

INDUCTION OF LATERAL BRANCHING IN YOUNG CHERRY TREES

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SUMMARY

Experiments were conducted over 2 years to assess ways of increasing branch production in young sweet cherry (*Prunus avium*) trees. A proprietary mixture of plant growth regulators containing gibberellic acids 4 + 7 and 6-benzyladenine (GAB) was tested on three scions on three rootstocks. Treatments assessed included concentration, timing and method of application and the interaction with pruning. There was no interaction between scion/rootstock combinations and GAB application. The best treatment was an application of 5000 ppm in acrylic paint at bud burst. Tree pruning and different methods of application had variable responses, depending on the age of the trees.

INTRODUCTION

Sweet cherry trees exhibit strong apical dominance and frequently branch poorly in their first year. This results in large trees which take several years to commence production and then carry fruit high in the tree.

Rain on cherries, near harvest, causes the fruit to split, rendering it unacceptable for export and of reduced value on the local market. Rain often occurs in New Zealand near cherry harvest time. To reduce the risk of rain splitting the cherries, some orchardists cover trees with plastic rain shelters, at considerable cost. Techniques which could control tree vigour and induce branching low to the ground would substantially reduce these costs.

Paclobutrazol is very effective at controlling the extension growth of cherry trees and at inducing early fruiting (Shearing *et al* 1986). However, a good branch structure is desirable before extension growth is controlled. A mixture of gibberellic acids 4 + 7 and 6-benzyladenine (GAB) marketed as Promalin, has been shown to induce branching and increase branch angle in cherry trees (Cody *et al* 1985; Veinbrants and Miller 1981). GAB has proved effective when applied to either first year wood at bud swell (Veinbrants and Miller 1981) or to first year growth from dormant buds during the growing season (Cody *et al* 1985).

This paper reports on trials conducted over 2 years at the Hawke's Bay Agricultural Research Centre, testing methods to induce branching in sweet cherry trees.

METHODS

All treatments were replicated four times on each cultivar tested. The paint used for GAB application was Taubmans Blue All-Weather Gloss Acrylic.

Application to single rod 1-year-old trees

In 1987, GAB was applied to 1-year-old wood of three cultivar/rootstock combinations of 1-year-old cherries, Bing on Colt, Bing on Mahaleb and Dawson on Colt. Details of the treatments applied are shown in Table 1. GAB was applied to completely cover 200 mm of stem about 1 m above the ground or to cut surface.

Trees were not pruned during the growing season and branches were counted, by location on the trunk in relation to the treated area, during the winter.

The more promising treatments using GAB 5000 ppm in paint plus Tween 20 at bud swell were repeated and a double application tested on six cultivars in 1988 (Table 2). 'Bandage' applications were also tested on Rainier on Mazzard (Table 2). Bandages

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TABLE 1: Mean number of branches induced by various techniques on three cherry cultivars (Bing on Colt, Bing on Mahaleb, Dawson on Colt) treated as single rod 1-year-old trees in 1987.

GAB conc. (ppm)	Applic. method	Carrier	Additive (0.2%)	Time	Mean no. of branches (SE)		
					Treated area	Below	Above
Trees Intact							
nil	—	—	—		0.9 (0.43)	1.2 (0.32)	5.2 (0.81)
5000	painted	p	Tw	budswell	2.4 (0.53)	1.2 (0.42)	4.0 (0.41)
500	painted	p	Tw	budswell	1.3 (0.41)	1.4 (0.40)	4.5 (0.78)
5000	painted	p	Tw	greentip	2.5 (0.40)	1.3 (0.39)	4.8 (0.66)
5000	sprayed	w	Tw	budswell	2.0 (0.55)	0.8 (0.34)	5.0 (0.71)
5000	sprayed	w	Sil	budswell	1.5 (0.35)	0.8 (0.29)	5.0 (0.60)
Trees Topped 1 m above ground, cut painted with 'Pruntech' before treatment.							
nil	—	—	—		1.6 (0.54)	0.9 (0.34)	5.0 (0.48)
5000	on stem	p	Tw	budswell	3.8 (0.75)	0.7 (0.31)	4.6 (0.26)
5000	on cut	p	Tw	budswell	1.5 (0.34)	1.8 (0.45)	5.0 (0.22)
5000	on cut	w	Tw	budswell	1.1 (0.53)	1.6 (0.43)	4.7 (0.30)

p = paint, w = water, Tw = Tween 20, Sil = Silwet L-77

TABLE 2: Mean number of branches induced in six cherry cultivars (Bing on Colt, Bing on Mazzard, Dawson on Colt, Dawson on Mazzard, Rainer on Mazzard, Rainier on Mahaleb) treated as single rod 1-year-old trees in 1988.

