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Ancymidol Rates and Application Timing Influence Asparagus Transplant Growth

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Abstract. **Single applications of ancymidol at 0.03, 0.12, 0.50, or 1.0 mg/plant were soil applied to asparagus seedlings (*Asparagus officinalis* L.) 3.5, 5.5, or 7.5 weeks after seeding. Increasing ancymidol rates from 0.03 to 1.0 mg/plant decreased bud number, fern dry weight, but not shoot number at all application times. When ancymidol was applied at 1.0 mg/plant at 3.5 weeks it reduced fleshy root production, but in plants treated at 5.5 to 7.5 weeks, it did not reduce fleshy root production. Increasing ancymidol rates from 0.03 to 1.0 mg/plant reduced the crown dry weight of plants 5.5 weeks and younger. Ancymidol from 0.03 to 1.0 mg/plant applied to 3.5-week-old plants increased the partitioning of dry matter into fern rather than crowns, but delaying application to 7.5 weeks after seeding reversed this relationship suggesting increased carbohydrate storage. Application of ancymidol from 0.03 to 1.0 mg/plant to plants 5.5-weeks-old or younger was considered detrimental to plant growth. Ancymidol at 0.50 mg/plant or less applied to 7.5-week-old plants enhanced the production of a stocky, compact transplant. Chemicals used. Ancymidol: α-cycloprophyl-α-(4-methoxyphenyl)-5-pyrimidinemethanol.**

Establishing new asparagus acreage with 10- to 12-week-old transplants is becoming more popular than traditional crown planting, but the use of transplants has some inherent problems. The fern often becomes tangled and damaged in machinery during transplanting, and, subsequently, the fern may die, reducing the growth potential of the plants during the 1st growing season. Such problems have changed plant characteristics considered most desirable in the production of asparagus transplants. We hypothesized that a transplant with stocky, compact fern and a vigorous root system might tolerate these stresses.

Growth retardants have the potential to alter plant characteristics. Growth retardants may inhibit cell division and elongation of the subapical meristems, reducing internode length, thereby producing compact plants (3). They have increased drought tolerance (8) and delayed senescence (7) in various plants, indicating a potential to decrease transplant shock. Several growth retardants change assimilate partitioning in roots and shoots (5, 6, 9), increase storage root to shoot ratios (2, 11), and reduce competition in high density populations (10). However, the use of growth retardants on vegetable crops is confounded by differential genotypic responses (8). Ancymidol has been reported to promote the growth of asparagus roots and shoots in tissue culture (4), but its effect on asparagus transplant shoot and crown growth is unknown. Therefore, the objective of this study was to determine the influence of ancymidol rate and application timing on asparagus transplant growth.

Plastic containers (5.5 cm deep and 163 cm^3) were filled uniformly with a mixture, by volume, of 1.5 vermiculite : 1.5 perlite : 7 peat media (pH 6.7). 'Green Giant Select' asparagus seeds were germinated in the dark for 5 days at 25°C, and then one seed was planted 1 cm deep in each container. Seedlings were fertilized with a solution of 370 mg N, 185 mg P, and 370 mg K/liter of H_20 every 10 days beginning 3 weeks after seeding. Micronutrients were applied once 6 weeks after seeding, using 600 ppm (formulation) of Peter's Soluble Trace Element Mixture (W.R. Grace and Co., Allentown, Pa.) (S = 15%, B = 1.45%, Cu = 3.2%, Fe = 7.5%, Mn = 8.2%, Mo = .046%, Zn =

