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Effect of GA_3 and Pollination on Fruit Set and Development in Rabbiteye Blueberry

Raquel Cano-Medrano[1] and Rebecca L. Darnell
Horticultural Sciences Department, University of Florida, Gainesville, FL 32611-0690

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Abstract. **To determine if multiple applications of GA_3 would increase size of parthenocarpic fruit, and to assess the interaction between GA_3 applications and pollination, 'Beckyblue' rabbiteye blueberry (*Vaccinium ashei* Reade) flowers were treated with single or multiple applications of GA_3 alone or in combination with full or partial pollination. Single or multiple applications of GA_3 resulted in similar or increased fruit set compared with pollination, and increased fruit set compared with no pollination. GA_3 applications decreased fruit mass and increased the fruit development period in comparison with pollination alone. Multiple, late applications of GA_3 were ineffective in overcoming these effects. Partial (nonsaturating) pollination resulted in an average fruit set of 60%, while set following GA_3 treatment in combination with full or partial pollination averaged 85%. Fruit mass was greater in the full pollination ± GA_3 treatments than in all other treatments. The number of large seeds and seed mass per fruit were greatest in the full pollination treatment, and were significantly decreased by all treatments in which GA_3 and/or partial pollination were used; however, there were no concomitant effects of GA_3 in delaying the fruit development period. Our results indicate that under optimal pollination conditions, no detrimental effects of GA_3 applications on fruit set, fruit size, or fruit development period in blueberry are to be expected, even though GA_3 reduces seed number and seed mass. Furthermore, GA_3 applications appear to be beneficial in increasing fruit set under suboptimal pollination conditions, although smaller fruit are to be expected under such conditions. Chemical name used: gibberellic acid (GA_3).**

Fruit set in rabbiteye blueberry is often low, and yields may be commercially unacceptable (Lyrene and Crocker, 1983). The causes of fruit abscission are unclear, but inadequate pollination, high temperatures during bloom, and/or pest problems may be factors. Gibberellic acid and potassium gibberellate have been used successfully to induce fruit set and parthenocarpic fruit development in lowbush and highbush blueberry (Barker and Collins, 1965; Doughty and Scheer, 1975; Mainland and Eck, 1968a, 1968b, 1969a, 1969b; NeSmith and Krewer, 1992). GA_3 also induces fruit set and development in rabbiteye blueberry when applied under greenhouse or growth chamber conditions (Williamson et al., 1995). However, results with field-grown rabbiteye blueberry have been inconsistent. Increased fruit set has been observed in some studies (Davies and Buchanan, 1979; Mainland et al., 1979; Vanerwegen and Krewer, 1991), but in others, GA_3 applications had no effect or actually decreased fruit set and yield (Davies, 1986; Davies and Buchanan, 1979). The response appears to be cultivar-dependent, and optimum conditions for GA_3 applications in the field have not been established.

The erratic fruit set response of field-grown blueberry to GA_3 applications may be due to detrimental effects of GA_3 on pollination and/or fertilization. Gibberellins reportedly inhibit pollen germination in *Vitis vinifera* L. (Weaver and McCune, 1960). Application of GA_3 to rabbiteye blueberries enclosed in a greenhouse with bees significantly reduced seed number compared with that in plants that did not receive GA_3 (NeSmith et al., 1995), suggesting an inhibitory effect of GA_3 on either pollination or fertilization. However, it is unclear from this work whether all of the GA_3-treated fruit were pollinated.

Even when bloom applications of GA_3 increase fruit set in blueberry, fruit size is often significantly reduced (NeSmith et al., 1995; Williamson et al., 1995). In both apple and grape, gibberellin applications increased fruit size following open pollination (McLaughlin and Greene, 1984; Weaver and Pool, 1971), especially when applied after completion of the fruit cell division stage (McLaughlin and Greene, 1984). In blueberry, gibberellin levels in GA_3-induced parthenocarpic fruit may become depleted by the time rapid cell enlargement occurs. Thus, later applications of GA_3 may replenish the GA_3 supply, resulting in larger fruit.

