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COMPARATIVE TOLERANCE OF LOWCHILL HIGHBUSH AND RABBITEYE BLUEBERRY CULTIVARS TO FROST DAMAGE

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INTRODUCTION

In the last two years cold temperatures during bloom have increased East Texas blueberry growers' awareness of the potentials of frost damage. In general, there are two ways that a plant reduces susceptibility of its flowers to spring frost injury. One is to avoid having susceptible flowers during frost, i.e., late bloom. This mechanism is call avoidance. Our data indicated that this can be accomplished by: 1) fruiting on fall growth (which naturally tends to bloom later than flowers from spring growth), 2) delaying flower bud development in the spring by using sod and mulch to reduce orchard temperature, and 3) selecting cultivars which bloom late, such as Tifblue. Tolerance is the other mechanism to reduce frost damage. This is the ability of the flower to tolerate cold temperature and still set fruit. Tolerance is usually genetically determined. In 1988 and 1989, we evaluated lowchill highbush and rabbiteye blueberry cultivars tolerance to spring frost.

MATERIALS AND METHODS

Four lowchill highbush cultivars (Cape Fear, O'Neal, Blue Ridge, and Georgiagem) and four rabbiteye cultivars (Tifblue, Climax, Brightwell, and Baldwin) were evaluted for their tolerance of frost damage. On March 14, 1988, the temperature fell to 24°F for 2 hours and was below 29°F for a total of 7 hours. Two days later, the percentage of flowers that were damaged by frost were rated across 3 stages of development (stage 4 - individual flowers distinguishable, stage 5 - individual flowers distinctly separated, corollas unexpanded and closed, and stage 6 - corolla expanded and open, full bloom). In a second experiment, flowers in all 3 stages that appeared viable (undamaged white corollas) were tagged and evaluated for fruit set 1 month later. In 1989, temperatures dropped from 80° on February 2 to 12°F on February 3. Temperatures stayed below freezing for 6 days. On February 13, the percentage of live flower buds were measured on swollen but unopened flower buds.

RESULTS

All rabbiteye blueberry flowers in full bloom (stage 6) that were exposed to low temperatures were killed (Table 1). This was in contrast with the lowchill highbush cultivars which had 18 to 47% undamaged flowers. Georgiagem and Blue Ridge appeared to have the most hardy flowers during full bloom. For stage 5 flower buds, the lowchill highbush cultivars and Brightwell were the most hardy, while Tifblue and Climax were the least. At stage 4 Climax had more bud loss than all other cultivars.

The lack of visible damage did not mean that those buds were completely uninjured. Fruit set for flowers with visually undamaged corollas varied across stage of development and cultivar (Table 2). As a group, the lowchill highbush cultivars set better than the rabbiteye cultivars, regardless of flower stage. There were no data for Tifblue and Baldwin flowers in stage 6 because no open flowers at that stage were found. All stage 6 Climax flowers were damaged. For all cultivars other than Tifblue, flowers that looked undamaged appeared to have a adequate fruit set. For Tifblue, however, fruit set was lower than expected. This indicated that flowers which had no visibly damaged corollas (petals) had some damage to the stigma or the style that resulted in reduced fruit set. Frost damage in 1989 occurred on less developed flower buds. Lowchill highbush had only slight damage, while damage in rabbiteye ranged from 25% live Climax buds to 85% live Tifblue buds (Table 3).

SUMMARY

One of the complaints about growing the lowchill highbush is that they flower too early and therefore are more subject to frost damage. For example, O'Neal will flower 10 days before Climax and 14 to 21 days before Tifblue. Despite early flowering the lowchill highbush cultivars flower were more tolerant of cold temperature during bloom than the rabbiteye cultivars. The need for overhead frost control for the lowchill highbush may be no greater than that for rabbiteye cultivars. Sharpblue appears to be in the same frost tolerant category as other lowchill highbush cultivars.

Table 1. Percentage of live flower buds after 2 hours of 24°F at different stages of development for different blueberry cultivars.

	Flower Bud Stage		
Cultivars	Stage 4	Stage 5	Stage 6
	----------% live flower buds----------		
Cape Fear	100	77	20
O'Neal	80	78	18
Blue Ridge	100	74	38
Georgiagem	100	87	47
Tifblue	90	26	0
Climax	70	26	0
Brightwell	100	61	0
Baldwin	100	49	0

Table 2. Percentage fruit set of flowers with undamaged corollas at different stages of development for different blueberry cultivars.

	Flower Bud Stage		
Cultivars	Stage 4	Stage 5	Stage 6
	----------% fruit set----------		
Cape Fear	84	95	92
O'Neal	85	100	75
Blue Ridge	95	73	42
Georgiagem	87	95	37
Tifblue	47	10	--
Climax	70	43	--
Brightwell	72	67	33
Baldwin	54	32	--

Table 3. Percentage of live flower buds (swollen, but unopen) after exposure to 12°F on Feb. 2, 1989.

Cultivars	% Live Flower Buds
Cape Fear	93
O'Neal	88
Blue Ridge	96
Georgiagem	93
Tifblue	86
Climax	26
Brightwell	56
Baldwin	62