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FROST TOLERANCE AND FRUIT RIPENING PATTERN OF RABBITEYE BLUEBERRIES AS INFLUENCED BY WOOD TYPE

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Rabbiteye blueberry flower buds are initiated on three distinct types of wood, 1) spring growth from old weak growth, 2) spring growth from 1-year-old vigorous shoots or 3) postharvest late summer/fall growth. Flower buds formed on spring growth are usually visible by July, while buds formed on postharvest growth flushes appear in late summer or early fall (Mainland, 1989). For blueberries, bloom time is correlated to the time of flower bud formation (Davies, 1986), with flower buds formed in summer blooming before those formed in the fall. By encouraging postharvest growth flushes it may be possible to delay floral development in the spring and avoid spring frost. The goals of this study were first, to determine the effect of season of wood development on flower bud frost tolerance and secondly, to determine the effect of wood type and time of flower bud formation on bloom and ripening patterns.

MATERIALS AND METHODS

Frost Tolerance. Shoots of 'Tifblue' and 'Delite' blueberry plants were tagged by season of growth flush - current season spring or late summer/fall during the fall of 1988. Following a 14°F freeze on 3 February shoots from each growth flush were collected. Thirty flower buds from five shoots per plant per growth flush were examined for dead ovaries. There were 6 whole plant reps for each growth flush period. Flower buds surviving the Feb. freeze were later evaluated for their resistance to a 28° frost occurring on 23 March when flowers were at stage 6 (6=corollas completely open) (Spiers, 1978). Fifty flowers per rep for each growth flush type were examined. Cold damage to shoots following the March frost were also rated 1-5 (1=no damage, 3=25% dead shoot tips, 5=dead plant) on 27 March. There were 4 whole plant replications.

Fruit Ripening. On 18 Mar. 'Tifblue' blueberry wood was identified as to season of growth - spring growth off old-wood, spring growth from 1-year-old wood or fall growth. Four hundred flower buds were identified as to stage of development (Figure 1) for each wood type on five whole plant reps. Mean stage of flower development was determined for each type of wood. On 24 June and 11 July all fruit

were removed from 5 shoots of each wood type. These dates correspond to early and midseason harvests, respectively. Fruit were ranked 1-6 by color (1=green, 2=yellow, 3=red/yellow, 4=red, 5=purple, 6=blue). Fruit weight, mean color as determined by a weighted average and percent mature fruit were determined across all fruit harvested. Soluble solids and fruit size was determined for mature, blue fruit.

RESULTS AND DISCUSSION

Frost Tolerance. 'Delite' flower buds on both spring and fall growth were much less cold tolerant than 'Tifblue' (Table 1). Season of wood growth greatly affected cold damage on 'Tifblue' plants. Floral buds produced on fall growth were much more freeze and frost tolerant than buds initiated on spring growth. The decrease in cold injury to 'Delite' flowers on fall wood versus spring wood, while significant, was not enough to assure an adequate crop. The late spring frost on 23 March killed most of the remaining flower buds on 'Delite', but did not greatly reduce the remaining crop on 'Tifblue'. Stem damage was much less severe on 'Tifblue' than 'Delite' (Figure 2). For both cultivars, fall growth was more cold tolerant than spring growth.

Percent fruit set on fall growth was similar for both cultivars and only slightly lower for 'Tifblue' blossoms on spring growth (Figure 3). There was no fruit set on 'Delite' spring growth since all flowers had been previously killed.

Fruit ripening. Floral buds formed on both spring wood types were earlier to develop in the spring than those on fall growth (Figure 4). On 18 March flowers on spring growth had reached stage 6 or greater (corollas completely open) while flowers on fall growth were approaching stage 4 (individual flowers distinguishable, bud scales abscised).

When fruit were harvested in June, fruit formed on spring growth off of old wood had lower sugar content, and were smaller and later maturing than fruit formed on growth from new wood with 39 versus 55-60% mature (Table 2). There were no differences between fruit removed from spring - new and fall wood. At the second harvest date, corresponding to a midseason harvest, there were no differences in fruit ripening on all wood types, with the exception of mean fruit size.

Flower buds formed on fall wood exhibit a delay in full bloom (1-4 weeks) compared to buds formed on spring wood. The decrease in cold damage on fall wood may be associated with this delay in flower bud development. Data on ovary cold

injury was assessed for buds at the same stage of development on both dates. It is probable that there was enough undetectable differences in bud development to account for hardiness differences. Cultivar tolerance to cold injury should also be considered. Previous experience has shown 'Delite' to be temperature sensitive (Clark, 1984; Lipe, 1981).

There is no difference in ripening date between fruit borne on fall wood and fruit borne on spring - new wood, although flower buds formed on fall wood are later blooming. Fruit formed on spring - old wood tend to be later ripening and smaller sized. This is most likely a function of vigor of the wood type, rather than bud physiology.

