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Gibberellin Effects on Rabbiteye Blueberry Seed Germination¹

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Abstract. A 24 or 48 hour soak in gibberellins (GA) did not influence the total germination of open-pollinated rabbiteye blueberry seeds (*Vaccinium ashei* Reade, cv. Tifblue). GA₄₊₇ at 100–500 ppm stimulated early germination of seeds from the 2nd to 4th week after sowing, with the maximum effect occurring after 3 weeks. The 48-hour, GA₄₊₇, 100 ppm treatment stimulated germination from the 2nd to 5th week after sowing. Stimulation of earlier germination by GA₄₊₇ hastened seedling transplanting by 2 to 4 weeks. Germination of mature seeds (large, filled) was significantly higher than immature (medium-size, filled) or imperfectly (partially-filled) developed seeds. GA₄₊₇ did not increase germination of immature or imperfectly developed seeds.

Delay in germination along with inconsistent germination have been perennial problems for blueberry breeders. Lowbush blueberry seed (*Vaccinium angustifolium* Ait.) germinate 3 to 4 weeks after sowing (3). Highbush (*V. corymbosum* L.) and rabbiteye (*V. ashei*) blueberry seeds usually require 6 to 8 weeks to complete germination and sometimes require up to 12 weeks (2). Scott and Draper (7) demonstrated that light was necessary for germination of highbush blueberry seeds that had been held in dry cold storage for 6 months at 4.4°C. Stushnoff and Hough (9) found that pregermination and germination temp were as important or more important than light in promoting germination of freshly extracted seed. Maximum germination (up to 90%) was obtained with alternating diurnal greenhouse temp and red filtered light, following pregermination after-ripening at alternating temp. Scott

and Ink (8), with seeds held in dry refrigerated storage, found that stratification was not essential for germination. Neither coumarin, KNO₃ (9), nor sodium hypochlorite (8) were effective in increasing blueberry seed

germination.

Gibberellins have been shown to substitute for the dormancy requirement of buds and seeds of some plant species (6), and have been implicated as the primary stimulus for germination (4). Results of a preliminary survey of GA compounds, concn, and treatment durations on dry cold stored open-pollinated highbush blueberry seed germination indicated that total germination might be enhanced by GA seed soaks, GA₄₊₇ might be more effective than GA₃, and that 100 ppm may be the lowest effective GA concn. The following studies were conducted to determine if GA could influence germination of rabbiteye blueberry seeds.

Test 1. To determine the effect of GA on rabbiteye blueberry seed germination, open-pollinated seed of 'Tifblue', which had been refrigerated at 4°C in the fruit for about 75 days, were extracted using the method of Morrow et al. (5) and randomly divided into lots of 50 seeds each. The 50-seed lots were

Table 1. Mean cumulative blueberry seed germination (open-pollinated seed of *V. ashei* cv. Tifblue, 1974).

