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Induction of lateral branches in red delicious apple

■A.H. PANDIT, K.M. BHAT[1], M.A. MIR[1] AND RIJOSH JOHN[2]

Associated Authors:
[1]Division of Pomology, S.K. University of Agricultural Sciences and Technology of Kashmir, Shalimar, SRINAGAR (J&K) INDIA
[2]Department of Packaging Sciences, Michigan State University, MICHIGAN, USA

Author for correspondence :
A.H. PANDIT
Department of Horticulture, Michigan State University, EAST LANSING, USA
Email : ashaqpandit@ gmail.com

Abstract : A study was carried out to determine the spontaneous growth and lateral branch induction of Red Delicious apple cultivar on MM-106 rootstock through application of various doses of benzyladenine alone; benzyladenine and pinching; and benzyladenine followed by application of gibberellin. There were significant differences between number of laterals, length of branches, total branch growth and greatest crotch angle in the plants treated by BA in the early spring followed by a dose of GA at 15 days interval as compared to control. Pinching treatments had no significant affect on branching.

Key words : *Malus domestica* Borkh, Growth regulators, Lateral branch, Nursery trees, Crotch angle

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The goal of the high density orchard systems is to ensure that the plants start bearing fruits as early as possible so as to overcome the extremely high investment in planting the orchard. The best possible way to ensure this is by planting of branched (feathered) trees in the orchard. Feathers provide sites for the first spur blossom clusters and also the primary limbs for future structure of the tree (Preston, 1968; Quinlan, 1980). Feathered trees as such on dwarfing series of rootstocks are high yielding than whips during the initial years of the orchard (Van Oosten, 1978; Quinlan, 1980) and the economic benefits can be significant (Ferree and Rhodus, 1987). The number of lateral branches provides the opportunity to have a good architectured plant for future. In addition, the height, location and angle of laterals provide early and higher yields (Barrit, 1992; Hrotko *et al.*, 1996). An ideal well feathered tree should have at least five branches of more than 20cm in length.

Lateral branches can be induced at desired height in the nursery by overcoming apical dominance. Various combinations of growth regulators and different timings of spray have been used overseas by scientists with fair amount of success (Werthein, 1978; Cody *et al.*, 1985; Popenoe and Barritt, 1988).

Most of the nurseries in Kashmir valley supply trees to orchadists as 'un-branched whips'. The predominant variety of the valley, 'Red Delicious', because of strong apical dominance forms only few laterals. For other varieties, such as Golden Delicious and Gala, the branches which are formed are of least value as they tend to develop on the trunk near to the ground. A number of new orchards in the valley are being planted on size controlling rootstocks and as such the present study to compare several methods and combinations of nursery treatments to induce lateral branches was conducted to enhance the profitability of the high density orcharding.

RESEARCH METHODS

The experiment was conducted on the pre-dominant apple variety of the valley 'Red Delicious' on MM-106 dwarfing apple rootstock in the experimental plots of the Division of Pomology, S.K. University of Agricultural Sciences and Technology of Kashmir, Shalimar, India. The soil profile is clay and loamy soil.

The rootstocks were planted in early spring of 2006 and were planted at 1.0x0.1m spacing. Uniform 1 year

old rootstocks were selected for the experiment. The rootstocks were budded (T budding method) at the height of 10cm above ground level. The experiment was planned as Randomized Block Design with each treatment represented by 10 trees and replicated three times. Pests, diseases, weed control and fertilizer applications were managed as required. Control trees were usually un-branched.

Treatments applied to each cultivar-rootstock combination were as follows: (1) BA@200ppm alone; (2) BA@400ppm alone; (3) BA@200ppm with pinching; (4) BA@400ppm with pinching; (5) BA@200ppm followed by a GA@100ppm spray 15 days later; (6) BA@ 400 ppm followed by a GA@100ppm spray 15 days later; (7) control (un-sprayed).

At the end of the growing season (December), tree height, trunk diameter (10cm above the graft union), branch number, individual branch length and crotch angle (angle between trunk and branch) were recorded for all the trees in the experiment.