CONCLUSION

These data indicate that postharvest pruning to encourage production of fall growth may be a means of frost damage avoidance. Pruning may be used to enhance fruit quality by maintaining vigorous, healthy growth. Cultivar and plant vigor must be considered if hedge pruning is to be incorporated into orchard management. Only plants with sufficient vigor and growth to achieve adequate late summer/early fall growth prior to the onset of dormancy would benefit from this production practice.

LITERATURE CITED

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Table 1. Cold injury damage of rabbiteye blueberries as a function of cultivar and season of growth.

Cultivar	Season of wood growth	Freeze damage	Frost damage	
		% Dead ovaries	% Dead ovaries	Stem damage
Tifblue	Spring	50	5	1.25
	Fall	28	0	1.0
Delite	Spring	99	100	3.0
	Fall	89	91	1.9

Table 2. Season of wood development effect on fruit ripening patterns at two harvest dates.

Wood type	6/24					7/11				
	All fruit			Mature fruit		All fruit			Mature fruit	
	% Mature	% Color	% Size (g/berry)	SS	Size (g/berry)	% Mature	% Color	% Size (g/berry)	SS	Size (g/berry)
Old	39.0 b	4.43 b	0.87 b	11.72 b	1.31 b	60.3	5.10	1.10 b	14.50	1.46
Spring New	55.4 a	5.01 a	1.12 a	14.66 a	1.52 a	75.0	5.46	1.26 a	15.18	1.51
Fall	59.6 a	5.08 a	1.17 a	15.56 a	1.49 a	61.4	5.16	1.16 ab	15.02	1.50

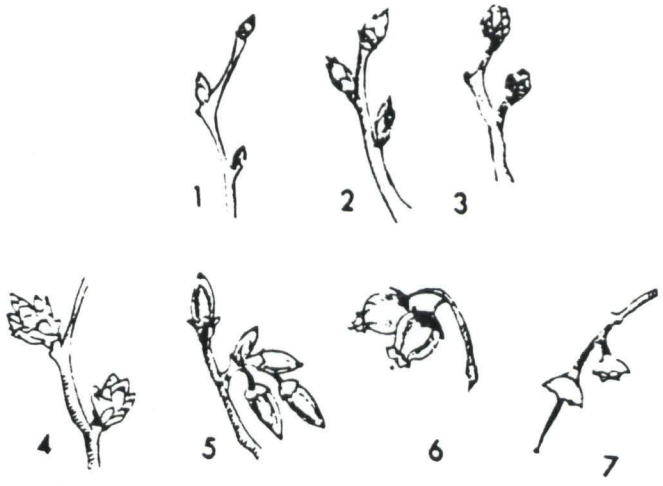

Figure 1. Stages of flower-bud development in rabbiteye blueberry.

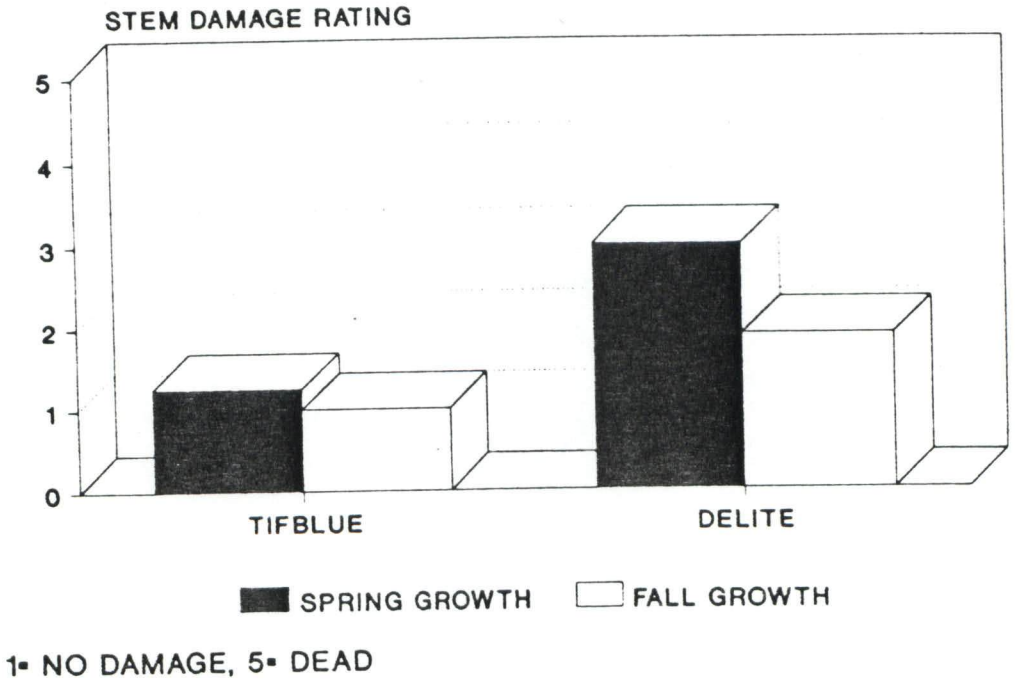

Figure 2. Stem damage as a function of cultivar and season of wood growth.