Pregermination treatment	GA concn (ppm)	Seed germination (%) ^z								
		Week								
		2	3	4	5	6	7	8	11	
24 hr air ^y		1.0 ^x	3.0	10.6	14.6	26.6	29.6	33.0	35.0	
48 hr air		0.0	0.6	5.6	9.0	14.0	17.6	22.0	23.6	
24 hr H ₂ O		0.6	3.0	6.0	7.0	12.6	16.0	17.6	23.0	
48 hr H ₂ O		0.0	2.0	5.6	8.0	10.0	13.0	14.6	15.6	
24 hr GA ₃	100	1.0	7.6	13.0	14.0	20.6	23.6	24.0	26.0	
	200	0.6	4.6	7.0	7.6	12.0	13.0	15.0	14.6	
	500	2.6	8.6	14.0	15.6	20.0	21.6	22.6	23.0	
	1000	1.6	8.0	11.6	15.0	21.0	21.6	25.0	27.0	
48 hr GA ₃	100	2.6	5.0	9.0	9.6	16.0	17.6	20.0	22.0	
	200	1.6	8.6	10.0	10.6	17.6	18.0	19.6	20.6	
	500	2.0	8.6	15.0	16.0	26.0	27.0	30.0	32.6	
	1000	1.6	5.6	11.6	14.0	19.0	21.6	23.0	24.0	
24 hr GA ₄₊₇	100	3.0	13.6	17.6	18.0	18.0	18.0	18.0	18.0	
	200	6.6	13.0	12.6	14.6	15.6	16.6	17.0	17.0	
	500	4.0	16.0	21.0	22.0	25.6	25.6	25.6	24.6	
	1000	0.6	8.6	15.0	16.0	15.6	16.0	15.6	16.0	
48 hr GA ₄₊₇	100	6.0	17.6	24.0	25.6	28.0	28.6	29.0	28.6	
	200	4.6	15.0	18.0	20.0	20.6	21.6	21.6	21.0	
	500	1.6	14.0	22.0	22.0	24.0	24.0	24.6	24.6	
	1000	1.0	5.0	11.6	12.6	16.0	16.0	17.0	16.6	
LSD 5%		3.8	8.2	9.6	10.2	NS	NS	NS	NS	

^zAverage germination percentage per 50-seed replication.

^yTreatment to which blueberry seeds are usually subjected prior to germination. Water checks are the most appropriate comparison for the effectiveness of the GA treatments.

^xData and LSD values were originally taken and calculated on the basis of number of germinated seedlings.

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placed in Petri dishes on a laboratory bench and subjected to one of the following treatments for 24 or 48 hr: air, distilled H₂O, 100, 200, 500, or 1000 ppm of either GA₃ (potassium salt) or GA₄₊₇. The 24-hr air check approximates the standard procedure followed in preparing dry-cold stored blueberry seeds for sowing, in that the seed are removed from refrigerated storage, counted, placed in labeled coin envelopes, and usually held overnight at room temp in the laboratory prior to sowing. The water and GA treatments were applied in 10 cc aliquot samples. Laboratory temp during the periods was 26° to 26.5°C. The treatments were arranged in a randomized complete block design with 4 replications. At the end of the 24 or 48 hr treatment periods the seeds were sown on the surface of a 1:1 milled sphagnum: sand mix in 8 cm clay pots and placed under intermittent mist in the greenhouse where the diurnal temp fluctuation during this germination period ranged between 22° and 25°C. Weekly germination counts were made from weeks 2 to 8. A final count was made at week 11.

At the end of 11 weeks, there were no significant differences in germination regardless of treatment (Table 1). Overall, time of pretreatment had little effect on germination potential. The 24-hr air check followed the usual germination pattern in that very little germination occurred until the 4th week, followed by doubling in germination between weeks 5 and 6. The other 3 checks showed a slow and steady increase in germination rate following week 4. Germination stimulation by

GA₃ treatments was not significantly higher than the controls at any time during the germination period. However, several GA₄₊₇ treatments were effective in increasing early germination over the control treatments. The greatest differences among GA₄₊₇ and control treatments occurred after 3 weeks, with the 24 hr 500 ppm and 48 hr 100, 200, and 500 ppm GA₄₊₇ treatments significantly higher in germination than the 24-hr air check. The 48 hr 100 ppm, GA₄₊₇ treatment was most consistent in stimulating early germination. It was significantly higher in germination than all check treatments in the 3rd through 5th weeks and was about equal to any other treatment in total germination. Germination of GA₄₊₇ treatments was essentially complete after 5 weeks and many of the seedlings in the 100, 200, and 500 ppm treatments had reached transplanting size at this time. Thus, seedlings in the 100, 200, and 500 ppm GA₄₊₇ treatments reached transplanting size 2 to 4 weeks earlier than the control and GA₃ treatments. Pretreatment of rabbiteye blueberry seeds with GA₄₊₇ at 100 ppm for 48 hr appears to successfully accelerate both germination and transplanting and is equal to the standard germination method in total germination.

