GAs) to accelerate growth and shorten production time of dwarf holly in the nursery.

Expt. 1. Two-year-old 'Helleri' holly plants growing in 4 liter (1 gal) plastic containers were purchased from a nursery on Dec. 1, 1973 and placed in a greenhouse maintained at 21°C (night) and 28°C (day). The plants, 20 cm wide x 15 cm high from soil level to tallest branch, were grown in a media of pine bark, soil, and peat (70:15:15 v/v) and fertilized with 6 g Osmocote 18-6-12 micronutrients (4) except that iron was initially dissolving the chemicals in 2-3 ml of solution by GA per plant. The experimental design was a randomized complete block design of 5 replicates consisting of 3 plants per replicate was used. Data were taken on Jan. 16, 1974.

Expt. 2. A second group of 'Helleri' holly plants was obtained as rooted liners, potted in 12 cm clay pots and maintained under the same greenhouse conditions described above. These plants were treated on July 5 and 19, 1974 with GA3 and GA4+7 except that 1.5 ml of solution was applied per plant equivalent to 0.15, 0.3 and 0.6 mg of GA per plant. The experimental design was the same as expt. 1. Data were taken on August 21, 1974.

Total stem and individual internodal length of new growth and plant diameter of 'Helleri' holly were significantly increased by GA4+7 applications (Table 1). GA4+7 at 100 ppm, however, did not significantly increase stem length and plant diam of the larger plants in expt. 1. GA3 was not as effective as GA4+7 in promoting growth but significantly increased stem length in both experiments and plant diam in expt. 1 (Table 1). Although internodal length was not significantly increased by GA3, some increase was observed at 200 ppm in expt. 1 and at all concn in expt. 2. The size of basal leaves on new growth branches was significantly reduced by GA3 and GA4+7 (Table 2). This response was not deleterious to the plant's appearance since only basal growth was affected. This occurred in both experiments and contrasts with increased leaf areas observed in other gibberellin treated herbaceous plants (1, 5, 7). The GA3 and GA4+7 reduction of leaf size may be attributed to a greater competition for assimilates by the rapidly extending internodes (Table 1) (1). It was observed that the effects of GAs on growth of dwarf holly persisted for approx 3 weeks.

Most studies on the effect of different gibberellins have been conducted with herbaceous plants rather than woody plants. GA4+7 has been shown to be more effective than GA3 in promoting stem growth of cucumber and lily (3, 6). This was also found with holly (Table 1). With woody plants, GA3 has been employed to accelerate the growth of dwarf apple and peach (2, 11) and forest trees (8), but no comparative study has been made with GA4+7. However, GA4 has been shown to be more effective than GA3 in promoting parthenocarpic growth of apples (10) and in conifers (9) and both GA3 and GA4+7 were equally effective in enhancing flowering.