To date, exogenous applications of GA_3 to increase fruit size in blueberry have not been tried in stages of development other than the cell division stage. In addition, the combined effect of GA_3, pollen source, and pollen amount has not been studied in blueberry. Thus, the objectives of the present experiments were to 1) evaluate the effect of GA_3 concentration and application time on fruit set, fruit development, and fruit quality in 'Beckyblue' rabbiteye blueberry, and 2) evaluate the interaction between GA_3 and pollination on fruit set and fruit development.

Materials and Methods

Experiment I. Five uniform 4-year-old 'Beckyblue' rabbiteye blueberry plants were grown outdoors in 12-L containers in 1 peat : 1 pine bark. Plants were watered as needed and fertilized with water-soluble fertilizer (20N–6.1P–11.6K) at 1.0 g·L^{-1} (Peters, Scott-Sierra Horticultural Products Co., Marysville, Ohio) once a week until early September. In November, plants were chilled in the dark at 7 ± 1 °C for 30 d. After the chilling period, the plants were transferred to a greenhouse with average temperatures of 17 °C day/16 °C night to force budbreak. Single or multiple applications of GA_3 were sprayed on individual flower clusters (five to nine florets per cluster) beginning at full bloom (FB). The following treatments were applied: 1) a single application of either 0.6 mM or 1.4 mM GA_3 at FB, 2) two applications of either 0.3 or 0.7 mM GA_3 at FB and FB + 7 d after full bloom (DAFB), 3) three applications of either 0.2 or 0.5 mM GA_3 at FB, FB + 7, and FB + 21 DAFB, or 4) four applications of 0.1 or 0.4 mM GA_3 at FB, FB + 7, FB + 21, and FB + 42 DAFB. A hand-pollinated and a nonpollinated control were also included for a total of six treatments. Prior to treatment application, each flower cluster was tagged, and the floret number and date were recorded. All treatments were applied on a single plant, which constituted a replication. There were 48 to 99 florets/treatment for each plant arranged in a randomized complete-block design, with five replications.

Experiment II. To further evaluate the effects of GA_3 when applied during later stages of fruit development, 45 one-year-old 'Beckyblue' rabbiteye blueberry plants were grown outdoors in 2-L containers in a 1 peat : 1 pine bark mixture, and budbreak was forced as described above, except that the average temperatures in the greenhouse were 25 °C day/22 °C night. Gibberellic acid at 0.3 or 0.7 mM was applied at FB and 7 DAFB, or 0.4 mM GA_3 was applied at FB, 7 DAFB, 21 DAFB, and 42 DAFB. Hand-pollinated and nonpollinated controls were also included, for a total of five treatments. The number of florets per cluster varied from four to seven and the average number of florets/plant from 26 to 35. Plants were blocked by size, and each treatment was applied to a single plant in a randomized block design, with two blocks per treatment, four or five plants per block, and nine replications.

For both experiments, GA_3 solutions were prepared from Pro Gibb (Pro Gibb 4%; Abbott

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[1]Current address: Colegio de Postgraduados en Ciencias Agricolas, Monticell-Texcoco, 56230 Edomex, Mexico.

Laboratories, Chicago) in McIllvaine buffer (Dawson et al., 1986), pH 3.5, with 0.01% Tween-80 as a surfactant. Pollinated treatments were hand-pollinated once at FB with 'Climax' pollen. Nonpollinated treatments were sprayed at FB with McIllvaine buffer.

Fruit abscission was monitored on a weekly basis and final fruit set was determined at 70 and 48 DAFB for Expts. I and II, respectively. The fruit development period (FDP) was calculated as the time when 80% of the fruits had been harvested. For each treatment, fruit from all harvests were pooled for fresh mass, soluble solids, titratable acidity, and pH measurements. Soluble solids were determined with an Abbe refractometer (model 10460; Cambridge Instrument, Buffalo, N.Y.). Titratable acidity was determined by titrating 5.0 mL of juice with 0.1 N NaOH to pH 8.2 using an automatic titrator (model 380; Fisher Scientific Co., Pittsburgh). Yield per treatment was calculated as a product of fruit fresh mass and final fruit number.

