

the effective compound in Ferriplus 138 is sufficient to give similar longevity as Sequestrene Fe 138; however, grower use and experience should be the most critical judge of cost effectiveness. Presently, Sequestrene Fe 138 retails at approximately \$12.00/lb., whereas the Ferriplus 138 should retail at between \$7.50 and \$8.00/lb. Hopefully, with the new availability of superior iron products on the market, competition will keep the cost of iron nutrition maintenance to a minimum.

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PRUNING, YIELD AND MORPHOLOGY OF 3 RABBITEYE BLUEBERRY CULTIVARS IN FLORIDA¹

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Abstract. 'Woodard', 'Bluegem' and 'Tifblue' rabbiteye blueberry (*Vaccinium ashei* Reade) plants were pruned beginning 7 yr after planting using 4 methods: 1) mechanical topping at 4.5 ft immediately after harvest 2) mechanical topping alternate halves of the bush at 4.5 ft immediately after harvest, 3) selective hand-pruning immediately after harvest, 4) selective hand pruning during dormancy (January). Topping alternate halves produced highest yields in most years for 'Woodard' and 'Bluegem', while other treatments were similar except in 1981 when winter hand-pruning reduced yields. Pruning treatment had little effect on yields of 'Tifblue', although topping at 4.5 ft encouraged excessive vegetative growth. Hand-pruned bushes were more open and upright than mechanically pruned bushes for all cultivars. Fruit distribution was uniform for 'Woodard', greatest in the top two thirds of the bush for 'Bluegem' and lowest in the top one third for 'Tifblue'.

Pruning of bearing highbush blueberries is recommended to balance fruiting with vegetative growth and to stimulate production of new shoots (9). Low-growing shoots, old, nonproductive canes, and weak, twiggy growth are removed routinely by light pruning. Severe pruning generally

induces vigorous vegetative growth and lower production but increases berry size (3, 8). Burning is generally used instead of pruning to regulate growth and fruiting of low-bush blueberry as well as to control weed growth (4, 5, 10).

Rabbiteye blueberry is more vigorous than highbush or lowbush blueberry. Young bushes require little pruning, but bearing plants may require routine removal of deadwood and topping to limit height (1, 2, 7). Pruning methods vary considerably with grower, location and method of harvest (hand or mechanical). Small operations generally prune bushes by hand while larger operations use mechanical methods.

No data is available on pruning of rabbiteye blueberry in Florida. The objective of this study was to compare the effects of 4 commercially used pruning methods on yield, morphology and fruit distribution of 'Woodard', 'Bluegem' and 'Tifblue' rabbiteye blueberries. Cultivar response to pruning treatment was also studied.

Materials and Methods

Forty bushes each of 'Woodard', 'Bluegem' and 'Tifblue' rabbiteye blueberries were selected following harvest in July, 1978. Bushes were planted in 1971 at the University of Florida, Horticultural Unit 3.5 miles north of Gainesville at a 6 x 12 ft spacing. Plants had begun to form a hedgerow and were ca. 6 ft tall. Four pruning treatments were assigned in a completely randomized design with 10 single bush replications per treatment: 1) topping at 4.5 ft immediately following harvest (topping); 2) selective hand-pruning immediately after harvest (hand-summer); 3) selective hand-pruning during January (hand-winter); 4) topping one half of the bush at 4.5 ft immediately following harvest in al-

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ternate years. Hand-pruning consisted of removing one of 5 to 6 major canes at the base, topping at about 6 ft, and selectively thinning twiggy or dead shoots from the interior of the bush. Cuts were made with loppers, saws, or hand shears. Pruning time averaged 7 to 10 min per bush. Topping of the entire bush or alternate halves was done nonselectively within 1 to 2 min using pneumatic saws.

Bushes were harvested in 1979, 1981, and 1982 by mechanically shaking berries into catch frames. Three bushes from each cultivar and treatment were separated into top, middle and lower thirds by dividing the vertical distance from the ground to the highest shoot into 3 equal sections. Bushes were hand harvested in 1983 to determine pruning effects on fruit distribution. A cup sample was removed following harvest and average berry size determined in 1981.

Results and Discussion

Yields. The effect of pruning treatments on yields of 'Woodard', 'Bluegem' and 'Tifblue' rabbiteye blueberries varied with season and cultivar. Topping alternate halves of the bush produced the highest yields for 'Bluegem' in moderate crop years 1979, 1981 and 1983, with other treatments being similar except in 1981 when hand-winter pruning reduced yields (Table 1). Pruning had no effect in 1982 when yields of all treatments were high.

