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Research Reports

Cutting Propagation and Container Production of 'Flora Sun' Beach Sunflower[1]

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Abstract

Helianthus debilis Nutt. ssp. *debilis* 'Flora Sun', 'Flora Sun' beach sunflower, is a native, herbaceous perennial that should be propagated by cuttings to maintain its genetic and phenotypic fidelity. Stem cuttings were treated with a quick dip of a potassium salt of 1*H*-indole-3-butyric acid (K-IBA) solution at 0, 250, 500, 1000, 1500, 2000, 2500, or 3000 mg/liter (ppm) and rooted under intermittent mist. The root systems of six of twelve cuttings were harvested 17 and 21 days after treatment. The remaining six cuttings were transplanted in a soilless substrate to determine the effects of K-IBA on establishment in containers. Treatment of stem cuttings with K-IBA increased the number of roots and root fresh weight when cuttings were rooted under summer greenhouse conditions, but K-IBA did not provide any substantial short-term benefits in survival or growth of rooted cuttings after they were transplanted into plastic containers.

Index words: cucumberleaf sunflower, dune sunflower, groundcover, native plant, stem cuttings.

Species used in this study: 'Flora Sun' beach sunflower (*Helianthus debilis* Nutt. ssp. *debilis* 'Flora Sun').

Plant growth regulator used in this study: potassium salt of IBA (K-IBA), K^+-1*H*-indole-3-butyric acid.

Significance to the Nursery Industry

Under summer conditions in Florida, 'Flora Sun' beach sunflower can be successfully rooted by stem cuttings and later established in containers without the use of K-IBA, and hence, probably without the use of other rooting compounds. While treatment of stem cuttings with up to 2000 mg K-IBA/liter (ppm) improved root initiation, treatment with K-IBA did not improve survival or growth of rooted plants during container production.

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Introduction

Helianthus debilis ssp. *debilis* Nutt. 'Flora Sun', 'Flora Sun' beach sunflower, is a native, herbaceous perennial that was released by the U.S. Dept. of Agric., Natural Resources Conservation Service's Plant Materials Center in Brooksville, FL (1). This mounding groundcover (0.6 to 0.9 m [2 to 3 ft] high × 1.5 m [5 ft] wide) has deep green leaves with showy yellow flowers that appear from March through November in Florida. 'Flora Sun' beach sunflower is a salt tolerant ornamental that thrives under xeric conditions, can be used in poorer soils, and is relatively insect and disease free (1). It is best adapted to the immediate Gulf Coast from Florida to Texas, and along the Atlantic coast as far north as the extreme southern coast of South Carolina (1). This area is within USDA Hardiness Zones 8b–10b (AHS Heat Zones 8–12). Further inland it should be treated as an annual that may reseed (especially in nonmulched situations) or as a tender

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perennial (1). This cultivar should not be used along the central peninsular gulf coast of Florida to avoid crossing with the endangered species *Helianthus debilis* Nutt. ssp. *vestitus* (E. Watson) Heiser (2). 'Flora Sun' beach sunflower can be used for dune stabilization, wind erosion protection, aesthetics, and a food source for wildlife (1, 2).

'Flora Sun' beach sunflower should be propagated by cuttings to maintain its genetic and phenotypic fidelity (1), especially since plant form can vary considerable within *Helianthus* species (3). However, there is no published protocol for cutting propagation of 'Flora Sun' beach sunflower. Phillips (5) recommends a well-drained medium and periodic misting of *Helianthus tomentosum* Michx. stem cuttings, but no mention is made of using a rooting compound.

The objective of this study was to determine whether the potassium salt of indolebutyric acid could enhance rooting of 'Flora Sun' beach sunflower stem cuttings and subsequent establishment in containers.