Treatment GAB ppm + Tween 20	Mean number of branches (SE)			
	All cultivars		Rainier on Mazzard	
	Treated Area	Below	Treated Area	Below
Untreated	0.6 (0.17)	1.7 (0.36)	0.0 (-)	0.3 (0.25)
5000 paint	5.2 (0.32)	1.1 (0.31)	4.8 (0.85)	0.3 (0.25)
5000 paint, tree topped ¹	5.6 (0.41)	1.9 (0.39)	4.8 (0.48)	2.8 (1.03)
5000 paint, applied twice ²	7.5 (0.45)	1.3 (0.33)		
5000 water, bandage			2.0 (0.71)	5.0 (1.41)
500 water, bandage			1.8 (0.75)	1.0 (0.41)

¹ Trees topped at 1 m just before treatment.

² Second application applied immediately above first application 3 weeks later.

were made from 'Hygenex' paper towels, cut in half and soaked in appropriate concentrations of GAB plus Tween 20. The bandages were wrapped round the trunks and covered with 'Glad-Wrap' for 2 weeks.

Trees were pruned during the growing season to remove all branches over 200 mm long, except for four in the treated area. The numbers of branches removed, and locations, were recorded and added to those remaining to give total branch number.

Application to 1 and 2-year-old branched trees (Table 3)

In 1988, 1-year-old branched trees were pruned, over winter, to a maximum of four lateral branches and one leader. Two-year-old branched trees were pruned to a maximum of four branches on a lower tier (previous year's treated area) and four on the upper natural tier.

Trees that had been topped in year 1 were pruned to one tier and one new leader. Treatments were allocated at random within each set. The 1-year-old laterals were painted with GAB 5000 ppm in acrylic paint plus Tween 20, 500 mm out from the trunk, and the new leader 1 m above the top branch tier. GAB was applied to a 200 mm section of stem. Some laterals and leaders were also topped above the treated area. Trees were not pruned during the season and branches were counted in the winter.

TABLE 3: Mean number of branches induced on leader and laterals of 1 and 2-year-old cherry trees.

Treatment GAB 5000 ppm plus Tween 20 in acrylic paint	Mean number of branches (SE)				
	Treated area	Main trunk		Lower tier Treated area	Upper tier Treated area
		Below	Above		
<i>2-yr-old trees, branched 2nd year¹</i>					
Untreated	0.6 (0.64)	3.9	4.3	0.5 (0.42)	0.1 (0.08)
Paint leader & laterals	4.6 (0.68)	1.3	5.1	2.1 (0.43)	2.0 (0.49)
		NS	NS		
<i>2-yr-old trees, topped year 1², 1 tier laterals + new leader</i>					
Untreated	0.3 (0.13)	1.1	8.9 (0.67)	0.7 (0.22)	
Cut/paint leader & laterals	3.6 (0.78)	1.5	4.3 (0.19)	3.8 (0.48)	
Paint leader only	2.7 (0.54)	0.7	7.2 (0.47)	0.5 (0.20)	
		NS			
<i>1-yr-old trees, branched 1st year³</i>					
Untreated	0.6 (0.26)	2.9	5.5	0.4 (0.20)	
Paint leader & laterals	5.2 (0.54)	1.8	4.0	3.0 (0.39)	
Cut/paint leader & laterals	4.8 (0.48)	1.8	3.6	3.1 (0.34)	
		NS	NS		

¹ Four cultivars: Bing on Colt, Bing on Mahaleb, Dawson on Colt, Dawson on Mahaleb.

² Three cultivars: Bing on Colt, Bing on Mahaleb, Dawson on Colt.

³ Three cultivars: Bing on Mahaleb, Dawson on Mahaleb, Rainier on Mahaleb.

Application to 'dormant bud' trees (Table 4)

In a dormant-bud trial first year growth from the buds was treated by spraying GAB 1000 ppm or 500 ppm in water plus Tween 20 or Silwet L-77 to wet the top 200 mm of stem and leaves when the stem reached 0.5 m or 1 m in height above the graft. Tipping (nipping out the apical bud) or topping (removal of the top 200 mm) were also tested both alone and in conjunction with GAB treatments. Trees were not pruned during the growing season and branches were counted in the winter.

RESULTS

There were significant differences in branch number between cherry cultivars, both scion and rootstock, but no significant interactions between cultivars and treatments. The results presented, therefore, are the means for all cultivars used for each treatment comparison.

Application to single rod 1-year-old trees

In 1987, GAB at 5000 ppm plus Tween 20 produced significantly more branches in the treated area when applied to the stem, regardless of application method and timing (Table 1). Neither the lower concentration of 500 ppm nor Silwet L-77 as an additive increased the number of branches significantly. Application of GAB to the cut surface, had no effect on branch production. Topping and stem painting slightly increased branch number over stem painting alone. Treatments had no effect on branch number above or below the treated area.