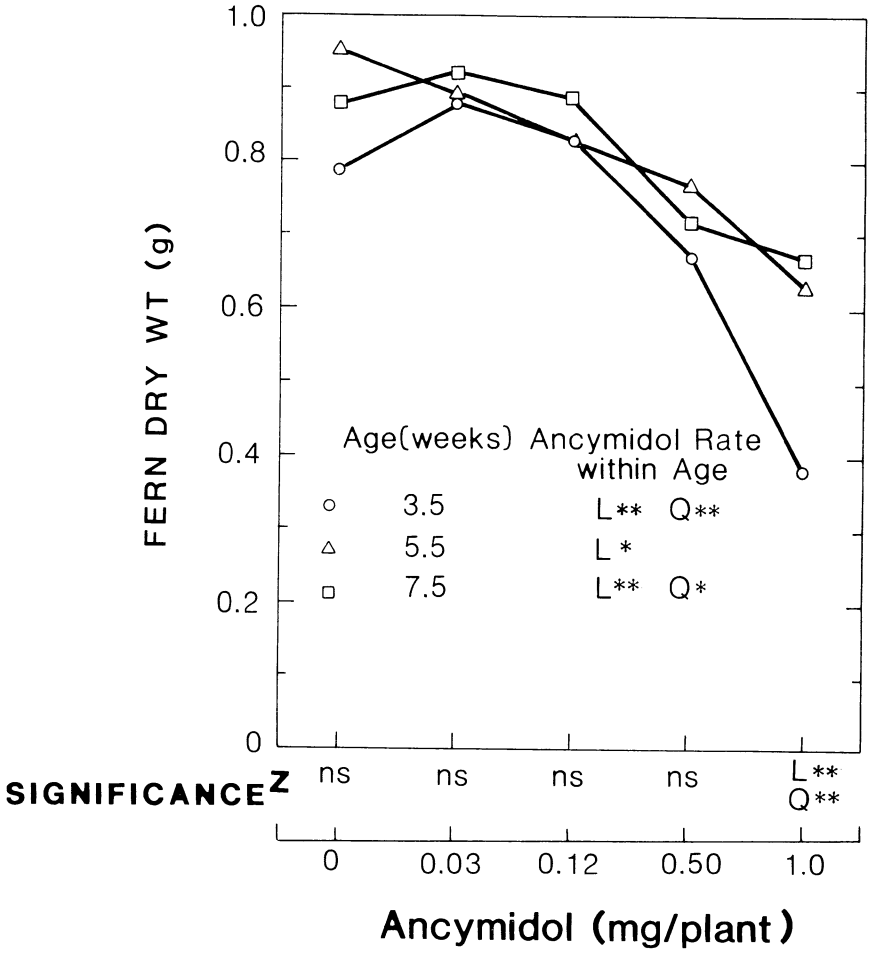

Fig. 1. Influence of ancymidol rate and application timing on fern dry weight accumulation. Linear (L) and quadratic (Q), nonsignificant (NS) or significant at the 5% (*) or 1% (**) level. [z]Indicates significance of transplant age within ancymidol rate.

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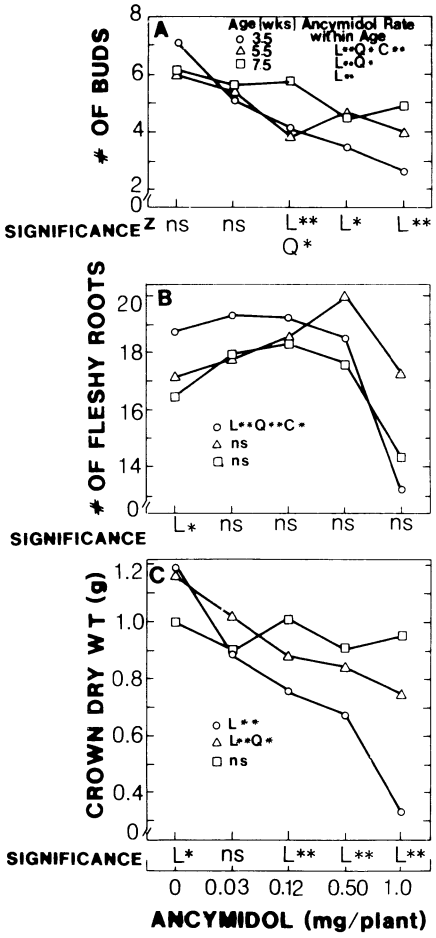

Fig. 2. Influence of ancymidol rate and application timing on (**A**) bud number, (**B**) fleshy root number, and (**C**) crown dry weight of 10-week-old asparagus transplants. Linear (L), quadratic (Q), and cubic (C) nonsignificant (NS) or significant at the 5% (*) or 1% (**) level. [z]Indicates significance of transplant age within ancymidol rate.

