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Short communication

Induction of lateral branching in sweet cherry cultivars in nursery

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ABSTRACT

The study was carried out on one-year-old trees of sweet cherry (*Prunus avium* L.) cvs. Siahe Mashhad and Dovomras in nursery for improving lateral shoot formation and increasing the tree quality. In the first experiment, heading back at 0, 40, 60 and 80 cm above ground and in the second experiment, Arbolin® (BA + GA_3) application (0, 5, 15, 25 ml l^{-1}) was investigated. Young trees were treated two times with foliar sprays of Arbolin at 7-day intervals in mid-June. A factorial experiment was laid out in a completely randomized block design with three replications where each plot had 10 trees. Results showed that all treatments increased the number of laterals in comparison to control. The cultivars had different response to the treatments. Heading back at 60 cm was the best treatment for improving total number of lateral shoots. The number of lateral shoots enhanced with application of higher concentrations and two application of Arbolin on both cultivars. Arbolin treatment (25 ml l^{-1} × 2 times) had significant effect on the number and length of lateral shoots than heading back treatments.

Key words: Arbolin, heading back, lateral shoot, sweet cherry, tree quality.

The goal of high-density planting systems is to achieve higher yield at early tree age. For this purpose, the first step is to train well-branched (feathered) trees. A number of lateral branches provide the opportunity to obtain good tree architecture in the future. If not properly managed, scaffold branches and leaders of young sweet cherry trees produce hardly any laterals (Jacyna and Puchala, 6). Formation of lateral shoots differs among sweet cherry cultivars and is determined by the apical dominance of the cultivar. Most of the sweet cherry cultivars exhibit strong apical dominance, particularly in young trees (Elfving and Visser, 1). Pruning (tipping) can interrupt the apical dominance mechanism and encourage buds that might remain quiescent (Elfving and Visser,1). Traditionally, the stimulation of lateral branches has been done in sweet cherries by heading the candidate shoots. Heading back is also simple to demonstrate to workers and inexpensive to perform (Hoying *et al*., 4).

Certain plant bio-regulators are able to break the dormant state of summer buds. Cytokinins such as benzyladenine (BA), alone or in combination with gibberellins, have been used to overcome apical dominance and stimulate the development of lateral shoots and successfully applied on different fruit crops (Magyar and Hrotko, 8; Neri *et al*., 9). Preliminary results have confirmed that Arbolin 036 SL promotes branching in nursery apple trees. Arbolin is highly effective in producing well branched maiden trees (Jaumien *et al*., 5). Detailed study by Jacyna and Puchała (5) demonstrated small movement of induction zone when BA + GA_{4+7} or BA + GA_3 were applied to sweet cherry shoots. Therefore, the present study was undertaken to enhance the number of lateral shoots and also to improve the feathering in young sweet cherry plants in nursery.

Two independent sub-experiments on one-year-old sweet cherry (*Prunus avium* L.) cvs. Siahe Mashhad and Dovomras trees budded on the Mahaleb rootstock were conducted at the Golmakan Horticultural Research Station located in Mashhad, Iran. In the first sub-experiment, *i.e.* in the late spring of the first year of planting, young trees without any lateral branches in cvs. Siahe Mashhad and Dovomras were pruned at the height of 40, 60 and 80 cm above the soil level. In second sub-experiment, Arbolin® (BA + GA_3) was applied at 0, 5, 15 and 25 ml l^{-1} with hand sprayers. The treatments were repeated at 7-day interval (15 and 22 June). Untreated (control) trees were sprayed with only tap water. The upper 20 cm of actively growing scion shoots with leaves were sprayed. At the end of the growing season, data on two-year-old plants was measured for trunk diameter (10 cm above the graft zone), height, number and length of lateral shoots. A factorial experiment was laid out in completely randomized block design with three replications where each replication had 10 trees. All data were subjected to analysis of variance and Duncan's multiple range test was used to compare the treatment means.

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Table 1. The effect of heading back treatments on the number of laterals.

Heading (cm)	No. of laterals per tree		
	Total	>10 cm	<10 cm
		Siahe Mashhad	
0.0 c	0.9 e	0.9 d*	Control
0.6 a	2.9 b	3.5 ab	40
0.3 b	2.8 b	3.1 bc	60
0.1 bc	2.2 d	2.3 c	80
		Dovomras	
0.0 c	0.7 e	0.7 d	Control
0.2 bc	2.4 cd	2.6 bc	40
0.2 bc	3.5 a	3.7 a	60
0.1 bc	3.5 a	3.7 a	80

*Means with similar letter in each column are not significantly different at 5% level.

