Journal of Fruit and Ornamental Plant Research vol. 12, 2004 Special ed.

Short communication

APPLICATION OF ENVIRONMENT FRIENDLY BRANCH PROMOTING SUBSTANCES TO ADVANCE SWEET CHERRY TREE CANOPY DEVELOPMENT IN THE ORCHARD

Tadeusz Jacyna and Aneta Puchała

University of Agriculture, Department of Pomology
Leszczyńskiego 58, 20-068 Lublin, POLAND
e-mail: tadjacyn@agros.ar.lublin.pl

(Received May 21/Accepted August 10)

ABSTRACT

Vegetative buds of scaffold branches of two-year old sweet cherry trees of 'Regina' were treated with harmless latex paint mixed with lateral-branch promoting substances containing either cytokinins or cytokinins combined with gibberellins. Branches treated with Accel, Arbolin, Paturyl, Promalin or Paturyl + branch tipping, at the rate of 5000 mg BA l^{-1}, or hand pruned according Brunner's method induced on average 9.3, 13.6, 9.2, 15.4, 6.9 and 6.6 shoots per branch, respectively. Control (intact) branches produced 7.1 shoots per branch. Length of induced shoots ranged from 42.1 for Arbolin to 58.9 cm for Paturyl + branch tipping treated trees. Study on the location of shoot induction indicated that both Promalin and Arbolin caused the most uniform distribution of induced shoots on treated branches.

Key words: branching agents, cytokinin, feathering, gibberellins, prolepsis

INTRODUCTION

Training process in densely planted sweet cherry orchards is an extremely important issue in tree management. Sweet cherry trees of recently introduced cultivars do not branch readily, especially at the initial stage of canopy development. Deficient branching results from the cultivar nature as such, and especially, from application of "non-pruning-training" techniques, which work for apple but do not for sweet cherry. In most cases it leads to dramatic malformation in tree-limb and leader structure, and thus tree shape. If not properly managed, scaffold branches and leaders of young trees produce hardly any laterals. Branching may be stimulated by a chemical treatment. Benzyladenine-based (BA) compounds appear to be the most efficient in inducing branching (Elfving, 1985). However, in sweet cherry trees foliar applications do not usually result in acceptable branching (Wustenberghs and Kuelemans, 1999), whereas young apple trees branch readily if treated with a BA-based compund, Paturyl (Basak et al., 1993). Veinbrants and Miller (1981) found that Promalin (BA + GA_{4+7}) mixed with latex paint promoted abundant branching in young sweet cherry trees.

Nowadays, an important requirement for chemical use in fruit production is a low impact on the environment. A chemical combined with harmless latex paint that is brush-applied to tree bark and buds seems to be a safe way to apply lateral-branch promoting substances because of non or negligible soil contamination (Jacyna and Dodds, 1999; Jacyna, data unpublished).

The object of this research was to examine different BA-based branching agents applied at the same rate of active ingredient – benzyladenine, in training young sweet cherry trees in the orchard, and their influence on vegetative growth and fruiting.

MATERIAL AND METHODS

The experiment, which started in 2003, was carried out in the Lublin district, Poland. Two-year old sweet cherry trees of cultivar 'Regina' on *Prunus avium*, planted at the approx. density of 1500 trees/ha, with semi-completed framework consisting of a leader and several scaffold branches, were used. Two thirds of the scaffold branch length from the branch insertion point was entirely brushed with a harmless latax paint premixed with such branching agents as Accel (1.8% BA + 0.18% GA_{4+7}), Arbolin (1.8% BA + 1.8% GA_3), Paturyl (10% BA), Paturyl + branch tipping or Promalin (1.8% A + 1.8% GA_{4+7}), each at the rate 5000 mg BA l^{-1} or hand-pruned according to Brunner's method (Brunner, 1982). Paint application was performed between bud swell and bud burst (Veinbrants and Miller, 1981). Control trees were left intact. Measurements of tree vegetative characteristic such as the number of lateral shoots, total shoot extension growth and the shoot length distribution were taken along with detailed study on the locations of shoot induction. A completed randomized design with 23 one-scaffold branch replicates was established. The data were processed by R.A. Fisher's analysis of variance and the means were compared using either Tukey's or Duncan's multiple range (for shoot location) test at P = 0.05. Data on shoot location were transformed before analysis of variance by y = Sqr (x), where x – number of shoots.

