Early Sweetpotato Plant Production Increased by GA_3 and BA Plus GA_{4+7}

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Treatments that decrease the interval from bedding to plant harvest or increase the number of sweetpotato *[Ipomoea batatas* (L.) Lam.] plants produced from bedded roots help reduce propagation cost and facilitate early transplanting. Immersing roots in 250 to 1000 mg/liter gibberellic acid (GA_3) before bedding increased the number of early and total plants produced (Tompkins and Bowers, 1970; Tompkins et al., 1973). However, those plants had thin, tough, wiry stems that could not be satisfactorily. transplanted mechanically (Tompkins et al., 1973). The cytokinin benzyladenine (BA) has been reported to interact with the activity of GA_3 (Malik and Archbold, 1992) and GA,.,, the latter in a proprietary material (Miller, 1988). The objective of this study was to determine if using lower GA concentrations than previously reported would increase plant production without the plant distortion reported by Tompkins et al. (1973).

'Georgia Jet' and 'Jewel' roots were removed from storage on 13 Apr. 1990 and sorted for uniformly large canner size (2.5 to 5 cm in diameter, 5 to 18 cm long). Roots of each cultivar were assigned randomly to lots of 20 and immersed 10 min in solutions of GA_3 at 0.5 or 1 mg·liter^{-1} (Pro Gibb 4%; Abbott Lab., North Chicago, Ill.), in solutions of BA + GA_{4+7} at 5 or 50 mg·liter^{-1} (Promalin; Abbott Lab.), or not immersed (nontreated control). Roots were air-dried, placed in 40 × 60-cm contiguous plots in a greenhouse, and drenched with a fungicide solution prepared with 16 g of 75% wettable powder 2,6-dichloro-4-nitroaniline (dicloran)/liter. Roots were covered with 5 cm of fumigated Tifton loamy sand (fine-loamy, siliceous, thermic Plinthic Kandiudults). The propagating bed was watered immediately after bedding and thereafter as needed to ensure adequate moisture levels for plant production. After the first plant harvest, granular fertilizer [28.0N–12.3P–23.2K ($g \cdot m^{-2}$)] was broadcast over the bed surface before watering. The air minimuminthe greenhouse was 24C, and the soil was at 28 ± 4C.

Plant harvests began 4 weeks after bedding, and all plants at least 20 cm in height were harvested weekly by manually pulling from individual plots for 7 consecutive weeks. The pulled plants included underground portions of stem and associated fibrous roots. Plants from individual plots were counted and weighed after each harvest. The cumulative number of plants harvested during the first three harvests was considered early plants. Length was measured from the shoot apex to the distal end of the underground stem, and nodes were counted on 10 plants from each treatment for the first five harvests. 'Georgia Jet' plants were mechanically transplanted on 25 May and 'Jewel' plants on 7 June, within 2 days of the closest harvest date. After harvest, plants were stored at ≈ 27C in an air-conditioned building until they were transplanted.

Treatments were arranged in the propagating bed in a split plot with four replications. Cultivars were the main plot, while the nontreated control, GA_3, and BA + GA_{4+7} treatments were randomized within the subplot. Separate analyses were conducted for GA_3 and BA + GA_{4+7} treatments using the same nontreated control plots for each analysis. All data, except plant weights and lengths, were subjected to a $(x + 0.5)^{1/2}$ transformation to equalize variances for analyses. Back-transformed means are presented.

'Georgia Jet' emerged earlier than 'Jewel' (14 vs. 21 days, $P \leq 0.01$, and 13 vs. 19 days, $P \leq 0.01$, respectively, for the GA_3 and GA_{4+7} analyses), but neither GA_3 nor BA + GA_{4+7} influenced plant emergence. The initial plant harvest date varied by 2 weeks for the various treatment combinations. A significant cultivar × GA_3 interaction ($P \leq 0.5$) indicated that GA_3 at 0.5 mg·liter^{-1} increased the number of early 'Georgia Jet' but not 'Jewel' plants (Table 1). Roots immersed in 50 mg BA + GA_{4+7}/liter produced 48% more early plants than the nontreated control roots. The total number of plants averaged 122 per plot and was not influenced by cultivars or by GA_3 or BA + GA_{4+7} at these low concentrations.

Plant measurements were not influenced by cultivar or by GA_3 or BA + GA_{4+7} (data not shown). Unlike Tompkins et al. (1973), I found no other visible differences in legginess or quality of plants produced from roots immersed in GA_3 or BA + GA_{4+7} solutions compared with plants produced from nontreated roots of either cultivar. The low GA_3 and BA + GA_{4+7} concentrations used in this experiment may account for the lack of influence on plant weight and quality characteristics, making these plants potentially easier to transplant mechanically than plants produced from roots immersed in higher GA_3 concentrations (Tompkins et al., 1973). Field survival and yields of plants produced from roots subjected to GA_3 or BA + GA_{4+7} were equivalent to that of control roots (data not shown). This lack of treatment influence on transplant field performance agrees with earlier findings for GA_3 (Tompkins et al., 1973).

Although GA_3 and BA + GA_{4+7} are not used commercially on sweetpotato, these findings and earlier information (Tompkins and Bowers, 1970; Tompkins et al., 1973) indicate potential for enhancing plant production from bedded sweetpotato roots. Whether the addition of BA to GA_{4+7} was beneficial for enhancing plant production characteristics compared to either material alone cannot be determined from these results.

Table 1. Influence of immersion in GA_3 or BA + GA_{4+7} on cumulative number of early[z] plants harvested from plots of 20-bedded 'Georgia Jet' and 'Jewel' sweetpotato roots.

Growth regulator	Concn (mg·liter^{-1})	Cultivar: Georgia Jet	Cultivar: Jewel	Treatment mean
None	---	50	42	46
GA_3	0.5	74	47	60
	1.0	56	57	57
		Q*	NS	L*Q*
BA + GA_{4+7}	5	49	40	44
	50	72	63	68
		NS	NS	L*

[z]Cumulative number of plants harvested at any time during the first three of the seven weekly harvests.
[NS], *Nonsignificant or significant at $P \leq 0.05$, respectively. L = linear; Q = quadratic for comparing GA_3 or BA + GA_{4+7}, with the nontreated control.

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