Experiment III. In order to assess GA_3 and pollination interactions, nine uniform 2-year-old 'Beckyblue' rabbiteye blueberry plants were grown in a 1 peat : 1 pine bark mixture in 12-L containers, chilled, and forced to budbreak at average greenhouse temperatures of 27/22 °C as described above. At bloom, the following treatments were applied: 1) saturating cross-pollination (X); 2) saturating cross-pollination + 0.7 mM GA_3 at FB + 7 DAFB (X + GA); 3) 1/4 saturating cross-pollination (1/4X); 4) 1/4 saturating cross-pollination + 0.7 mM GA_3 at FB + 7 DAFB (1/4X + GA); 5) saturating self-pollination (S); and 6) saturating self-pollination + 0.7 mM GA_3 at FB + 7 DAFB (S + GA).

'Climax' pollen was used for all cross-pollination treatments. The saturating pollination treatment consisted of applying 200 pollen tetrads to the stigmatic surface, while the 1/4 saturating pollination consisted of application of 50 pollen tetrads. The number of pollen tetrads selected for the treatments was based on work by Parrie and Lang (1992) indicating that blueberry stigmatic pollen saturation, i.e., the maximum number of pollen tetrads that the stigmatic fluid can hydrate, ranges from 200 to 300. Pollen tetrads were counted on a 100 mm^2 black lid under a stereoscopic microscope at 15× magnification. The pollen was transferred by touching the black lid to the stigma. After each transfer, pollen tetrads left on the black lid were transferred onto the stigma with a spatula. This process was repeated until all the pollen tetrads were on the stigma.

All treatments were applied on a single plant, using ≈10 florets/treatment for each plant, in a randomized complete-block design with nine single-plant replications. GA_3 treatments were applied in the evening, at least 4 h after pollination. Treatments not receiving GA_3 were sprayed with buffer and surfactant at the same time.

Fruit abscission was recorded weekly, and final fruit set was determined at 56 DAFB. Fruit was harvested every other day and weekly harvests were pooled to determine fresh mass. Subsequently, fruit was macerated with a mortar and pestle and seeds were separated and air dried for 24 h. Total seed number and seed mass per fruit were recorded, then seeds were separated into small and large seeds using a sieve of 1 mm^2, counted, and weighed. Viability of small and large seeds was not determined.

Data for all experiments were analyzed by analysis of variance (ANOVA) and means separated by LSMeans. Fruit set data were arcsin transformed prior to analysis. For Expt. II, both block and replication were analyzed as factors in the ANOVA.

Results

Experiments I and II. Final fruit set was significantly lower in the nonpollinated treatment than in the pollinated or GA_3 treatments in both experiments (Tables 1 and 2). Final fruit set did not differ among any of the GA_3 treatments within an experiment. Fruit set in the pollinated and GA_3 treatments was similar in Expt. I; however, in Expt. II, fruit set in the pollinated treatment was significantly lower than in the GA_3 treatments.

Application of GA_3 reduced fruit fresh mass compared with the pollinated control in both experiments (Tables 1 and 2). In Expt. I, fruits from the pollinated control were four times as large as those from GA_3 treatments, but in Expt. II these differences were not as great. Yield was lower for GA_3 treatments than for pollinated treatments in Expt. I, but there were no differences in total yield among treatments in Expt. II.

In Expt. I, GA_3 treatments increased the FDP by 34 to 49 d relative to the pollinated control (Table 1), while in Expt. II, a 10-d delay in development was observed only with two applications of 0.3 mM GA_3 or four applications of 0.4 mM GA_3 (Table 2). In general, GA_3 treatments reduced fruit soluble solids compared with the pollinated treatment in Expt. I (Table 1); however, no differences in solids were found in Expt. II (Table 2). There were no consistent differences in pH or titratable acidity among treatments.