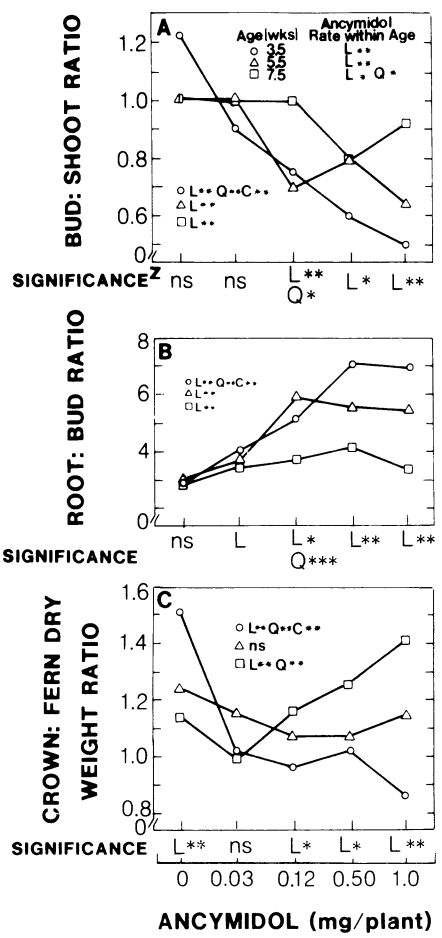

Fig. 3. Influence of ancymidol rate and application timing on the (**A**) bud:shoot ratio, (**B**) root:bud ratio, and (**C**) crown:fern dry weight ratio of 10-week-old asparagus transplants. Linear (L), quadratic (Q), and cubic (C) nonsignificant (NS) or significant at the 5% (*) or 1% (**) level. [z]Indicates significance of transplant age within ancymidol rate.

4.5%). Nutrient solutions were applied to each container until runoff.

Ancymidol (Elanco Products Co., Indianapolis, Ind.) was applied at 0.03, 0.12, 0.50, and 1.0 mg/plant (container) as a soil drench, at 3 developmental stages: 3.5, 5.5, and 7.5 weeks after seeding. The factorial experiment was arranged in a split plot design with ancymidol rate as the main plot, and application timing as the subplot. Each treatment included 6 plants and was replicated 5 times. The plants were grown in a greenhouse with about 24°/18°C ± 3° (day/night) temperatures from July through mid-September. The experiment was terminated 10 weeks after seeding, and the number of shoots, buds, and fleshy roots were counted and fern and crown fresh and dry weights were measured. In this study, a "crown" included rhizome, buds, and fleshy and fibrous roots; "fern" included cladophylls and stems.

Ancymidol rates affected asparagus fern dry weight production differently depending on the stage of development at which application occurred. Ancymidol rates of 0.50 mg/plant or higher, applied either 3.5 or 7.5 weeks after seeding, decreased fern dry weight (Fig. 1). Ancymidol at 0.03 to 1.0 mg/plant applied to 5.5-week-old plants decreased fern dry weight linearly. Young plants were more sensitive to ancymidol than older plants. Ancymidol at 1.0 mg/plant applied to 3.5-week-old plants decreased fern dry weight more than application to plants treated at 5.5 to 7.5 weeks. Since the number of shoots produced was unaffected by rates or application timing (data not shown), ancymidol affected only fern biomass accumulation at the rates evaluated. As ancymidol rates increased, the fern appeared shorter and darker green with larger shoot diameters suggesting the ancymidol enhanced the production of stocky, compact plants.

