Freeze Damage in Six Rabbiteye Blueberry Cultivars

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Rabbiteye blueberries (*Vaccinium ashei* Reade) are becoming an increasingly important small fruit crop in the Southeastern United States. Most of this area has relatively mild winters and comparatively few chilling hours (hours below 7° C). Studies have indicated that 400-500 hours of chilling are usually sufficient for normal floral bud break in rabbiteye blueberries (2, 3, 4, 6). In this region, cold periods are often interrupted by weeks of temperatures above 7° C. After the chilling requirements of blueberries are satisfied, extended periods of warm temperatures (around 20° - 25° C) initiate flower-bud growth. Individual flower buds and solitary flowers become more susceptible to cold damage as flower development increases. Flower buds in Tifblue cultivar in stage 2 as described in a previous study (5) withstood temperatures of −4° C or below. Tifblue flower buds in advanced stages (floral rating of 4 or above) were severely damaged by temperatures of −4° C (5).

By February 17, 1980 over 700 chilling hours (hours 7° C) had been recorded at Poplarville, MS (30.5° N). Temperatures were warm for the next 12 days, averaging 22° C maximum and 10° C minimum. During this period floral buds broke dormancy and had reached an average of about four on the floral rating scale (Fig. 1) (5). On the morning of March 2, temperatures dropped to a minimum of −9° C, causing considerable damage to the flowering buds of rabbiteye blueberries.

The objectives of this report are to relate the differences in cold damage to rabbiteye blueberry cultivars and to determine the relative hardiness of floral buds at various stages of floral development.

MATERIALS AND METHODS

Data for this study were collected from a test of six rabbiteye blueberry cultivars planted in 1974. Two stems containing from 7 to 25 buds per stem were randomly selected from two plants per cultivar from each of four replications.

Flower buds were rated for stage of development on March 3 by using a previously reported scale (Fig. 1). This rating was taken the morning after a severe freeze which occurred on March 2, 1980. Flower buds were still frozen at the time the rating was made; therefore, floral stages remained identical to development immediately before freezing. The number of surviving buds and the number of berries produced by them were counted on April 22 (about 7 weeks after the freeze).

RESULTS AND DISCUSSION

Temperatures of −9° C on March 2, 1980 severely damaged the flower buds of all cultivars. Mean flowering stages were relatively uniform with only one stage separating the least and most advanced cultivar (Table 1). The average flower stage ratings indicate that flowers of Delite and Woodard were not significantly more advanced than those of Climax; however, 97% of the flower buds of Delite were killed by the cold temperatures (Table 1) whereas Woodard lost 85% of its flowers. Fewer floral buds of the other varieties were killed: Southland, 63%, Climax, 56%, Tifblue, 49%, and Briteblue, 42%.

The number of flowers per inflorescence (floral) bud in blueberries varies

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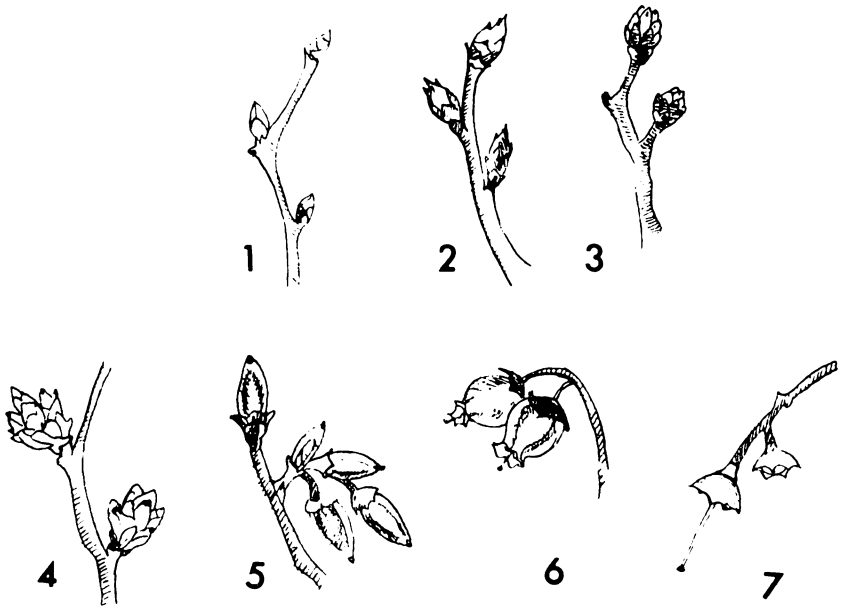