Materials and Methods

The original plants, from which 'Flora Sun' beach sunflower was selected, were propagated from seed collected in Jensen Beach, Martin County, Florida in 1977 and maintained by vegetative propagation by the Soil Conservation Service—Plant Materials Center (PMC) at Brooksville, FL (1). In 1997, 'Flora Sun' plants were obtained from the PMC. On June 23, 1998, 10 cm (3.9 in) sub-terminal cuttings of *Helianthus debilis* ssp. *debilis* 'Flora Sun' were trimmed to two distal leaves and the basal 1.5 cm (0.6 in) was dipped (3 sec) into one of eight potassium salt of 1*H*-indole-3-butyric acid (K-IBA, Sigma Co., St. Louis, MO) aqueous solutions. K-IBA treatments were: 0, 250, 500, 1000, 1500, 2000, 2500, and

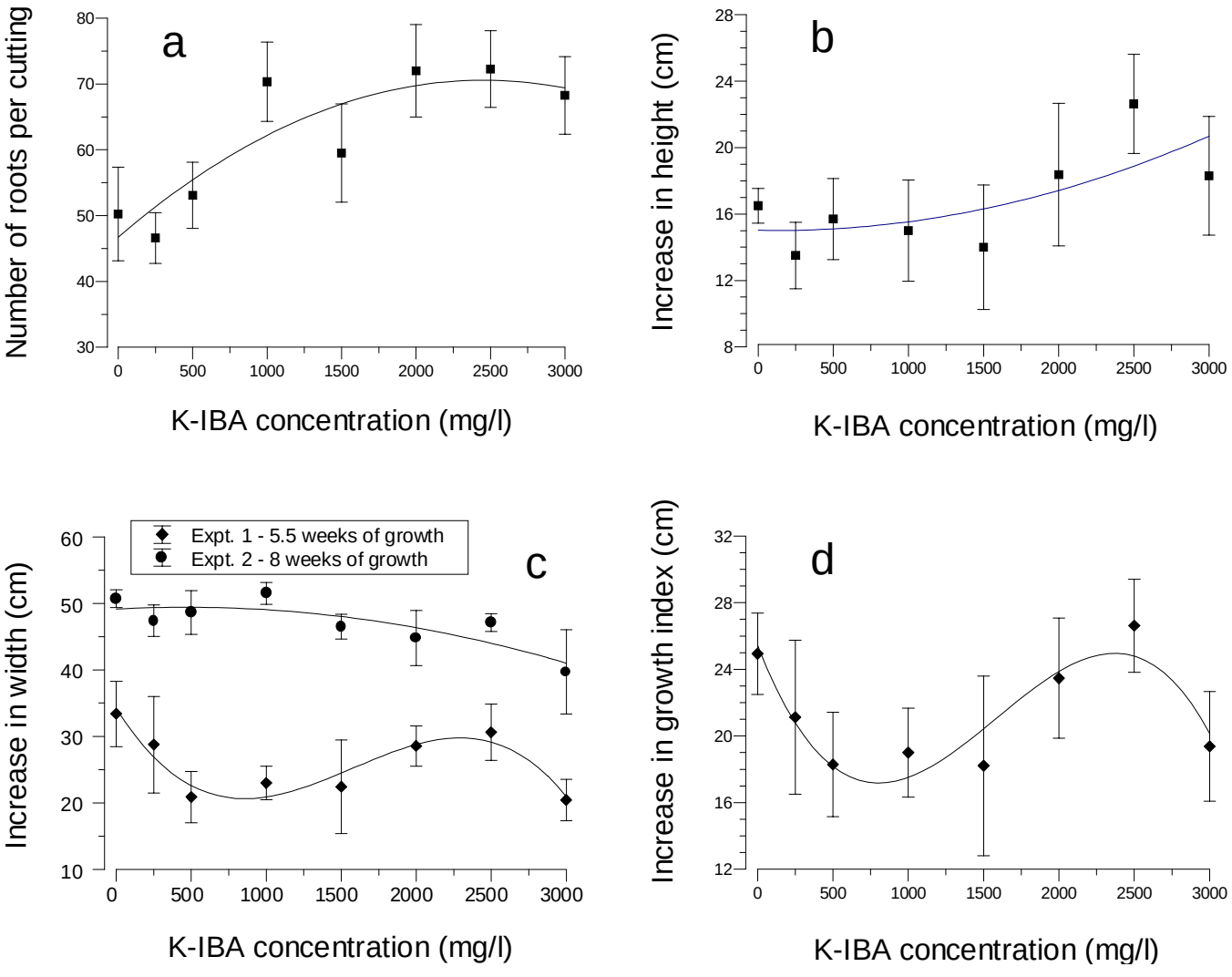

Fig. 1. The effect of K-IBA concentration on adventitious root formation in sub-terminal stem cuttings of 'Flora Sun' beach sunflower and subsequent growth of rooted cuttings after they were transplanted in 3.8-liter (#1) containers. Values indicate means (± SE). (a) Adventitious root formation per cutting: $y = 46.7 + 0.01944x - 3.959 \times 10^{-6}x^2$, $R^2 = 0.52$; $P \leq 0.0049$. (b) Increase in height from the time of transplant to 5.5 weeks later: $y = 15.2 + 1.758 \times 10^{-4}x - 6.88 \times 10^{-7}x^2$, $R^2 = 0.50$; $P \leq 0.0505$. (c) Increase in average width from the time of transplant to 5.5 (◆) or 8 (●) weeks later: 5.5 (◆) weeks—$y = 34.19 - 0.03619x + 2.903 \times 10^{-5}x^2 - 6.14 \times 10^{-9}x^3$, $R^2 = 0.89$; $P \leq 0.0215$; 8 (●) weeks—$y = 49.14 + 0.001195x - 1.302 \times 10^{-6}x^2$; $R^2 = 0.70$; $P \leq 0.0505$. (d) Increase in growth index from the time of transplant to 5.5 weeks later: $y = 25.44 - 0.02319x + 1.932 \times 10^{-5}x^2 - 4.059 \times 10^{-9}x^3$, $R^2 = 0.84$; $P \leq 0.0440$.