The effect of ancymidol on bud production differed with rate and timing of application. Ancymidol applied from 0.03 to 1.0 mg/plant to plants 3.5- to 5.5-weeks-old, decreased curvilinearly the number of buds (Fig. 2a). However, bud production decreased linearly as ancymidol rate increased from 0.03 to 1.0 mg/plant when applied to 7.5-week-old plants. The number of buds produced decreased linearly when ancymidol at 1.0 mg/plant was applied at earlier stages of development, further indicating that young plants were more sensitive to high ancymidol rates than older plants.

Although ancymidol decreased bud number, visual observations of these crowns indicated that bud size increased with rate. Ancymidol applied from 0.03 to 1.0 mg/plant to plants 3.5- to 5.5-weeks-old linearly decreased the ratio of buds to shoots (Fig. 3a). This effect was curvilinear for plants treated at 7.5 weeks. Thus, these few large buds subsequently produced shoots of apparently increased girth. Blasburg (1) reported that bud size is correlated highly with subsequent spear size in seedlings.

Ancymidol did not significantly affect fleshy root production of plants 5.5-weeks-old or older, but ancymidol at 1.0 mg/plant, applied to 3.5-week-old plants, reduced fleshy root production (Fig. 2b). Visual examination of these young plants treated with 1.0 mg/plant revealed considerable root necrosis, indicating the unsuitability of this rate. The number of fleshy roots increased, relative to buds, as ancymidol rates increased from 0.03 to 1.0 mg/plant at all application times. This effect was more pronounced if higher ancymidol rates were applied at an early stage of development. The ratio of roots to buds decreased linearly as ancymidol applications of 0.50 mg/plant or higher were delayed to progressively older seedlings (Fig. 3b). A possible benefit of increasing the root to bud ratio would be to increase the availability of root carbohydrates needed for bud growth and shoot expansion.

Ancymidol rate and timing of application affected crown dry weight accumulation. Ancymidol, applied from 0.03 to 1.0 mg/plant to 3.5- to 5.5-weeks-old plants, reduced crown dry weight (Fig. 2c). Delaying application to 7.5 weeks, however, had no effect. Significant reductions in crown dry weight are unacceptable, since large crowns have better growth and yield potential than small crowns.

The crown to fern ratios (dry weight basis) indicate the relative rates of biomass partitioning between crowns and ferns. Crown to fern ratios decreased curvilinearly for 3.5-week-old plants treated with ancymidol rates increasing from 0.03 to 1.0 mg/plant, indicating increased fern to crown dry matter accumulation (Fig. 3c). Yet, ancymidol applied to 5.5-week-old plants had no effect on dry matter partitioning. Conversely, ancymidol, applied at 0.03 to 1.0 mg/plant to 7.5-week-old plants, increased crown relative to fern dry weight. These alterations in partitioning cannot be accounted for by changes in actual numbers of roots or shoots produced, since root to shoot ratios were not affected significantly by ancymidol (data not shown). The enhancement of crown rather than fern dry matter accumulation in plants treated with ancymidol at 7.5 weeks suggested increased availability of storage carbohydrates in the crowns.

The response of asparagus plants to ancymidol outlined in this study suggested that these techniques have some potential for increasing the stockiness and compactness of

transplants. Ancymidol at 1.0 mg/plant generally seemed to damage fleshy roots thereby reducing crown dry weight, especially if applied on young plants. Application of ancymidol to plants younger than 5.5-weeks-old generally caused greater retardation of growth than application to older transplants. The enhancement of dry matter in crowns rather than fern in plants treated at 7.5 weeks may be beneficial in withstanding the stresses of transplanting. However, rates lower than 1.0 mg/plant applied to 7.5-week-old plants should be field-tested to determine the effect of ancymidol on improving tolerance to mechanical damage, and improving growth and stand establishment.