In 1988, GAB at 5000 ppm in paint plus Tween 20 produced a large increase in branch number in the treated area but topping did not increase this effect (Table 2). A second application 3 weeks after the first treatment produced a further significant response in branch number. Again there was no effect above or below the treated area. The 'bandage' application of GAB caused some bud death under the bandage and had no effect on branch number in the treated area. However, 5000 ppm produced a significant response below the treated area (Table 2).

Application to 1 and 2-year-old branched trees

Application of GAB 5000 ppm in paint plus Tween 20 to 1-year-old wood of leaders and laterals of 1 and 2-year-old trees increased the branch number on leaders

TABLE 4: Mean number of branches induced on three cultivars of cherries (Bing on Mahaleb, Dawson on Mahaleb, Rainier on Mahaleb) in first year from dormant buds.

Treatments	Tree height when treated (mm)	Mean number of branches (SE)
Untreated		1.6 (0.33)
GAB 1000 ppm in water + Tween 20	500	3.4 (0.60)
GAB 500 ppm in water + Tween 20	500	2.3 (0.82)
GAB 1000 ppm in water + Silwet-L77	500	1.6 (0.65)
GAB 1000 ppm in water + Tween 20	1000	2.4 (0.74)
Tipped	750	3.4 (0.74)
Topped	850	4.0 (0.81)
Tipped, GAB 1000 ppm in water + Tween 20	750	3.8 (0.55)
Topped, GAB 1000 ppm in water + Tween 20	850	6.7 (0.47)
Topped, GAB 1000 ppm in water + Tween 20*	850	4.3 (0.66)

*Cut surface only

and laterals wherever application was made (Table 3). There was no additional response in branch number from cutting laterals or leaders.

Application to 'dormant bud' trees

Spray applications of GAB at 1000 ppm plus Tween 20 to foliage and stems during active growth from the buds produced a significant increase in branch numbers (Table 4). The lower concentration of GAB (500 ppm) and later application did not induce significant responses, nor did Silwet L-77 as an additive. Tipping and topping produced responses similar to GAB alone. The combination of GAB with tipping and topping showed an accumulative effect only with topping and GAB applied to leaf and stem.

DISCUSSION

Our results show GAB application to the stem can enhance branch production in cherry trees. This agrees with earlier published work (Cody *et al* 1985; Miller 1983; Veinbrants and Miller 1981). A minimum of four branches per tier is considered desirable. Induction of more than four branches increases the opportunity to shape the tree by pruning. The ability of GAB to induce branches where required creates an opportunity to produce a compact tree which could be protected from rain at an economic cost.

Application in acrylic paint proved the most satisfactory treatment though spraying in water plus Tween 20 (Table 1) also had a significant effect. However, applications in a water soaked 'bandage' was ineffective, possibly due to physical damage to the buds while covered by wrapping (approximately 2 weeks). The higher concentration bandage treatment was the only treatment to have a significant effect on branch number below the treated area (Table 2). There was no evidence of run down from the bandage but damage to the covered buds may have allowed the lower buds to respond to the hormone uptake from the bandage. If this technique were to be used it should be applied above the region where branches are required.

Although bandages were easier to apply than paint, the painting technique is probably the most satisfactory application method and can be applied exactly where the branches are required. Miller (1983) claimed brown paint was more effective than white. Unfortunately his different coloured paints were also of different types. It may be that the *type* of paint used as a carrier is important.

Silwet L-77 as an alternative additive to Tween 20 proved ineffective in treatment of both 1-year-old and actively growing foliage and stems. The GAB mixture in paint or in water was taken up very readily by the cut surface of 1-year-old wood or new stems growing from dormant buds but such application had no effect on branching, indicating uptake has to be via the bark and not internally.

Topping of 1-year-old trees had little effect on branch number compared to GAB painted on the stems. Neither was cutting any advantage in enhancing lateral branching over GAB alone (Table 3). As tree shape was considered better, by visual observation, without topping this practice is not recommended. With first year growth from dormant buds both tipping and topping proved as useful as GAB in inducing branching while the maximum number of branches arose from topping and spraying. Topping at this stage did not affect the final shape of the tree, so this could be a useful treatment on first year growth.

The significant response of a number of sweet cherry cultivars to GAB indicates that GAB could provide a useful technique to alter tree shape. Application of 5000 ppm plus Tween 20 in paint could be used to stimulate branch development where required on 1-year-old wood, thus producing a relatively compact tree. Spray application to new growth from dormant buds could also be used but in young trees topping is equally useful and easier.

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