Fig. 1. Stages of flower-bud development in rabbiteye blueberry: 1 = no visible swelling, bud scales completely enclose inflorescence; 2 = visible swelling of bud, scales separating, flowers still completely enclosed; 3 = bud scales separated, apices of flowers visible; 4 = individual flowers distinguishable, bud scales abscised; 5 = individual flowers distinctly separated, corollas unexpanded and closed; 6 = corollas completely expanded and open; 7 = corollas dropped.

greatly, with a range from 6 to 14 (2). Counting the number of berries per surviving bud (bud with at least one fruit present after the freeze), we found the range in *V. ashei* cultivars to vary between 1 and 18 individual fruits per inflorescence (floral) bud (Table 1). Most of the surviving buds with less than 6 berries per bud had severely cold-damaged flowers within the floral bud. Delite and Woodard cultivars had the smallest number of berries per alive bud of the cultivars tested. Briteblue had more berries per bud than the other cultivars.

All cultivars had flower buds at stage 2 or higher before the freeze, with a majority of flower buds at the 4 and 5 development stages (Table 2). Percentages of floral buds at each stage of floral development of Woodard, Climax, Delite, and Southland were similar whereas Tifblue and Briteblue had greater percentages of floral buds at the 2 and 3 (more freeze resistant) stages than the other cultivars. Four cultivars had greater than 75% flower buds at stages 4 and 5: Climax, 81%; Woodard, 85%; Southland, 78%; and Delite, 78% (Table 1). As floral development increased, the percentage of flower buds killed increased (Table 3). This trend was evident in all cultivars tested. One-half of the individual floral buds of Climax which had reached stage 4 in flower

Table 1. Response of rabbiteye blueberry cultivars subjected to freezing temperatures (–9° C), March, 1980.

Cultivar	Average floral rating before freeze	% Flower buds killed	No. of fruit per alive bud
Briteblue	3.2c[1]	42a	7.7a
Tifblue	3.6bc	49a	4.5c
Climax	4.1ab	56a	5.5b
Southland	4.1ab	63ab	7.2ab
Woodard	4.2a	85bc	5.2bc
Delite	4.0abc	97c	4.8c

[1]Mean seperation in columns by Duncan's Multiple Range Test, 5% level.

Table 2. Percent flower buds at each stage of floral development, rabbiteye blueberry cultivars, March 1, 1980.

	% Flower buds						
	Floral development stage						
Cultivar	1	2	3	4	5	6	7
Woodard	0	3	12	52	53	0	0
Climax	0	4	15	50	31	0	0
Southland	0	2	20	49	29	0	0
Delite	0	5	17	51	27	0	0
Tifblue	0	4	42	43	11	0	0
Briteblue	0	32	23	33	11	0	0

Table 3. Freeze damage to blueberry flower buds at various stages of floral development.

	% Flower buds killed			
	Floral development stage			
Cultivar	2	3	4	5
Climax	9b[1]	9c	53c	100a
Southland	0b	47b	63c	100a
Tifblue	0b	12c	63c	100a
Briteblue	0b	17c	56c	100a
Woodard	0b	37b	85b	100a
Delite	78a	96a	98a	100a

[1]Mean seperation in columns by Duncan's Multiple Range Test, 5% level.

Table 4. Mean number of rabbiteye blueberries set per surviving flower bud at different floral development stages.

	Floral development stage			
Cultivar	2	3	4	5
Tifblue	6.9	4.9	3.1	0
Woodard	7.0	6.8	3.5	0
Briteblue	8.7	7.3	5.2	0
Delite	5.3	4.6	3.5	0
Climax	9.3	6.5	4.2	0
Southland	7.5	7.2	6.2	0

development set fruit. All Climax floral buds at stages 2 or 3 before freeze damage had fruit present when examined 7 weeks after freezing. In contrast, Delite buds in stages 3, 4, and 5 were severely damaged and 21% of the buds in stage 2 were also killed. Woodard floral buds were more cold tolerant than those of Delite but were less hardy than buds of Climax, Southland, Tifblue, and Briteblue at the stage 4 development rating. Floral buds of Briteblue, Tifblue, and Climax were the most cold tolerant of the cutivars tested. Damage of individual flowers within a floral bud increased with highest stages of development (Table 4). This pattern was similar for all cultivars.

These data indicate that floral buds at stage 2 rating were cold tolerant. As bud development advanced, flowers became more sensitive to cold damage. Floral buds with individual flower distinctly separated, and corollas unexpanded and closed (stage 5) were completely killed by –9° C. Delite and Woodard were the most susceptible to freeze damage.

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