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Refrigerated Storage Influence on Sweet Potato Transplant Viability and Root Yield

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Abstract. **'Jewel' sweet potato transplants were held in refrigerated storage at 4.4°, 8.9°, 13.3°, 17.8°, or 26.7° C for 7 or 14 days before planting. Some treatments received a fungicide dip before storage. Maximum plant survivability and root yield were obtained from transplants held for 7 days at 13° to 18°. Ambient storage (26.7°) greatly reduced transplant survivability. Fungicide treatment had no influence on plant stand.**

Sweet potato growers often are confronted with weather conditions, plant bed productivity, or labor problems that require them to hold large volumes of transplants under storage conditions for a number of days before planting in the field. Limited information is available on holding conditions for sweet potato transplants. Hammett (1) held 'Jasper' vine cuttings for up to 4 days under an equipment shed (20.6° to 35°C) with thorough watering 2 times a day. The length of the holding period had no influence on the percentage of survival in the field, but this result could be confounded by the fact that the test received 2.3 cm of rain less than 4 hr after formation is available on refrigerated storage of sweet potato transplants.

The objectives of this study were to investigate the influence of fungicide dips, refrigerated storage temperatures, and length of storage time on plant survivability in the field and shape and yield of marketable roots.

'Jewel' sweet potato transplants were purchased from a commercial producer 3 times during the study, based on refrigerated storage time. One box (1000 transplants) was used as the handling unit for each treatment combination. Transplants were in storage for 14, 7, or 0 days at 4.4°, 8.9°, 13.3°, 17.8°C, or ambient temperature. Ambient temperature was outside storage under a 2-sided pole building. The ambient temperature ranged from 18.3° to 32.2° with the relative humidity ranging from 50% to 95%; mean 26.7°. All refrigeration rooms were at 85% to 90% RH. Half of the transplants had the root ends dipped 15 cm into a solution of 100 ppm Cl^- and 1.27% Botran 75 W (2, 6-dichloro-4-nitroaniline) for 60 sec and drained before placing at the treatment temperature. The other half of the transplants were not dipped.

All treatment combinations were planted 20 June 1983 at the Horticultural Crops Research design with 6 replications. Plots 6.1 m in length consisted of 2 rows spaced 1.1 m apart. Plants were spaced 0.3 m within the row. Each tier of treatments was separated by a 1.5 m unplanted buffer area. A normal commercial fertilizer program was maintained on the Orangeburg loamy sand soils (2).

Stand count was conducted 27 July 1983 (38 days from transplanting). All plots were harvested on 18 Oct. 1983 (120 days from transplanting) and graded into U.S. No. 1, canner, jumbo, and cull grades before weights were determined.

The 2 control treatments (transplants removed from seed beds and planted within 3 hr, fungicide dip and nontreated) were deleted from the treatment combinations and the remaining treatment combinations formed a 2 fungicide treatment by 2 storage time by 5 storage temperature factorial. The fungicide dip treatment did not influence survivability of the transplants or yield of U.S. No. 1, canner, or cull sweet potato roots. Storage time and temperature did influence these variables. Jumbo roots and total marketable yield were influenced by the 3-way interaction; fungicide dip, storage time, and storage temperature.

Since there were some 3-way interactions present, the data were grouped by fungicide dip treatment and analyzed using a one-tailed Dunnett's test, comparing the control against the other treatments within each fungicide treatment (Table 1). With both fungicide treatments, plant stand of the control treatments (no storage, direct transplant) was comparable to the survivability of those transplants stored 7 days at either 8.9°, 13.3°, or 17.8°C. Storage of the transplants for 7 days at 4.4° or ambient temperature (26.7°) greatly reduced survivability as did all treatment combinations held for 14 days storage.

Response of root yield to the treatment combinations analyzed by the Dunnett's test was similar to the response of plant stand. U.S. No. 1, jumbo, canner, and marketable root yields were similar, in that the control treatments were comparable to the yield from transplants stored 7 days at 13.3° or 17.8.°C.

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