PHYTOTOXICITY AND GROWTH REGULATION OF ROOTED CHRYSANTHEMUM CUTTINGS FROM INSECTICIDAL DIPS

Michelle Bell
Departments of Entomology and Horticultural Science, NCSU

This information was presented, in part, as a poster at the Southeast Greenhouse Conference and Trade Show in Greenville, SC on June 16-19, 1994.

Summary. Rooted cuttings of 'Sunny Mandalay' chrysanthemums were dipped in six insecticide emulsions for various durations. From the time of application through the duration of the experiment, tissues of all plants treated with 2% horticultural oil appeared oil-soaked. One week after treatment, plants dipped in 2% oil exhibited the most severe phytotoxicity; symptoms were greater with increasing dip duration. Minor tip and marginal leaf burn appeared on plants dipped in Margosan-O (azadirachtin) for 4 hours. At weeks two, four and seven, insecticide effects on plant growth were determined. The 10-second oil dip stunted growth and pinched some cuttings. Oil dips of 1 and 15 minutes resulted in stunting, pinching and death. Oil dips of 1 and 4 hours were lethal to all cuttings treated with these two combinations. Dips of Enstar II (kinoprene) for 4 hours and Margosan-O for 1 and 4 hours chemically pinched apical meristems resulting in multiple shoot growth.

The use of pest-free propagative material in any crop is a basic pest management procedure. Unfortunately, insecticide resistance among such major pests as the melon aphid, western flower thrips and silverleaf whitefly makes production of insect-free stock plants difficult. Chrysanthemum cuttings purchased from even the most conscientious propagators may arrive infested. Upon arrival, material should be quarantined and inspected. If pests are found on a shipment, it is best to send it back to the propagator. If, however, the cuttings must be stuck, dipping the cuttings in insecticide solutions may be an option. A pesticide dip ensures total coverage compared to spray applications. However, dipping young, actively growing plants places more active and "inert" ingredients at the site of meristematic tissue. This study investigates potential phytotoxicity and growth regulating activity of insecticides used as dips for cuttings and is part of a larger effort to use moderately effective pesticides in suppressing highly resistant pests by prolonging pest exposure to the wet pesticide.

On January 11, rooted cuttings of 'Sunny Mandalay' chrysanthemums were either treated

Table 1. Trade namess, chemical names and rates for products used as insecticidal dips.

M-Pede	insecticidal soap	5 Tbs/gal (1%)
SunSpray	Ultra-fine spray oil	5 Tbs/gal (2%)
Mavrik Aquaflow	fluvalinate	1/4 tsp/gal
Joust	oxythioquinox	1/2 tsp/gal
EnstarII	kinoprene	5/8 tsp/gal
Margosan-O	azadirachtin	5 tsp/gal

with a dip or left untreated. Six insecticides, chosen for their stated efficacy against aphids, thrips and/or whiteflies, plus a water control were used as dips. Table 1 lists the insecticides and rates used.

Dip rates were based on rates recommended for spray applications, except Mavrik, which is labeled as a dip. It should be noted that Joust is not labeled for use inside the greenhouse. With Joust, cuttings may be treated outside and then brought inside the greenhouse for planting.

Plant stems and foliage were submerged in dip solutions with roots exposed. Five dip durations were used: 10 seconds, 1 minute, 15 minutes, 1 hour or 4 hours. During treatment, air temperatures and dip solution temperatures ranged from 68 to 72 °F (20 to 22 °C). After treatment, cuttings were potted and arranged on the greenhouse bench in a randomized complete block design using five blocks with one experimental unit per block. Artificial long days were maintained for two weeks followed by natural short days. One week after treatment, plants were rated for phytotoxicity using a scale of 1 (no symptoms) to 9 (severe symptoms). Heights were measured on the unpinched plants at two, four and seven weeks after treatment to determine whether any insecticide treatment or insecticide/dip duration combination had growth regulating effects. Height data for weeks two and four only are presented (since weeks four and seven data are similar). Data were analyzed using analysis of variance (ANOVA) and means separated using least significant difference (LSD).