Experiment III. Fruit abscission was minimal for X, X + GA, 1/4X + GA, and S + GA from 0 to 21 DAFB, averaging 5% for all treatments (Fig. 1). This was followed by a slow increase from 21 to 35 DAFB, after which abscission ceased. In contrast, abscission in the 1/4X and S treatments increased slowly from 0 to 21 DAFB, followed by a dramatic increase from 21 to 42 DAFB. There were no significant differences in final fruit set among X, X + GA, 1/4X + GA and S + GA treatments, with set averaging ≈85% (Fig. 1). Final fruit set was significantly reduced by the 1/4X treatment (60%), while set in the S treatment was the lowest, averaging <20% (Fig. 1).

Table 1. Effects of gibberellic acid (GA_3) on fruit set and development in 'Beckyblue' rabbiteye blueberry (Expt. I).

No. applications[w]	Concn (mM)	Flower no./plant	Fruit set[z] (%)	FM (g/fruit)	Total yield (g/trt/plant)	FDP[y] (days)	SS[x] (°Brix)	pH
1	0.6	71.0	62.8 b[v]	0.49 b	28.2 b	134.6 a	10.4 b	3.7 a
	1.4	57.0	74.6 ab	0.53 b	25.7 b	126.4 ab	11.4 b	3.9 a
2	0.3	77.0	77.6 ab	0.51 b	31.9 b	131.4 ab	10.6 b	3.6 a
	0.7	72.2	77.8 ab	0.46 b	26.9 b	120.8 ab	11.7 ab	3.7 a
3	0.2	75.8	79.8 ab	0.57 b	36.0 b	129.8 ab	10.6 b	3.6 a
	0.5	98.8	84.6 ab	0.42 b	36.2 b	124.4 ab	10.5 b	3.6 a
4	0.1	81.2	77.0 ab	0.52 b	31.4 b	126.8 ab	11.7 b	3.9 a
	0.4	53.8	85.8 ab	0.46 b	22.1 b	119.8 b	12.3 ab	3.6 a
Hand pollinated		48.2	78.4 ab	1.67 a	79.0 a	85.0 c	13.4 a	3.7 a
Nonpollinated		52.0	29.0 c	---	---	---	---	---

[z]Data were arcsin transformed prior to analysis.
[y]FDP = fruit development period.
[x]SS = soluble solids.
[w]GA_3 application times: 1 application = full bloom (FB); 2 applications = FB and FB + 7 d after full bloom (DAFB); 3 applications = FB, FB + 7, FB + 7 + 21 DAFB; 4 applications = FB, FB + 7, FB + 7 + 21, FB + 7 + 21 + 42 DAFB.
[v]Mean separation within columns by LSMeans, $P < 0.05$.

Table 2. Effects of gibberellic acid (GA_3) on fruit set and development in 'Beckyblue' rabbiteye blueberry (Expt. II).

No. applications[w]	Concn (mM)	Flower no./plant	Fruit set[z] (%)	FM (g/fruit)	Total yield (g/plant)	FDP[y] (days)	SS[v]	TA[x] (%)	pH
2	0.3	32.9 a	76.2 a[u]	1.18 b	30.3 a	64.4 a	11.6 a	0.69 a	3.1 ab
	0.7	28.2 a	74.8 a	1.19 b	25.0 a	57.8 b	12.0 a	0.98 a	3.0 b
4	0.4	34.8 a	68.8 a	1.11 b	26.4 a	66.1 a	12.6 a	0.89 a	2.9 b
Hand pollinated		34.8 a	43.0 b	2.04 a	23.7 a	55.6 b	12.1 a	0.69 a	3.2 a
Nonpollinated		26.1 a	3.3 c	---	---	---	---	---	---

[z]Data were arcsin transformed prior to analysis.
[y]FDP = fruit development period.
[x]TA = titratable acidity.
[w]GA_3 application times: 2 applications—full bloom (FB) and FB + 7 d after full bloom (DAFB); 4 applications—FB, FB + 7 DAFB, FB + 7 + 21, FB + 7 + 21 + 42.
[v]SS = soluble solids.
[u]Mean separation within columns by LSMeans, $P < 0.05$.