RESULTS AND DISCUSSION

This experiment was meant to modify to some extent the training of sweet cherry trees by maximizing the induction of lateral shoots on scaffold branches in order to provide sites for flower bud formation. Application of branching such as Promalin and Arbolin, significantly increased the number of shoots in comparison with other treatments, especially those where pruning was involved (Paturyl + branch tipping and Brunner's method), to 15.4 and 13.6 versus 6.9 and 6.6 shoots per branch, respectively (Tab. 1). Mika (1986) reports that excessive pruning brings about the growth of long, poor yielding shoots.

T a b l e 1 . Some vegetative characteristics of young sweet cherry trees of 'Regina'

Treatment	Number of lateral shoots per branch unit			Total extension shoot growth per branch unit* [cm]	Mean length of shoots ≥ 10 cm
	< 10 cm	≥ 10 cm	total		
Promalin	2.2 bc*	13.2 c	15.4 c	594 b	45.0 ab
Paturyl	0.5 ab	8.7 ab	9.2 ab	437 ab	50.2 ab
Arbolin	2.9 c	10.7 bc	13.6 bc	450 ab	42.1 a
Accel	0.4 a	8.9 ab	9.3 ab	430 ab	48.3 ab
Paturyl + branch tipping	0.3 a	6.6 ab	6.9 a	389 ab	58.9 b
Brunner`s method	0.7 ab	5.9 a	6.6 a	332 a	56.3 b
Control	1.0 ab	6.1 a	7.1 a	291 a	47.7 ab
P	0.0000	0.0000	0.0000	0.0032	0.0028

*Means followed by the same letter within the column do not significantly differ at $P < 0.05$
Length of scafold branch (unit) does not significantly differ from each other ($P < 0.0826$)

Shoots induced by Arbolin, and to some extent by Promalin, were significantly shorter than those produced by either Paturyl + branch tipping or Brunner's method (Tab. 1). Then, it may be expected that such short shoots could be characterized by a greater potential of flower bud setting than those longer, especially when stimulated by pruning. Flower spur development in sweet cherries largely depends on the length and thickness of the bearing branch segment (Kramer et al., 1984).

Despite the same rate of BA in all the agents applied, Promalin proved to be significantly more efficient in shoot induction than Paturyl and Accel by inducing 15.4 vs 9.2 and 9.3 shoots per branch, respectively (Tab. 1). It is likely that higher contents of gibberellins in Promalin (1.8% GA_{4+7}), and Arbolin (1.8% GA_3) versus none in Paturyl and 0.18% GA_{4+7} in Accel, especially GA_3 and GA_7, might have influenced shoot growth synergistically along with BA (Grochowska, 1997). However, these results are in contrast with those obtained from similarly treated apple trees using foliar sprays instead of paint applications (Jacyna, 2001). Promalin and Arbolin caused the induction of the greatest number of short (< 10 cm) and long (≥ 10 cm) shoots as compared with other treatments (Tab. 1).