Table 1. Pruning and yields of 'Bluegem' rabbiteye blueberry.

Treatment	Yield (lb./bush) ^z				Treatment mean
	1979	1981	1982	1983	
Topping (4.5 ft)	16.5	11.0	20.2	9.0	14.3
Hand-pruning (summer)	18.5	9.2	22.0	14.7	16.0
Hand-pruning (winter)	16.3	5.5	19.8	11.9	13.4
Topping alternate halves (4.5 ft)	22.4	11.4	21.6	21.1	19.1
SE of the mean	3.1	1.8	2.2	1.5	

^zMean of 10 bushes/treatment ± S.E. of the mean.

'Woodard' responded to pruning in a similar manner. Yields of alternate topped bushes was numerically greatest in all years but statistically highest in 1983 only (Table 2). Topping in 1978 reduced yields in 1979 compared with other treatments which had comparable yields. Hand-pruning in winter also reduced yields in 1981 for 'Woodard', and pruning did not affect yields in 1982.

Table 2. Pruning and yields of 'Woodard' rabbiteye blueberry.

Treatment	Yield (lb./bush) ^z				Treatment mean
	1979	1981	1982	1983	
Topping (4.5 ft)	10.8	9.2	19.8	13.6	13.4
Hand-pruning (summer)	14.3	8.6	18.7	15.0	14.1
Hand-pruning (winter)	15.2	6.4	18.7	11.7	13.0
Topping alternate halves (4.5 ft)	15.2	10.3	23.1	21.3	17.4
SE of the mean	2.2	0.7	1.8	2.0	

^zMean of 10 bushes/treatment ± S.E. of the mean.

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Pruning treatments had little effect on 'Tifblue' yields in any season, except in 1979 when topping reduced yields (Table 3).

Table 3. Pruning and yields of 'Tifblue' rabbiteye blueberry.

Treatment	Yield (lb./bush) ^z				Treatment mean
	1979	1981	1982	1983	
Topping (4.5 ft)	7.7	11.2	10.1	11.9	10.1
Hand-pruning (summer)	13.9	10.6	8.6	8.1	10.3
Hand-pruning (winter)	16.7	11.9	10.1	9.2	12.1
Topping alternate halves (4.5 ft)	11.2	12.1	8.8	11.4	11.0
SE of the mean	2.9	2.9	1.8	2.4	

^zMean of 10 bushes/treatment ± S.E. of the mean.

Morphology and fruit distribution. Pruning altered bush morphology dramatically (Fig. 1). Summer and winter hand-pruned bushes were more upright, open and taller than mechanically topped bushes. Alternate topped bushes were tall and bushy on one side and short and compact on the other. The mechanically pruned bushes had many shoots originating from the pruning cuts, contained many dead twigs, and were less attractive than hand-pruned bushes.

Pruning treatment had a less dramatic effect on fruit distribution than on morphology; however, cultivar response was again important. Fruit were evenly distributed in 'Woodard' for all treatments except topping at 4.5 ft which produced less fruit in the top one-third (Table 4). In contrast, 'Bluegem' yields tended to be greatest in the top and mid thirds and considerably less in the lowest one third, except for topped bushes where fruit distribution was uniform (Table 5). 'Bluegem' is more upright and vigorous than 'Woodard' and mature bushes tend to bear poorly in lower portions of the canopy.

Fruiting of 'Tifblue' varied with pruning treatment and location. Summer and winter hand-pruned bushes produced

Table 4. Pruning and fruit distribution for 'Woodard' rabbiteye blueberry, 1983.

Treatment	Yield (lb./bush) ^z		
	Top	Middle	Low
Topping (4.5 ft)	3.7 ± 2.0	5.9 ± 1.1	7.3 ± 2.0
Hand-pruning (summer)	2.9 ± 2.0	4.6 ± 1.1	4.0 ± 1.5
Hand-pruning (winter)	4.6 ± 2.9	4.8 ± 3.1	3.7 ± 1.7
Topping alternate halves (4.5 ft)	7.3 ± 0.6	8.3 ± 0.4	7.0 ± 0.0

^zMean of 3 bushes ± SD.

Table 5. Pruning and fruit distribution for 'Bluegem' rabbiteye blueberry, 1983.