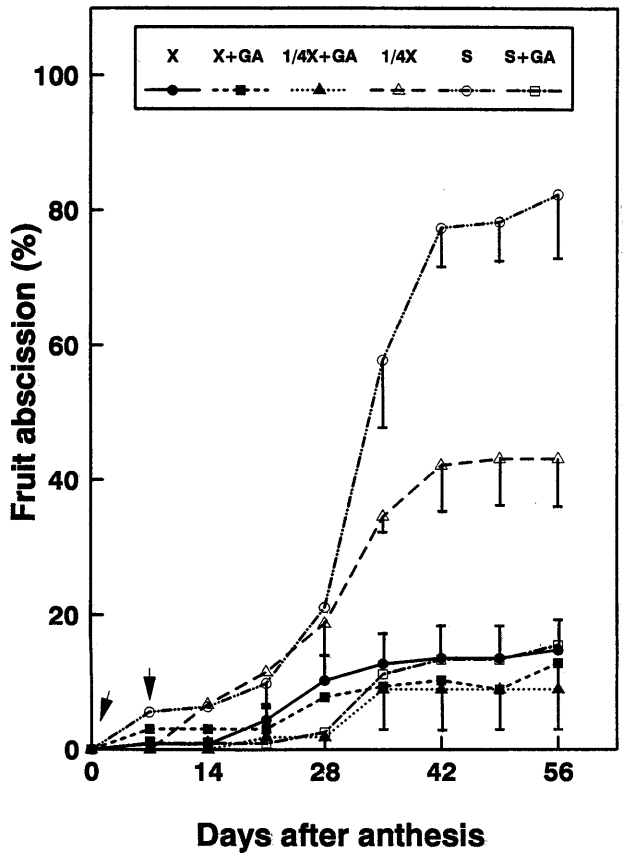

Fig. 1. Time-course and extent of fruit abscission in 'Beckyblue' rabbiteye blueberry as affected by gibberellic acid (GA_3), pollen source, and pollen amount. X = cross-pollination (200 pollen tetrads); 1/4X = 50 pollen tetrads; S = self-pollination (200 pollen tetrads). GA_3 = 0.7 mM GA_3; GA_3 application times indicated by arrows. Values are means ±SE, n = 9; SE bars present only when larger than symbol.

Table 3. Effects of gibberellic acid (GA_3), pollen source, and pollen amount on fruit fresh mass (FM) and seed number/seed mass in 'Beckyblue' rabbiteye blueberry.

	FM	FDP[z]	Seeds/fruit		Seed mass (mg)		Total per plant	
Treatment[y]	(g/fruit)	(days)	Large	Small	Large	Small	Seed no.	Seed mass (mg)
X	1.98 a[x]	72 a	12.1 a	40.3 a	8.6 a	9.8 a	52.4 a	18.4 a
X + GA	2.03 a	72 a	5.0 b	37.1 a	2.9 b	8.4 a	42.1 ab	11.3 b
1/4X	1.37 b	87 a	4.6 b	32.4 a	3.6 b	5.2 a	37.0 b	8.7 bc
1/4X + GA	1.61 b	72 a	1.9 c	33.3 a	1.1 c	4.4 a	35.2 b	5.6 cd
S	1.07 b	92 b	0.3 c	28.2 a	0.1 c	3.3 a	28.5 b	3.5 cd
S + GA	1.65 b	87 a	0.5 c	30.7 a	0.3 c	2.8 a	31.2 b	3.2 d

[z]FDP = fruit development period.
[y]Treatments: X = cross pollination with 'Climax' pollen (200 pollen tetrads), 1/4X = 50 pollen tetrads, S = self-pollination with 'Beckyblue' pollen (200 pollen tetrads), GA_3 = 0.7 mM GA_3 applied at full bloom (FB) and FB + 7 d after full bloom (DAFB).
[x]Mean separation within columns by LSMeans, $P < 0.05$.