Phytotoxicity. Plants with varying degrees of wilting, chlorosis and necrosis were given ratings of "2" through "9". Plants with oil-soaked tissues were given a phytotoxicity rating of "3". A rating of 3 or greater was considered commercially unacceptable. Cuttings dipped in soap for 4 hours, in Margosan-O for 4 hours, and in oil for all durations tested showed significant phytotoxicity compared to undipped and water-dipped cuttings (Figure 1). Phytotoxicity symptoms common to plants treated with soap for 4 hours included "rabbit tracks" (repeating interveinal necrosis) and minor marginal necrosis. Plants treated with Margosan-O for 4 hours commonly exhibited minor marginal and leaf tip necrosis. All plants treated with oil, regardless of dip duration, had oil-soaked tissues. One week after treatment, only the oil dips resulted in commercially unacceptable phytotoxicity (Fig. 1). By the fourth week after treatment, all plants treated with oil for 1 and 4 hours had died. By week seven, half of the plants treated with oil for 1 and 15 minutes had died.

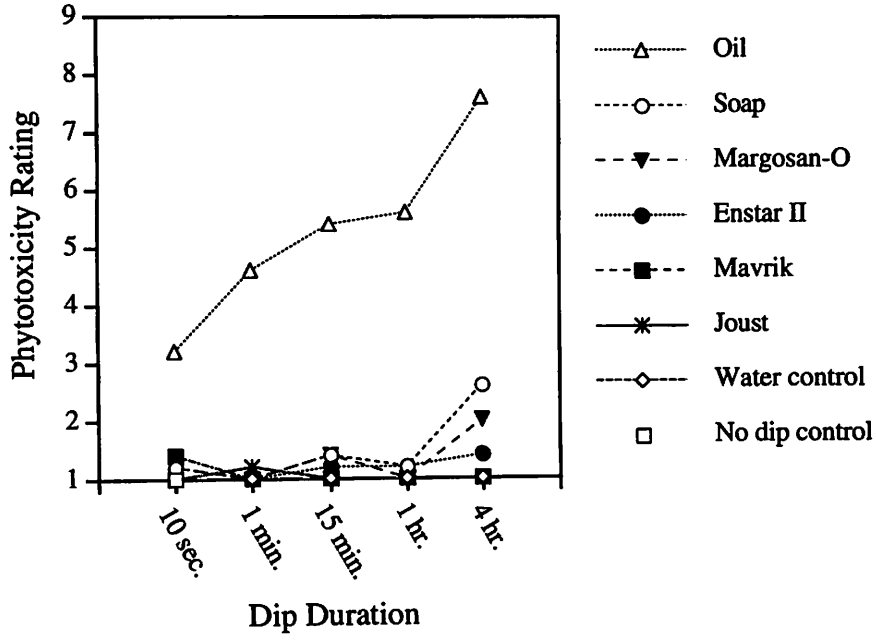

Figure 1. Phytotoxicity ratings one week after treatment (average rating for 5 cuttings). Ratings are 1 (no damage) to 9 (severe symptoms).

Plant Growth Regulation. Cuttings dipped in oil for all durations tested, in Enstar II for 4 hours, and in Margosan-O for 1 and 4 hours grew significantly less than undipped and water-dipped cuttings (Figure 2). Some oil-dipped cuttings became shrunken and withered before dying thus