Treatment	Yield (lb./bush) ^z		
	Top	Middle	Low
Topping (4.5 ft)	3.5 ± 0.9	3.7 ± 0.6	3.7 ± 2.2
Hand-pruning (summer)	5.7 ± 3.3	8.8 ± 3.3	2.4 ± 2.4
Hand-pruning (winter)	5.1 ± 2.0	4.4 ± 1.1	2.4 ± 2.2
Topping alternate halves (4.5 ft)	9.7 ± 4.4	7.5 ± 3.7	3.7 ± 1.3

^zMean of 3 bushes ± SD.

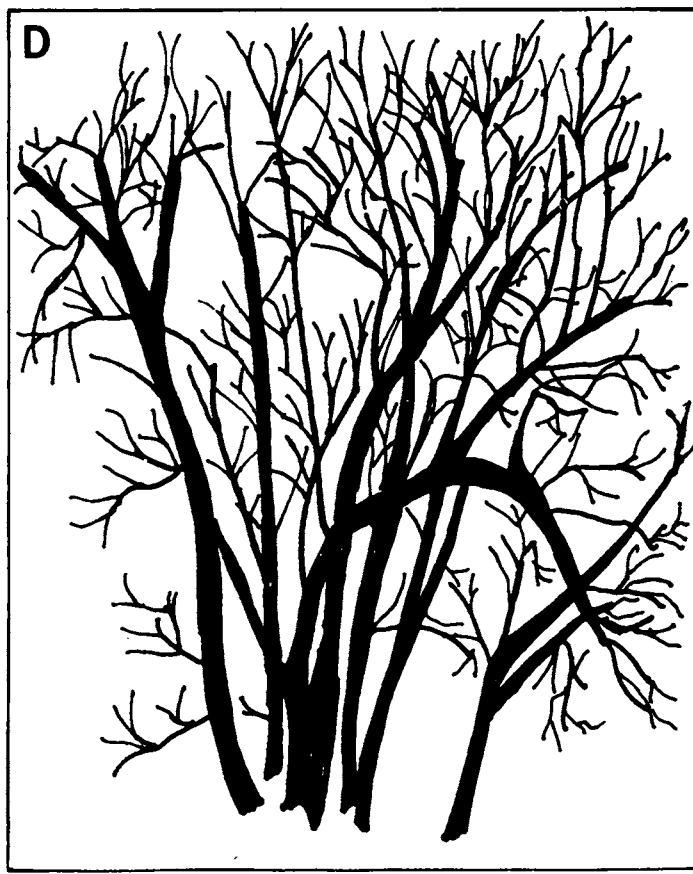
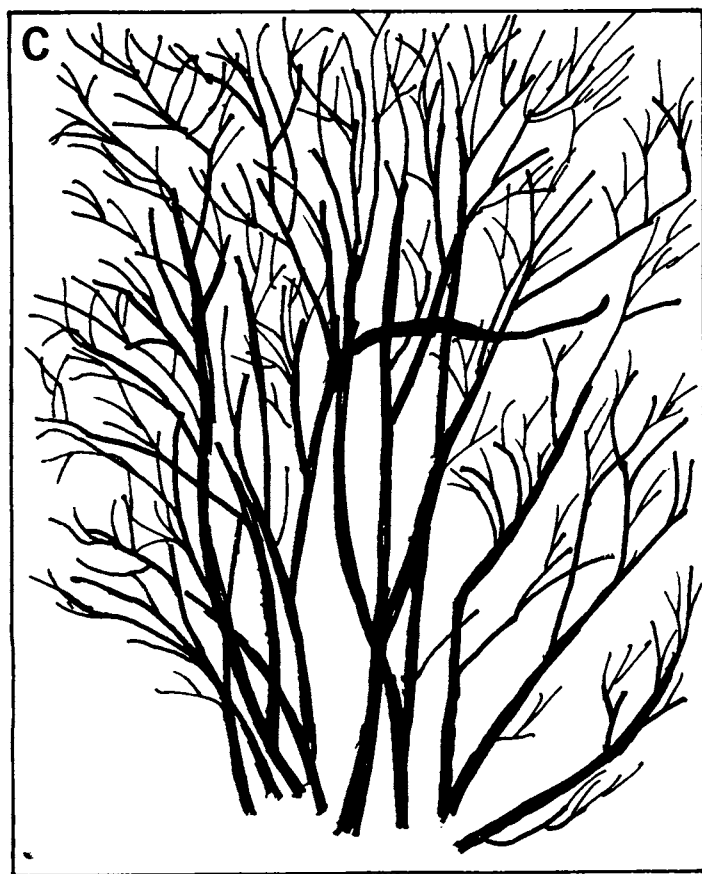
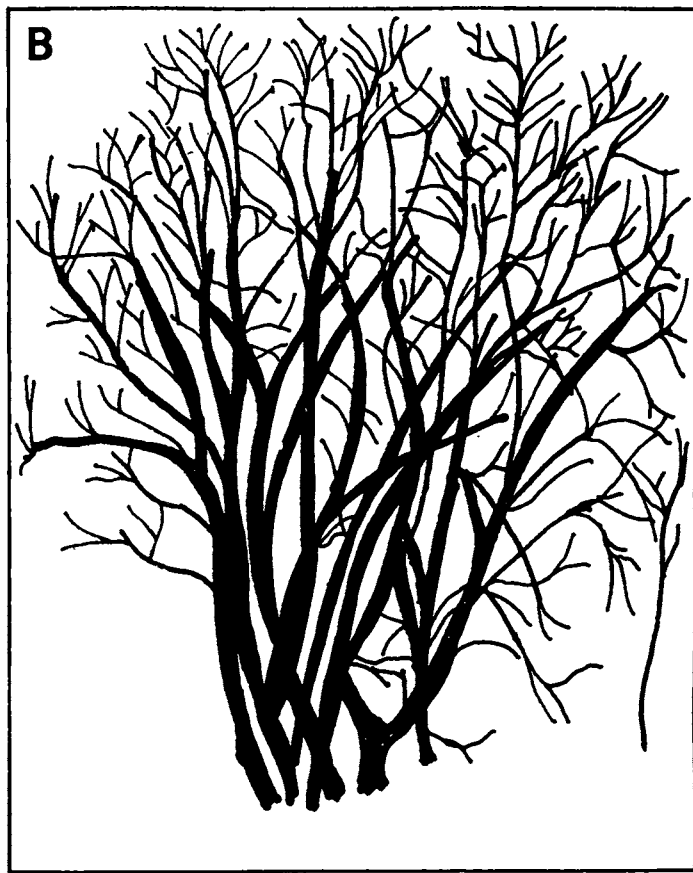
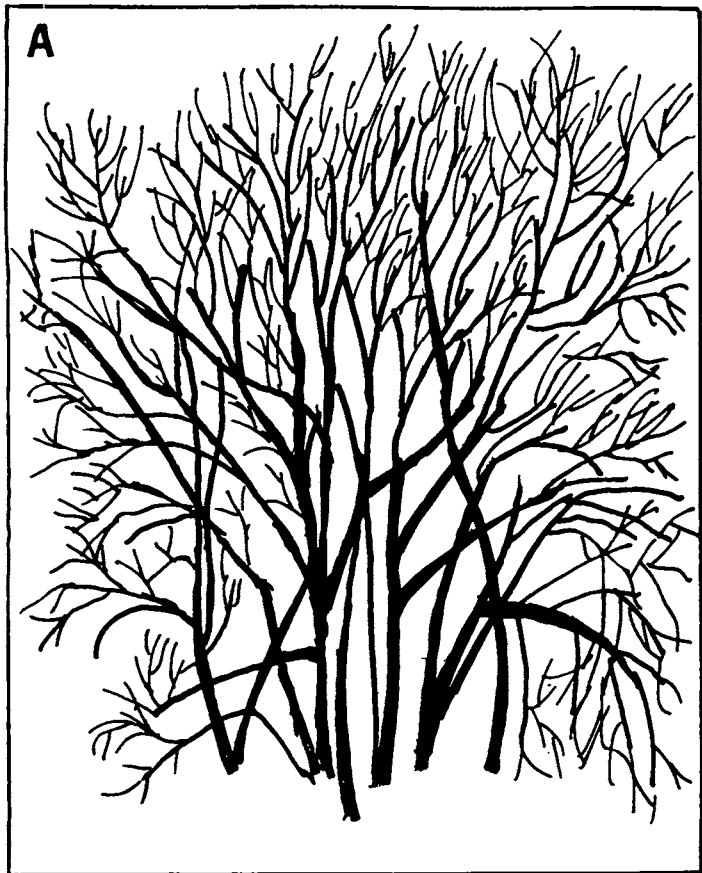