Fruit mass in the X and X + GA treatments was significantly greater than in the other treatments, averaging 2.0 g/fruit (Table 3), but differences in berry mass among 1/4X, 1/4X + GA, S, or S + GA treatments were nonsignificant. The FDP was similar among all treatments except for the self-pollinated (S) treatment, in which the development period averaged 14 d longer (Table 3).

The number and mass of large seed per fruit were greater in the cross-pollinated (X) treatment than in the other treatments (Table 3). Within a given cross-pollination treatment (X or 1/4X), application of GA_3 significantly reduced number and mass of large seeds compared with the pollination treatment alone. The number and mass of small seeds per fruit did not differ among treatments. Total seed mass per fruit in the cross-pollinated (X) treatment was significantly higher than in all other treatments.

Discussion

In controlled studies, where blueberry flowers were either pollinated or treated with GA_3 (but not both), fruit set of GA_3-treated plants was as high or higher than in pollinated plants (Mainland et al., 1979; Mainland and Eck, 1969a, 1969b; Williamson et al., 1995). Results from our studies confirm this. The reason for the relatively low fruit set observed in the pollinated treatment in Expt. II relative to Expt. I is unknown, although it may be partially due to the higher greenhouse temperatures that occurred during the fruit setting period (25/22 °C) in Expt. II vs. 17/16 °C in Expt. I . Temperatures of 26 °C day/21 °C night decreased fruit set 23% in rabbiteye blueberry relative to 26/10 °C (Williamson et al., 1995). High temperatures may decrease set by reducing pollen germination and/or tube growth, stigmatic receptivity, or ovule longevity. Since GA_3 substitutes for pollination and fertilization, high temperatures probably have a much less negative impact on GA_3-induced fruit set.

In both experiments, average fresh mass of GA_3-treated fruit was less than that of pollinated fruit. In Expt. I, initial numbers of flowers/plant averaged 48 for pollinated treatments, vs. 73 for GA_3 treatments. Although these differences were not statistically significant, the increased flower number in the GA_3 treatments, combined with similar fruit set percentages among all treatments, resulted in higher fruit loads in some of the GA_3 treatments compared with pollinated treatments. This may partially explain the decrease in fruit mass caused by GA_3. However, calculations of fruit number within each treatment revealed no significant differences in fruit number between the pollinated and several of the GA_3 treatments (one application of 0.6 mM or 1.4 mM GA_3, four applications of 0.4 mM GA_3), yet fruit mass was still significantly less in all of the GA_3 treatments. This suggests that the decreased fruit mass in GA_3 treatments was not solely due to increased fruit load. These results agree with previous work in which GA_3-induced parthenocarpic fruit was significantly smaller than pollinated fruit even though fruit number on the GA_3-treated and pollinated plants was identical (Williamson et al., 1995).

The decreased fruit mass in GA_3 treatments may be related to seed number, since berry mass and seed number are positively correlated (Aalders and Hall, 1961; Darnell and Lyrene, 1989; Lyrene, 1989; Moore et al., 1972; Payne et al., 1989). Although seed number was not recorded in Expts. I and II, no seeds were observed in GA_3-treated fruits. In Expt. III, there was a positive correlation between fresh mass and total seed number (r^2 = 0.60, $P < 0.01$). Thus, a decrease in seed number probably accounts, at least partially, for the decrease in mass of GA_3-treated fruit.

Fruit mass was significantly lower in Expt. I relative to Expt. II, especially for the GA_3 treatments. The relatively greater decrease in mass of GA_3-treated fruits vs. pollinated fruits in Expt. I may be due, in part, to the fact that all treatments were applied to the same plant in that experiment. Since pollinated fruits are stronger sinks than parthenocarpic (i.e., GA_3-treated) fruits (Goldwin, 1984), pollinated fruits would outcompete GA_3-treated fruits for assimilates. Because fruit size was the dominant factor in yield in Expt. I (r^2 = 0.92, $P < 0.01$), this would also explain the differences in yield between the pollinated and GA_3 treatments in that experiment.