3000 mg/liter (ppm). Treated cuttings were placed in propagation cups (90 ml (3.1 oz); 2.9 × 5.4 × 5.7 cm [1.1 × 2.1 × 2.2 in]) filled with Metro Mix 200 (Scotts Co., Marysville, OH) and arranged in a completely random design with 12 single plant replications per treatment. Cuttings were rooted in a greenhouse under intermittent mist (9 sec/2.5 min), 30% light exclusion (black polypropylene shade cloth), and natural photoperiod. Fans for the fan/pad cooling system were set to run at ≥32.2C (90F).

The number of roots greater than 1 mm and root fresh and dry (dried at 70C [158F] for 72 hr) weights were determined July 10 [2.5 weeks after treatment (WAT)] for six randomly selected cuttings per treatment. The remaining cuttings were transplanted in 3.8-liter (#1) containers on July 10. The substrate consisted of hammer milled pine bark:Canadian sphagnum peat (Berger Peat Moss Inc., St. Modeste, Québec, Canada):sand (3:1:1 by vol) amended with 3.6 kg/m^3 (6.1 lb/yd^3) Osmocote 18N–2.6P–10K (18–6–12; 8–9 month formulation at 21C (70F); Scotts Co.) and 0.94 kg/m^3 (1.6 lb/yd^3) Micromax 12S–0.1B–0.5Cu–12Fe–2.5Mn–0.05Mo–12Zn (Scotts Co). Containers were placed in a randomized complete block design (six single plant replications per treatment) on black plastic under 35% light exclusion shade cloth for 2 weeks. Daily overhead irrigation (pH 7.7) of 0.6 cm (0.24 in) was applied. After 2 weeks, containers were placed in the same design on black plastic under full sun with daily overhead irrigation of 0.6 cm (0.24 in) in the morning and 0.3 cm (0.12 in) in the afternoon. Height, the widest width (W1), and width perpendicular to the widest width (W2) were recorded at transplanting and again about 5.5 weeks later (August 18). Growth index was calculated as (height + average width) / 2, where average width was equal to (W1 + W2) / 2.