Fig. 1. Pruning effects on the morphology of 'Bluegem' rabbiteye blueberry. A) Topping at 4.5 ft after harvest B) Hand-pruning after harvest C) Hand-pruning (January) D) Topping alternate halves after harvest. Drawings were made from photographs of representative bushes taken in February, 1983.

less fruit in the upper one-third of the bush, while fruit distribution was fairly uniform in other treatments (Table 6). These data are slightly misleading, however, since 'Tifblue' is a much larger bush than 'Woodard' or 'Bluegem'. Consequently, yield per section on a volume basis is much less for 'Tifblue' than for the other cultivars. Topping of vigorous cultivars like 'Tifblue' encourages vigorous, upright vegetative growth. Generally, the more severe the pruning, the more vigorous the vegetative regrowth and the greater the reduction in yield. Similar effects of pruning on growth and yields have been observed for highbush blueberry (8).

Table 6. Pruning and fruit distribution for 'Tifblue' rabbiteye blueberry, 1983.

Treatment	Yield (lb./bush) ^z		
	Top	Middle	Low
Topping (4.5 ft)	4.2 ± 4.2	4.6 ± 4.2	3.7 ± 1.1
Hand-pruning (summer)	2.2 ± 0.6	3.7 ± 1.5	5.5 ± 2.2
Hand-pruning (winter)	2.4 ± 0.6	4.0 ± 1.1	4.8 ± 0.9
Topping alternate halves (4.5 ft)	3.7 ± 1.1	3.7 ± 0.4	4.0 ± 0.6

^zMean of 3 bushes ± SD.

Cultivar, economics and market should dictate the best pruning method for rabbiteye blueberry. Alternate topping at 4.5 ft and topping mechanically are the least costly methods particularly for a large operation and produce acceptable yields for 'Woodard' and 'Bluegem'. Topping, however, should not be used for 'Tifblue' because it encourages excessive vegetative growth which makes harvesting extremely difficult. Mechanical pruning does not allow for removal of old, nonproductive canes and may need to be coupled with some hand-pruning in order to rejuvenate older bushes.

Hand-pruning has no yield advantages over mechanical pruning in most years and may actually reduce yields (hand-winter) if not carefully supervised. Nevertheless, hand-pruning produces an aesthetically pleasing bush which is easily harvestable particularly for U-Pick operations. It requires 7-10 min per bush and may be too costly for large blueberry operations.

There were no differences in fruit size due to pruning treatment in 1981. Berry weight averaged 0.045, 0.044, and 0.042 oz for 'Bluegem', 'Woodard' and 'Tifblue', respectively. Fruit quality was examined in 1979 only but also was unaffected by pruning treatment. Similarly, Mainland and Rohrbach (6) observed no effect of pruning treatment on quality or size or highbush blueberry in North Carolina.

Average yields per bush were 15.6, 14.5, and 11.0 lb. per bush for 'Bluegem', 'Woodard' and 'Tifblue', respectively. This translates to 9372, 8712, and 6600 lb. per acre. 'Tifblue' yields were considerably lower than and tended to fluctuate less than those of 'Woodard' and 'Bluegem' in years with less than 400 hr of chilling (hr <45°F). Nevertheless, in 1978 the Gainesville area received over 800 hr of chilling and 'Tifblue' yielded 30 to 35 lb. per bush. These data support recommendations that 'Tifblue' not be planted in areas receiving less than 650 hr chilling.

Acknowledgements

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POOR FRUIT SET ON RABBITEYE BLUEBERRIES AFTER MILD WINTERS: POSSIBLE CAUSES AND REMEDIES¹

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Abstract. Rabbiteye blueberries (*Vaccinium ashei* Reade) frequently have low percent fruit set in north central peninsular Florida. Flowering may be heavy, but high percentages of the young fruit abscise, usually within 6 wk after anthesis. Percent fruit set appears to be reduced by mild winters, in-

appropriate choice of cultivars, failure to maximize cross-pollination opportunities, and use of cultural practices that promote excessive vigor. Solution of the problem of poor fruit set through development of new cultivars and cultural procedures would allow extension of rabbiteye blueberry cultivation farther south in peninsular Florida.

Blueberry production is an expanding horticultural enterprise in north Florida. For the past 20 yr, and particularly during the last decade, many small (2 to 5 acre) blueberry plantations have been established in Florida from Ocala northward to the state line and westward through the panhandle. Most of the fruit from these small plantations has gone to the pick-your-own market. During the past few

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