Increasing Tuberous Root Production in *Dahlia pinnata* Cav. with SADH and Chlormequat

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Abstract. Foliar sprays of succinic acid-2,2-dimethylhydrazide (SADH) at 2500 ppm and (2-chloroethyl)trimethylammonium chloride (chlormequat) at 1500 ppm increased no. and size of tuberous roots of dahlias under short-day conditions. Root wt were frequently tripled, both in cultivars which normally form tuberous roots readily, and those which generally form slender, poor-quality roots. Plants grown from roots of treated plants were of excellent size, color, and quality. Similar treatments under long-day conditions caused formation of tuberous roots where untreated cuttings produced only fibrous roots.

According to Zimmerman and Hitchcock (7) and others (3, 5), the formation of tuberous roots by dahlias occurs as a response to short days. Charles Crittendon (unpublished), using small flowered dahlia seedlings, found an increase in formation of tuberous roots as a result of SADH sprays applied during long-day periods, but reduction in root no. and growth with chlormequat. Here we report the response of vegetatively propagated large-flowering dahlias to foliar applications of SADH and chlormequat.

**Long-day (LD) & short-day (SD) experiment.** Uniform, 15 cm rooted cuttings of the cultivar 'Nita' were maintained under LD conditions with 4-hr night interruption, using 150-watt incandescent bulbs 76 cm above the plants. Plants were grown in 15 cm pots containing peatlite mix fertilized weekly with 12% solution of 20-8.6-16.6 (N-P-K) (commercial formulation containing micronutrients). Treatments included foliar sprays of SADH at 2500 and 5000 ppm, as well as chlormequat at 2360 ppm. Treatments were applied 23 days after potting with an additional repeat application at 37 days with SADH at 2500 ppm. Nontreated plants were maintained as controls. There were 5 plants per treatment with 4 replications. Plants were removed from the pots after 55 days, the roots washed and checked for the presence of tuberous roots. The plants were repotted and placed in the greenhouse under natural (12½ hr) day lengths on Dec. 31. Harvest of the tuberous roots was made 41 days later.

Only slight growth retardation was observed during the early part of the growing period, along with slightly darker green color. The plants appeared to outgrow these effects and at harvest time no vegetative differences were observed. Flowering occurred uniformly with all treatments, except that a slight lessening of pigment intensity was observed in the ray florets of chlormequat treated plants.

When the plants were removed from the LD conditions, no fleshy roots were observed on the control plants. However, small tuberous roots were present on all replications of both 2500 ppm SADH treatments, on 75% of the chlormequat treatment, and on half of the 5000 ppm SADH treatments.

The yield of tuberous roots harvested after 41 days treatment was increased considerably by the chlormequat (2360 ppm) treatment and more so with 2500 ppm SADH applied once or twice, while 5000 ppm treatments did not provide such striking differences (Fig. 1). Apparently the single 2500 ppm SADH treatment applied 23 days after potting was responsible for the increase in tuberous root production in both 2500 ppm treatments, since the yield increase with 2 sprays was essentially the same as that produced by 1 spray of 2500 ppm. The largest roots were found in those treatments in which tuberous roots were initiated under long-day conditions. It would appear that the growth retardants were able to alter the plants' tuberous root responses to photoperiodic stimuli.

**Short-day (SD) experiments.** The effects of SADH under SD tuberizing conditions were determined with 2 large flowered cultivars, 'Celebrity' which forms fleshy roots readily, and 'Joe Davis' which makes very few tuberous roots and which are usually spindly, and of poor keeping quality. Rooted cuttings were planted in 15 cm pots, on Sept. 14, (9½ hr natural daylength) and treated 1 month later with foliar sprays of 2500 and 5000 ppm SADH. There were 2 plants per treatment replicated 4 times. The tuberous roots of 'Celebrity' were harvested 75 days after potting, and those of 'Joe Davis' were harvested at 90 days. Roots with a diam of 2 mm or more were arbitrarily termed...
"tuberous." All fibrous roots, stems and leaves were removed to obtain crown and tuberous root wt.

To determine if SADH treated roots sprout as readily as nontreated roots, and if the resulting plants were of acceptable quality, 'Celebrity' roots the day after harvest were stored in polyethylene bags containing horticultural vermiculite in a cold storage room maintained at 3.3°C ± 1°C for 3 months. After all buds were observed prior to bedding, both SADH treatments, LSD 5% and LSD 1% resulted roots were planted in flats for 3 months. After all buds were recorded roots were planted in flats containing vermiculite for observation.

A definite increase in tuberous root size and no. resulted from treatment with SADH, under day-length conditions considered optimum for inducing the formation of tuberous roots (Table 1, Fig. 2). The resulting wt increase results from the combined effects of an increase in root no. and size. Stem and leaf size were not noticeably affected by these treatments and flowering was normal.

When stored roots of 'Celebrity' were observed prior to bedding, both SADH treatments averaged 7.7 buds per crown, while the control treatments averaged just over 2. The treated crowns produced an avg of 3 healthy plants per crown while the nontreated crowns failed to produce a single plant, probably because of insufficient reserve carbohydrate. Crowns of nontreated plants normally produce good plants, however, under the short duration of root-forming conditions of this experiment, insufficient carbohydrates were stored by nontreated plants, while treated plants stored quantities adequate for development of high-quality plants.

The formation of thick tuberous roots on the cultivar 'Joe Davis', which normally forms few and poor quality tuberous roots, offers a definite advantage for commercial producers of dahlia pot-roots. With SADH treatments, it should be possible to produce better quality pot-roots, and more of them, especially with cultivars which normally are very difficult to propagate in this manner. In addition, it appears practicable to obtain increased yields with the more easily propagated varieties.

This same response has been observed under conditions with several cultivars which form tuberous roots readily ('Nita', 'Arthur Godfrey', and 'Tartan'), and with cultivars which form tuberous roots with great difficulty ('Roben's Superior', 'Sei Ki').

Long-day (LD) experiments. Rooted cuttings of 'Arthur Godfrey' (which forms tuberous roots readily) were placed under long-day conditions and treated with SADH at 2500 and 5000 ppm and chlormequat (1000 and 2500 ppm). Treatments were applied 9 days after potting with an additional repeat application after 23 days with SADH at 2500 ppm. There were 5 plants per treatment. The roots were harvested 79 days after potting.

Although the treatment differences for the LD experiment utilizing 'Arthur Godfrey' were not statistically significant, the trend toward increased root diam and wt is evident (Table 2). This concurs with recent work by Moser and Hess (2). The fact that nontreated plants also produced tuberous roots under these conditions suggests the possibility that the day length (night interruption) was not sufficient in duration and/or intensity to provide non-inductive conditions. It is also possible that photoperiodic stimulation of tuberous root production is not a simple direct response to day length, but rather a result of a combination of physiological effects resulting from the growing conditions characteristic of short day lengths. This merits further study.