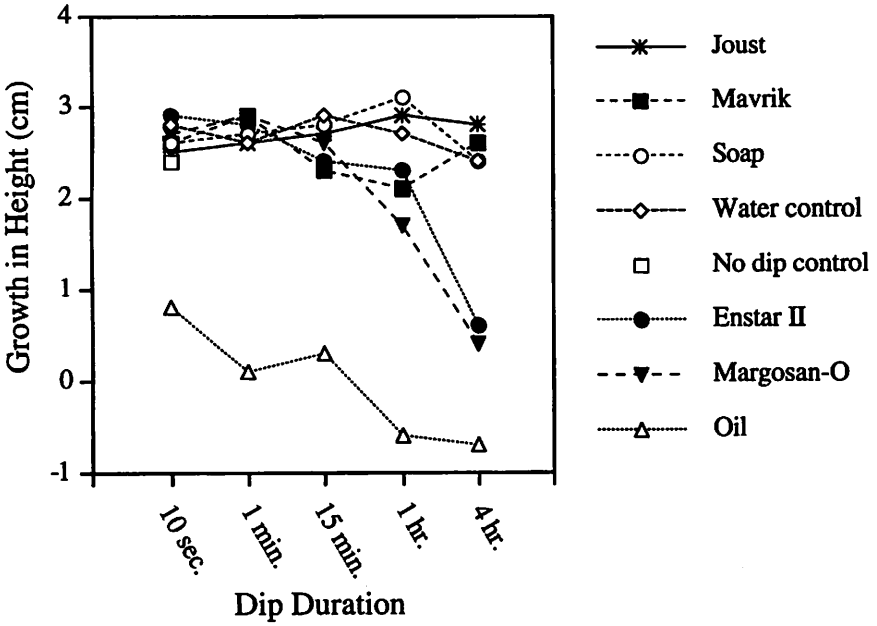

Figure 2. Average increase in height two weeks after treatment (average increase for 5 cuttings).

explaining the negative growth. Four weeks (Figure 3) and seven weeks (data not shown) after treatment, cuttings dipped in Enstar II for 4 hours, in Margosan-O for 1 and 4 hours, and all remaining cuttings dipped in oil grew less than the undipped cuttings. Of the oil-treated plants that had not died by week seven, all were greatly stunted and some appeared pinched due to damage to the apical meristem. The apparent growth stunt by the Enstar II dip for 4 hours and Margosan-O dips for 1 and 4 hours resulted from a chemical pinch of the apical meristem at the time of treatment. As a result, plants in these treatments had multiple shoots.

Results of this study indicate that chrysanthemum cuttings should not be dipped in a 2% solution (a recommended spray concentration) of horticultural oil. Ingredients in formulations of Enstar II and Margosan-O may kill chrysanthemum apical meristems if cuttings are left in a dip solution for 1 hour or more. Neither soap, Mavrik nor Joust, used at the rates listed above, has any negative effects on growth of chrysanthemum cuttings even when left in a dipping solution up to 4 hours.

Future studies will focus on the effects of dipping cuttings of poinsettia, a crop on which whitefly infestation during stock production is a common and often serious problem. Furthermore, efficacy of insecticidal dips on the different life stages (egg, nymph, "pupa," adult) of silverleaf whitefly will be determined.

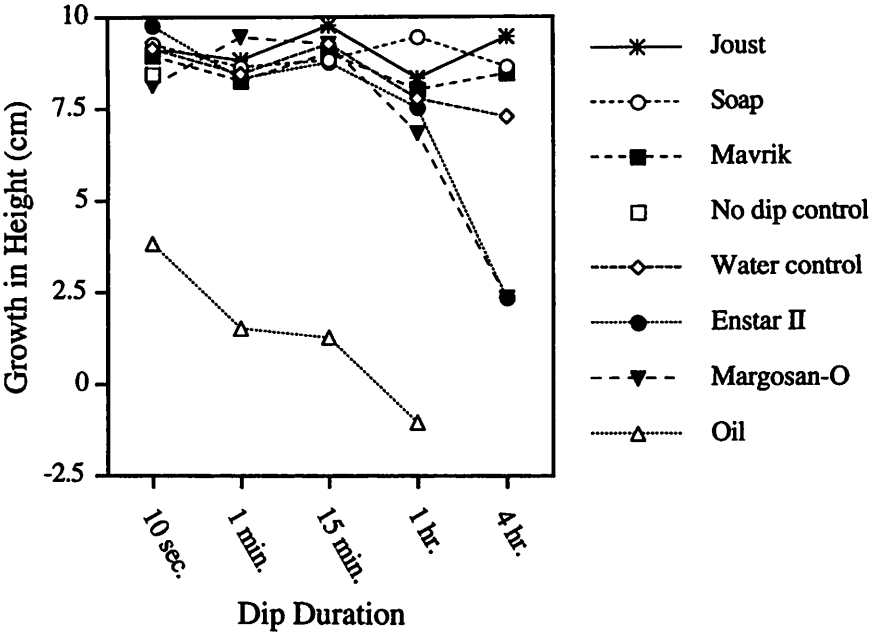

Figure 3. Average increase in height four weeks after treatment (average increase for 5 cuttings).