THE EFFECT OF SEVERAL CONCENTRATIONS OF ETHEPHON ON BREAKING BUD DORMANCY IN BLACK WALNUT

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Ethephon solutions of 1,000 and 5,000 p/m completely inhibited bud break. Concentrations of 25 to 500 p/m delayed bud break in early spring and became less inhibitory as the season progressed.

Efforts to improve the rooting of black walnut (*Juglans nigra* L.) have included research on the response of cuttings to such root-promoting compounds as IBA and ethephon (2-chlorethyl phosphonic acid).

Farmer (*2*) treated cuttings from girdled and ungirdled shoots of black walnut seedlings with an 0.8 percent 113A-talc dip, and 60 percent rooted. In a study by Shreve and Miles (*3*), 76 percent of the softwood cuttings taken from adventitious shoots on mature trees rooted after having been treated with several concentrations of IBA in 95 percent ethanol.

Success with rooting cuttings from the crowns of mature black walnut trees has been reported only by Carpenter (*1*). In his study, hardwood cuttings were treated with three concentrations of ethephon (500,1,000, and 5,000 p/m) for 2, 4, 6, and 24 hours. From 60 to 70 percent of the cuttings collected in early spring and treated with 5,000 p/m ethephon rooted. Rooting success at the lower concentration (500 p/m) was enhanced by lengthening the soaking periods to 24 hours. Information regarding the effects of this compound on bud break was not reported.

Although these reports suggest that progress has been made in developing black walnut rooting techniques, none of the above procedures have been reported successful on an operational scale. Therefore, the present study was designed to further develop Carpenter's techniques by expanding the range of ethephon treatments. Additional objectives included determining whether a relationship exists between the location of buds on the stem and the speed in which dormancy is broken, and evaluating the relationship of cutting-collection time to ethephon's effectiveness.

Methods and Results

In a preliminary test, 30 dormant 15-cm cuttings from 2-year-old black walnut seedlings and from each of eleven 5-year-old clones were taken in early February 1974. The basal ends of 10 cuttings from each clone were soaked for 6 hours in the following concentrations of ethephon: (1) 1,000 p/m, (2) 1,000 p/m + 500 p/m I BA, and (3) 500 p/m IBA. Following each treatment, the cuttings were planted in pots containing a peat-perlite (1:1) rooting medium. Greenhouse air temperature was 18° to 24°C.

Observations over a 3-week period revealed that none of the cuttings broke bud or rooted. As a result of these findings, formal tests were designed:

Test I

In early March and April 1976, dormant cuttings were taken from four 7-year-old black walnut clones. The treatments consisted of soaking the basal ends for: (1) 6 hours in 5,000 p/m ethephon; (2) 24 hours in 500 p/m ethephon; (3) 6 hours in 5,000 p/m ethephon plus a quick dip in a 10,000 p/m solution of IBA in 95 percent ethanol; and (4) a quick dip in 10,000 p/m IBA (controls). The cuttings were inserted into a perlite-vermiculite rooting medium (1:1) in the greenhouse rooting bed.

Each treatment-clone combination was replicated twice with 10 cuttings per replicate (320 cuttings). Observations were made daily and data were recorded as the number of days from planting to bud break.

Ethephon, at a concentration of 5,000 p/m, completely inhibited bud break. Fifty-one percent of the controls and 11 percent of the cuttings exposed to the lower concentration (500 p/m) broke bud within 2 weeks after sticking; however, bud break was somewhat slower for the ethephon-treated cuttings. No rooting took place in any of the treatments.

The results revealed the existence of clonal variation in bud break. Of the four clones treated with a 24-hour soak in ethephon (500 p/m), 20 to 25 percent of the cuttings from two (clones) broke bud. Cuttings from the other clones either died during the test period or remained alive and dormant.

Test II

On the 3rd and 29th of March 1977, dormant 15-cm cuttings were taken from 8-year-old ramets of four black walnut clones. The fol-

lowing treatments were applied to the basal ends: (1) 6-hour soak in 5,000 p/m ethephon; (2) 24-hour soak in 500 p/m ethephon; (3) 6-hour soak in 5,000 p/m ethephon plus a quick dip in 10,000 p/m IBA; (4) a 5-second dip in 10,000 p/m
IBA, 24-hour soaks in ethephon at concentrations of (5) 100 p/m; (6) 50 p/m; (7) 25 p/m; and (8) a 24-hour soak in distilled water (controls). After each treatment, the cuttings were placed in a greenhouse rooting bed containing a perlite-vermiculite (1:1) rooting medium that had a soil temperature of 24 to 26° C. As bud break occurred, intermittent mist was provided.

Each treatment-clone combination was replicated five times with three cuttings per replicate (480 cuttings), and arranged in a randomized complete block design. In order to confound the position of buds on the stem with replication, the third replicate contained apical cuttings only. Observations were made daily and data were recorded as the number of days from planting to bud break.

As in previous tests, none of the cuttings rooted. Ethephon at a concentration of 5,000 p/m completely inhibited bud break (table 1). Cuttings treated with the lower concentrations (25 to 500 p/m) remained dormant 4 to 6 days longer than the controls and cuttings treated with IBA. In addition, apical buds broke dormancy 1 to 6 days earlier than those on subapical and basal cuttings.

Table 1.—*Effects of several concentrations of ethephon on breaking bud dormancy in black walnut. (Data presented as averages for the two collections in Test II.)*

Treatments	Avg. no. of days for cuttings to to break bud	Percentage of cuttings that broke bud[1]
1. 6-hour soak in ethephon 5,000 p/m[2]	-	-
2. 24-hour soak in ethephon 500 p/m	22	16a[3] (7-20)
3. 6-hour soak in ethephon 5,000 p/m plus a quick dip in IBA 10,000 p/m	13	14[a] (0-14)
4. 5-second dip in IBA, 10,000 p/m	14	88[c] (70-100)
5. 24-hour soak in ethephon 100 p/m	17	76[b] (70-87)
6. 24-hour soak in ethephon 50 p/m	17	76[b] (70-89)
7. 24--hour soak in ethephon 25 p/m	15	86[c] (75-100)
8. 24-hour soak in dH20 (controls)	14	100[d] (99-100)

[1]Percentages based on 60 cuttings per treatment.

[2]This treatment completely inhibited bud break.

[3]Letters denote which treatment means differed significantly.

A 24-hour soak in ethephon at 25 p/m exerted the least inhibitory effect on bud break.

Statistically, there was no significant interaction between the ethephon treatments and time of collection. However, the percentage of ethephon-treated cuttings that broke bud within the first 2 weeks after planting increased from 29 percent for the early March collection to 47 percent for the March 29 collection. This suggests that the treatments were generally less effective in bud inhibition as the time of natural bud break approached.

Carpenter also found that the stimulation of rooting by ethephon decreased with collection time. As the time of bud break approached, rooting percentages decreased from 60 percent in early March to 10 percent 6 weeks later.

However, in contrast to Carpenter's results, our findings confirm previous observations that ethephon, at the concentrations tested, does not stimulate rooting in black walnut and does inhibit bud break.

(Literature Cited on p. 15)

Literature Cited

1. Carpenter, Stanley B.
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