RESEARCH FINDINGS AND DISCUSSION

There was a statistically significant difference for the number of laterals, average length of laterals and crotch angle among various treatments tried. Both the growth regulators induced more number of lateral branches. Pinching seemed to have little or no effect on the number of laterals. The highest number of laterals (>20cm) was obtained from the treatment combination of BA@400ppm + GA@100ppm (3.08) which was followed by BA@200ppm + GA@100ppm. The lowest number of laterals was observed in un-treated plants (Control) (Table 1). It appears that BA + GA could provide the major stimulus for branch production which is in line with some previous findings (William and Stahly, 1968; Render and Carpenter, 1972). BA applied after bloom with followed by application of GA 15 days latter-on induced a very healthy branching response. Red Delicious, which naturally produces few, if any branches in the nursery, produced the good number of branches after the BA + GA application.

Growth regulators seemed to decrease the length of the laterals in all the treatments. However, pinching showed minimal effect on the length of the laterals. The average length of laterals ranged from 21.05 (BA@200ppm and BA@200ppm + Pinching) to 30.14cm (Un-treated). Total branch growth was consistently greater for both the BA treatments alone than un-treated control. Pinching had generally little effect on total growth. The BA alone treatments were the only treatments to induce more than five long branches (>20cm). The combination of BA and GA produced greater number of longer branches than with pinching. As the branches are formed, they need to achieve desirable growth. Application of BA or BA + GA to orchards after bloom (Elfving, 1984; Miller and Eldridge, 1986) or to apple nursery stock (Cody *et al.*, 1985) may promote branching, but average length is often reduced, possibly because of the increased inter-shoot competition for resources. Generally yields are directly related to branch number at planting for trees on dwarf rootstocks in North Europe (Van Oosten, 1978; Quinlan, 1980)

The crotch angle was highest (59.50) with treatment combination of BA@200ppm + GA@100ppm followed by treatment combination of BA@200ppm alone and BA@200ppm + Pinching (57.40). The lowest crotch angle (32.10) was observed in un-treated plants. Pinching showed very little impact on the crotch angle (Fig. 1).

Table 1 : The effect of chemicals on lateral branch induction in Red Delicious apple plants

Treatments	No. of laterals (>20cm)	Average length of laterals (cm)	Crotch angle^0 (with vertical)
BA @200ppm	2.15	21.05	57.40
BA @400ppm	2.05	28.77	49.30
BA @200ppm + Pinching	2.66	20.11	51.50
BA @400ppm + Pinching	2.50	27.80	48.00
BA @200ppm + GA3 100ppm	2.72	26.10	59.50
BA @400ppm + GA3 100ppm	3.08	25.68	56.20
Control	1.20	30.14	32.10
CD $_{0.05}$	0.0058	0.0795	0.2516

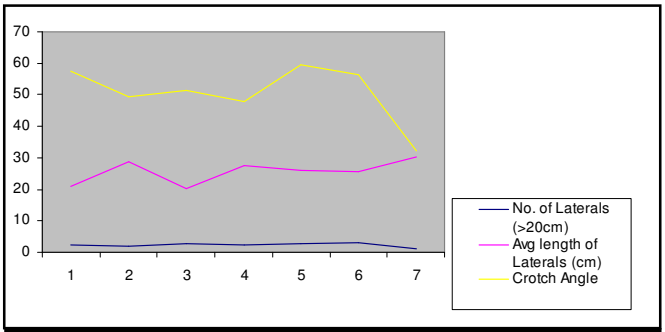

Fig. 1 : Impact of growth regulators piching including lateral branches in red delicious apple

Conclusion:

At the young tree level, the differential in lateral branching appears to be an accurate predictor of the time at which a given cultivar will enter production. However

a high percentage of fruiting branching over the first two years of growth may be indicative of a risk of alternate bearing at the adult stage. On an average, almost all the treatments increased the number of sylleptic branches and total shoot length. The use of such well branched nursery trees should allow Kashmir apple growers to increase yields substantially during the early life of an orchard.

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