There were significant differences between cultivars and heading treatments. “Dovomras” had better response compared to “Siahe Mashhad” (Table 1). The total number of lateral shoots increased with heading back in comparison with the control. All the treatments effectively enhanced the branching of young sweet cherry trees. Heading back at 60 cm, was the best treatment for improving the number of lateral shoots. The number of long lateral shoots (>10 cm) and short lateral shoots (<10 cm) were also affected with heading back treatments. There were non significant differences between 60 to 80 cm and 40 to 60 cm height in both cultivars (Table 1). Heading back at heights of 60 and 80 cm could induce the number of long laterals (>10 cm) more than 40 cm in Dovomras cultivar. Heading back at 40 cm was the best treatment for inducing the short lateral shoots (<10 cm) in Siahe Mashhad cultivar.

Height and trunk diameter of treated trees were lower than control (Table 2). Foreshy (2) reported that the plenty of regrowth were in relation with pruning intensity and caused reduction of total vegetative growth. For both cultivars, heading back at 80 cm improved the height and stem diameter of young trees (Table 2). Similar trend were reported by Gudarowska *et al*. (3) on “Ligol” apple trees. Heading back at 60 cm increased the height of treated trees more than 40 cm heading treatment (Table 2). In control there were meagre lateral shoots. Total lateral shoots was more with higher concentration of Arbolin (15 ml l^{-1}) was better than 25 ml l^{-1} in Dovomras cultivar (Fig. 1). These results are in agreement with Jacyna and Puchała (5) with application of Promalin and Arbolin. “Siahe Mashhad” had better response to Arbolin treatments than “Dovomras”. Repeated Arbolin treatments produced more total lateral shoots than a single treatment (Fig. 2). Regular application of plant growth hormones could increase the number of laterals that is reported for cherries (Magyar and Hrotko, 8). There was no significant difference between 15 and 25 ml l^{-1} with two sprays in cultivar Dovomras.

The number of lateral shoots >10 and <10 cm also were affected with Arbolin treatments. In all the Arbolin treated trees, the number of laterals >10 cm were significantly greater than control. The most number of lateral shoots >10 cm were observed in Arbolin 15 × 1 and 15 × 2 in “Dovomras” and “Siahe Mashhad”, respectively. This result is agreement with Kopytowski *et al*. (7). The number of lateral shoots <10 cm increased with application the BA treatments but Arbolin 5 ml l^{-1} with 1 to 2 sprays did not have any significant differences with control in “Dovomras”. For both cultivars, the best treatment for inducing lateral shoots <10 cm was observed in Arbolin 25 ml l^{-1} × 2 sprays. The number of laterals <10 cm in length increased with repeated Arbolin sprays (Table 3). Height and stem diameter due to Arbolin treatments were slightly more than control trees. In general, “Siahe Mashhad” trees were taller than “Dovomras”, which was also reflected with Arbolin treatment (Table 4). Kopytowski *et al*. (7) obtained best results with of 30 ml l^{-1} Arbolin. The best response was observed when Arbolin was applied at 25 ml l^{-1} twice.

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Table 2. The effect of heading treatments on the growth of tree leader.

Heading (cm)	Height (cm)	Stem diameter (mm)
	Siahe Mashhad	
Control	172.4 a*	16.6 a
40	112.6 c	14.1 ab
60	120.6 c	13.5 b
80	144.5 b	14.5 ab
	Dovomras	
Control	161.2 ab	15.7 ab
40	73.9 d	10.9 c
60	115.5 c	13.1 bc
80	150.2 b	15.6 ab

	No. of laterals per tree		
<10 cm	>10 cm	Total	Heading (cm)
		Siahe Mashhad	
0.0 c	0.9 e	0.9 d*	Control
0.6 a	2.9 b	3.5 ab	40
0.3 b	2.8 b	3.1 bc	60
0.1 bc	2.2 d	2.3 c	80
		Dovomras	
0.0 c	0.7 e	0.7 d	Control
0.2 bc	2.4 cd	2.6 bc	40
0.2 bc	3.5 a	3.7 a	60
0.1 bc	3.5 a	3.7 a	80

*Means with similar letter in each column are not significantly different at 5% level.