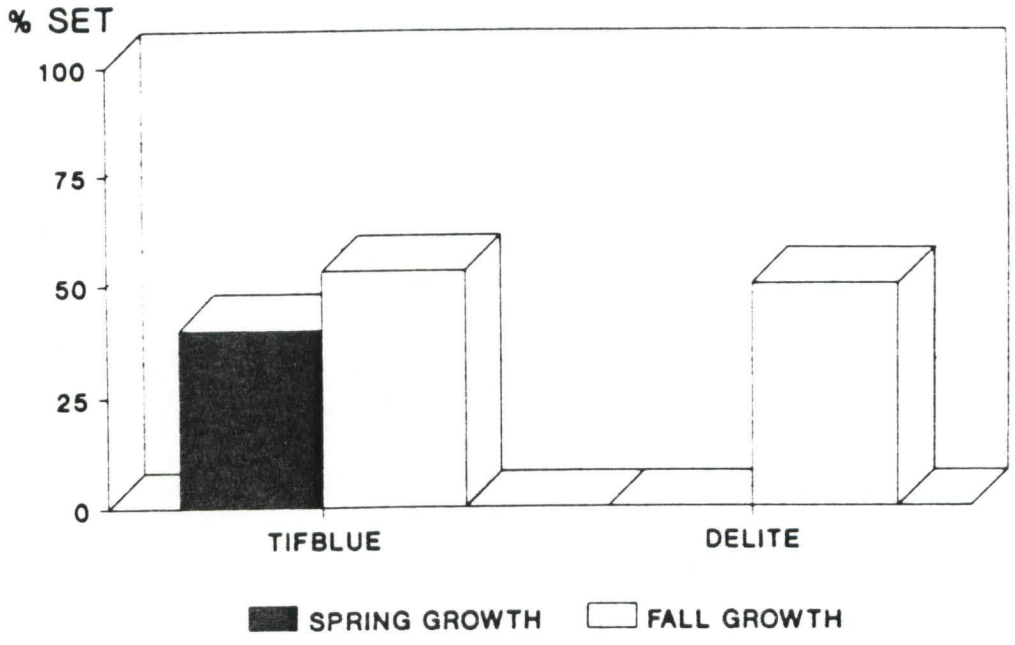

Figure 3. Percent fruit set as a function of cultivar and season of wood growth.

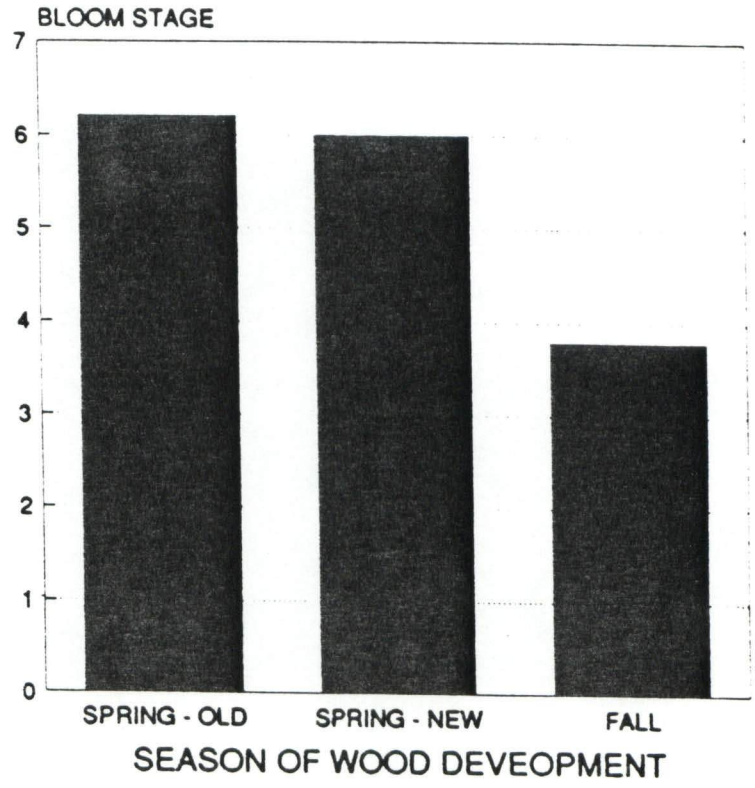

Figure 4. Season of wood development effect on stage of flowering.