Test 2. When sowing seeds obtained from fruits resulting from blueberry crosses, only the fully mature, well-filled seeds are normally included. However, medium-sized, well-filled seeds are often found in fruits along with full-sized seeds, and externally appear normal except for seed size. The viability of these medium-sized seed in

fruits of either highbush or rabbiteye blueberries has not been determined although Bell (1) found them to be inviable from lowbush blueberries. To determine the effect of seed size, seed coat color, and seed fill, with and without GA pretreatment, on germination rate and percentage, two 25-seed replications of open-pollinated 'Tifblue' seed in each of the following categories: large, brown, filled (considered fully mature); large, tan, filled; medium-size, brown, filled; medium-size, tan, filled; and large, partially-filled (without regard to seed coat color), were soaked for 48 hr in 10 cc of either distilled H₂O or GA₄₊₇. Seeds were categorized with the aid of a dissecting microscope. Treatments were arranged in a randomized complete block design and applied at the same time and under the same conditions, and germination counts made at the same times as the 1st test.

The mature seed classes (large, brown or tan, well-filled) were significantly higher in total germination than all other seed phenotypes from week 3 through the conclusion of the test (Table 2). The most mature seed class (large, brown, well-filled) had the highest germination but it was not significantly higher than the large, tan, well-filled treatment except in week 4. Germination of medium-size and partially-filled seeds was very poor. Gibberellin pretreatment significantly hastened germination only in week 3 in this test. Gibberellin pretreatment neither increased total germination nor stimulated germination of immature or imperfectly developed seeds.

Table 2. Mean cumulative germination of different seed phenotypes with and without gibberellin pretreatment^Z (open-pollinated seed of *V. ashei* cv. Tifblue, 1974).

Seed phenotype	Pre-germ. trt.	Germination (%) ^X										
		Week										
Size	Color	Fill ^Y		2	3	4	5	6	7	8	11	
Large	brown	filled	H ₂ O	0.0	2.0	12.0	12.0	30.0	44.0	52.0	68.0	
			GA ₄₊₇	2.0	22.0	40.0	42.0	42.0	44.0	44.0	46.0	
			Mean	1.0	12.0	26.0	27.0	36.0	44.0	48.0	57.0	
Large	tan	filled	H ₂ O	0.0	6.0	14.0	16.0	28.0	30.0	36.0	38.0	
			GA ₄₊₇	0.0	10.0	20.0	24.0	34.0	36.0	40.0	40.0	
			Mean	0.0	8.0	17.0	20.0	31.0	33.0	38.0	39.0	
Med.	brown	filled	H ₂ O	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
			GA ₄₊₇	0.0	0.0	0.0	0.0	0.0	4.0	4.0	4.0	
			Mean	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	
Med.	tan	filled	H ₂ O	0.0	0.0	2.0	2.0	4.0	4.0	4.0	4.0	
			GA ₄₊₇	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	
			Mean	0.0	0.0	1.0	1.0	2.0	3.0	3.0	3.0	
Large	brown	partial	H ₂ O	0.0	0.0	4.0	4.0	8.0	8.0	10.0	12.0	
			GA ₄₊₇	0.0	0.0	4.0	8.0	8.0	8.0	8.0	8.0	
			Mean	0.0	0.0	4.0	6.0	8.0	8.0	9.0	10.0	
LSD 5% seed type ^W			NS	8.0	2.4	32.8	34.0	36.8	38.4	30.8		
LSD 5% chem. trt. ^V			NS	NS	NS	NS	NS	NS	NS	NS		

^Z48 hr soak in 200 ppm GA₄₊₇.

^YSeeds were classified either as well-filled or partially-filled.

^XAvg. of two, 25-seed samples/pregermination treatment for each seed phenotype.

^WAmong means for each seed type.

^VChemical treatments within seed type.

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