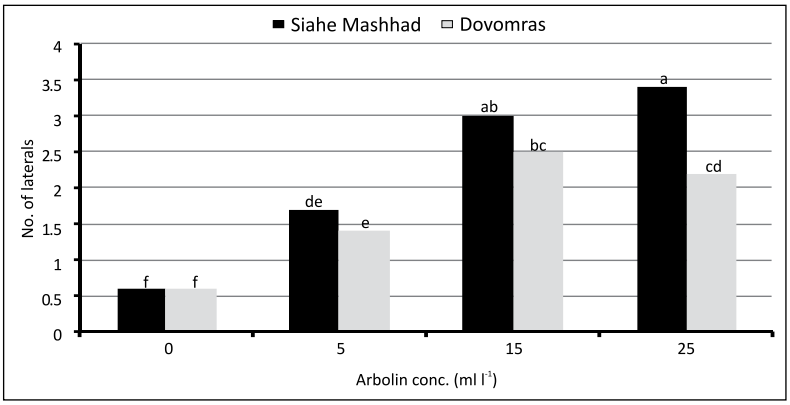

Fig. 1. Effect of cultivar and Arbolin concentrations on the total number of lateral shoots.

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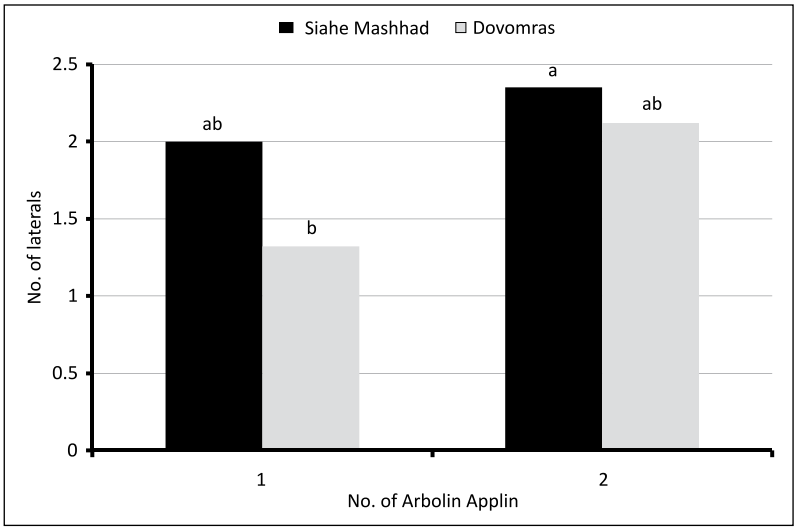

Fig. 2. Effect of cultivar and Arbolin application times on the total number of lateral shoots.

Table 3. The effect of Arbolin treatments on the number of lateral shoots.

Treatment	Shoot number		
	Total	<10	>10
		Siahe Mashhad	
Control	0.7 g**	0.1 f	0.6 fg
AR5×1*	1.7 de	0.4 def	1.3 def
AR5×2	1.6 de	0.8 bcd	0.8 fg
AR15×1	3.3 b	0.1 ef	3.2 a
AR15×2	2.7 bc	1.3 b	1.4 def
AR25×1	2.6 bcd	0.9 bcd	1.7 bcde
AR25×2	4.3 a	1.8 a	2.5 b
		Dovomras	
Control	0.6 g	0.1 f	0.5 g
AR5×1	1.4 efg	0.1 f	1.3 def
AR5×2	1.5 ef	0.1 f	1.4 def
AR15×1	1.9 cde	0.2 cd	1.7 bcde
AR15×2	3.1 b	0.6 cde	2.5 b
AR25×1	1.2 efg	0.3 ef	0.9 efg
AR25×2	3.2 b	1.1 bc	2.1 bcd

*Repeated sprays (1 and 2) were applied at 7-day interval, starting 15 June 2010.
**Means with similar letter in each column are not significantly different at 5% level.

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Table 4. The effect of Arbolin treatments on the growth of tree leader.

Treatment	Height (cm)	Dia. (mm)
	Siahe Mashhad	
Control	154.9 bcde**	14.7 ef
AR5×1*	198.9 a	15.8 b
AR5×2	161.3 bcd	13.2 i
AR15×1	188 ab	14.9 e
AR15×2	166.8 bc	14.4 g
AR25×1	166.9 bc	13.7 h
AR25×2	196.2 a	16.6 a
	Dovomras	
Control	137.8 def	15.5 c
AR5×1	172.0 b	16.4 a
AR5×2	124.2 f	15.2 d
AR15×1	132.8 ef	12.5 j
AR15×2	147.1 bcdef	15.2 d
AR25×1	131.5 ef	11.6 k
AR25×2	139.4 cdef	14.6 fg

*Repeated sprays (1 and 2) were applied at 7- day interval, starting 15 June 2010.

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