The experiment was repeated on July 14, 1998, as described above, except the mist was applied 6 sec/5 min from 0500 to 2100 HR, then a total of 18 sec/hr from 2200 to 0400 HR. On August 4 (3 WAT), six replications were harvested and six replications were transplanted as described above except root dry mass was determined after 48 hr in the oven. Plants were measured as above on August 4, and again at about 4.5 weeks (September 4) and 8 weeks (October 9). On October 9, shoots were removed and dried, as above, for 10 days and then mass was recorded.

Data were subjected to analysis of variance. There was no treatment by experiment interaction for number of roots, or root fresh and dry masses, therefore these data were pooled. Data were subjected to multiple regression analyses, with polynomial regression lines being fitted to the means.

Results and Discussion

Adventitious root formation of 'Flora Sun' stem cuttings was quadratically related to K-IBA concentration, with maximum root formation at approximately 2000 mg/liter (ppm) (Fig. 1a). Root mass was not significantly ($P \leq 0.05$) affected by K-IBA applications (data not presented).

During establishment of rooted cuttings in 3.8-liter (#1) containers there was an effect on all three growth parameters (increase in height, width, and growth index) only in the first experiment when growth increase was measured about 5.5 weeks after transplanting rooted cuttings (Fig. 1b–1d). Increase in height was quadratically related to K-IBA concentration (Fig. 1b) while there was a cubic relationship of K-IBA concentration to both width increase (Fig. 1c) and growth index increase (Fig. 1d). However, only in the case of height was the increase in growth in K-IBA treated plants greater than that of nontreated plants, but the positive effect of K-IBA was minimal compared to nontreated plants (Fig. 1b).

In the second experiment, the trends in height, width, and growth index increase at 4.5 weeks were similar to those at 5.5 weeks in the first experiment, but the linear, quadratic, and cubic relationships of these parameters to K-IBA concentration were nonsignificant (data not presented). The means (± SE) for height, width, and growth index increase after 4.5 weeks were 17.6 ± 1.0 cm, 30.6 ± 1.3 cm, and 24.1 ± 1.0 cm, respectively. The only significant effect of K-IBA concentration at 8 weeks after transplanting rooted cuttings was on width increase (Fig 1c). The increase in width of transplanted cuttings was quadratically related to K-IBA concentration in a negative manner. At K-IBA concentrations above 500 mg/liter (ppm), width decreased compared to the nontreated plants. The mean (± SE) increases in height and growth index after 8 weeks were 29.4 ±1.3 cm and 38.4 ± 1.0 cm, respectively.

Survival of cuttings after the rooting and establishment stages, combined over both experiments, ranged from 50% for cuttings treated with K-IBA at 2500 mg/liter (ppm) to 83% for nontreated cuttings. The average percent survival for all cuttings treated with K-IBA by the end of both stages was 57%. Moreover, only nontreated cuttings exhibited 100% survival during the establishment stage in both experiments.

Although treatment of 'Flora Sun' beach sunflower stem cuttings with K-IBA increased the number of roots when cuttings were rooted under summer greenhouse conditions, K-IBA did not provide any substantial short-term benefits in survival or growth of rooted cuttings after they were transplanted into plastic containers. These results concur with the results of Liu et al. (4) and the recommendations of Phillips (5). Liu et al. (4) noted that over 60 root primordia, nearly half of which grew out, were produced in young cuttings of *Helianthus annuus* L. placed in water only. The recommendation of Phillips (5) for propagating *Helianthus tomentosum* by stem cuttings does not include the use of a rooting compound. It should be noted that when used in the landscape, 'Flora Sun' beach sunflower forms adventitious roots along the internodes contacting the soil.

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