Late applications (i.e., 21 and 42 DAFB) of GA_3 were ineffective in increasing fruit mass

compared with bloom applications. Application times were based on days after bloom, rather than phenological stages of development. In Expt. I, these application times corresponded to 25% to 35% of the FDP, while in Expt. II, they corresponded to 35% to 65% of the FDP. The stage(s) of fruit development at these application times were not determined. However, in a separate study, differences in fruit size between pollinated and GA_3-treated fruit were due to differences in cell size, rather than cell number, with significant differences in cell size evident only after 24 DAFB (Cano-Medrano and Darnell, 1997). This represented 25% and 35% of the total FDP for GA_3-treated and pollinated fruit, respectively. Thus, replenishing the GA_3 supply prior to and/or after differences in cell size are manifested apparently is not sufficient to stimulate adequate cell enlargement in these fruit. Applications of GA_3 during later stages of fruit growth (i.e., after 65% of the FDP) may be effective in increasing cell size; further experiments are required to determine if this is true.

The increased development period observed in GA_3-treated fruit in Expts. I and II is probably related to decreased seed number. Increased seed number is significantly associated with a shorter FDP in both lowbush (Alders and Hall,1961) and rabbiteye blueberry (Meader and Darrow, 1944; Tamada et al., 1977). Lang and Danka (1991) found that cross-pollination in southern highbush blueberry increased both the mean number of well-developed seeds per fruit and the proportion of early ripening fruits compared with self-pollination. A significant negative correlation between seed number and FDP in Expt. III ($r^2 = 0.64$, $P < 0.01$) also supports the observations in Expts. I and II.

There were no apparent negative interactions between pollination and GA_3 applications on fruit set or fruit size in blueberry, as has been observed in grape (Weaver and Pool, 1991) and apple (Edgerton, 1981). The fruit set percentages for both saturating cross- and self-pollination are similar to those reported by others (El-Agamy et al., 1982; Garvey and Lyrene, 1987; Lyrene and Goldy, 1983; Williamson et al., 1995). Although fruit set was relatively high under conditions of 1/4X pollination, the detrimental effect of this treatment on fruit mass suggests that yield may be negatively affected in the field under conditions of suboptimal pollination. The reduced fruit size obtained by 1/4X pollination may be partially, although not completely, offset by GA_3 treatment.

A comparison of the X and X + GA treatments, and the 1/4X and 1/4X + GA treatments indicates that GA_3 inhibits the development of large seeds in previously pollinated flowers. GA_3 may be acting as a pollenicide, as reported by Weaver and McCune (1960) for grape flowers. The decrease in large seed number and total seed mass in fruit from the GA_3 treatments did not affect final fruit mass. Subsequent studies have confirmed that GA_3 applications in conjunction with pollination decrease both large and total seed number compared with pollination alone, without negatively affecting fruit mass (Darnell, unpublished data). This suggests that although GA_3 appears to be acting as a pollenicide or embryocide, sufficient seed development occurs, even under conditions of nonsaturating pollination, so that fruit size is not negatively affected. Although seed number is highly correlated with fruit mass, as indicated previously, as much as 41% to 69% of the variability in fruit mass may be attributable to factors other than seed number under conditions of varying pollination loads (Brewer and Dobson, 1969).

In conclusion, the application of GA_3 alone or in combination with pollination increased fruit set compared with no pollination or self-pollination. Application of GA_3 alone decreased fruit mass, and multiple late applications of GA_3 did not overcome this. Under optimal pollination conditions, no detrimental effects of GA_3 on fruit set, fruit size, or FDP in blueberry are to be expected. Furthermore, GA_3 applications appear to be beneficial in increasing fruit set under suboptimal pollination conditions (i.e., partial cross-pollination or self-pollination), although smaller fruit are to be expected under those conditions.

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