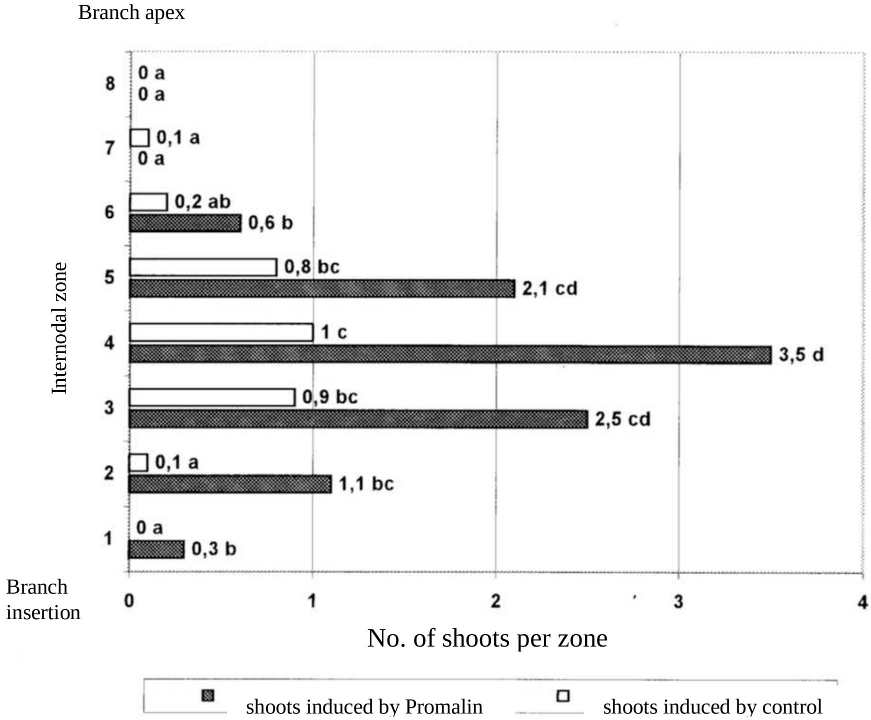

Figure 1. Pattern of lateral branching in Promalin – treated and control trees. (Comparisons valid between zones within the same treatment. Means followed by the same letter are not significantly different at P = 0.05

One of the important issues in paint treatment is moving shoot induction zone upwards from the application area (Jacyna, data unpublished). It seems that the extent of this shift may depend on the type and rate of the compound used. Also, a difference in the degree of bud rest between lower and upper parts of the branch itself should not be overlooked. A study on the location of shoot induction indicates that, contrary to other treatments, shoot growth brought about by either Promalin or Arbolin (data not presented) did not shift much from the application area (from 2nd to 27th node) and it was located between the 3rd and 30th internode on a 40-node long scaffold branch (Fig. 1).

This research is being continued to study treatment's influence on blooming, fruit setting and other carry-over effects.

REFERENCES

Basak A., Buban T., Kołodziejczak P. 1993. Paturyl 10 WSC as a branching agent for apple trees in nurseries and young orchards. ACTA HORT. 329: 201-203.

Brunner T. 1982. Bending effect of sectorial double pruning on fruit-trees. ACTA AGRON ACAD. SCIENT. HUNG. 31: 240-246.

Elfving D.C. 1985. Comparison of cytokinin and apical-dominance-inhibiting growth regulators for lateral-branch induction in nursery and orchard apple trees. J. HORT. SCI. 60 (4): 447-454.

Grochowska M., 1997. Gibereliny. In: L.S. Jankiewicz (ed.), Regulatory wzrostu i rozwoju roślin, vol. 1, PWN Warszawa, pp. 41-59.

Jacyna T., Dodds K.G. 1999. Effect of method of application of paclobutrazol in high density sweet cherry orchards on tree performance and apparent soil residue. J. HORT. SCI. BIOTECH. 74 (2): 213-218.

Jacyna T. 2001. Studies on natural and chemically induced branching in temperate fruit and ornamental trees. ROZPRAWY NAUKOWE AKADEMII ROLNICZEJ W LUBLINIE 246: 45-66.

Kramer K.S., Ayaad H., Hake R. 1984. Die Ausbildung der Buketsprose bei der Sisskirche in Abhengigkeit von Verzweigungsmerkelen der Krone. ARCHIV FUR GARTENBAU 32 (7): 327-333.

Mika A.L. 1986. Physiological responses of fruit trees to pruning. HORT. REV. 8: 337-371.

Veinbrants N., Miller P. 1981. Promalin promotes lateral shoot development of young cherry trees. AUSTRAL. J. EXP. AGR. A. HUSB. 21: 618-622.

Wustenberghs H., Kuelemans J. 1999. The sweet cherry: quality improvement of planting stock. FRUIT BELGE 7 (480): 106-110.

ZASTOSOWANIE BIOLEGRATORÓW DO FORMOWANIA GĘSTO SADZONYCH DRZEW CZEREŚNI

Tadeusz Jacyna i Aneta Puchała

STRESZCZENIE

Pąki liściowe szkieletowych pędów dwuletnich drzewek czereśni odmiany ‘Regina’ pomalowano akrylową farbą emulsyjną z dodatkiem różnych bioregulatorów zawierających benzyloaminopurynę (BA) lub BA z giberelinami GA_3 lub GA_{4+7}. Pąki potraktowane preparatami Accel (1,8% BA + 0,18% GA_{4+7}), Arbolin (1,8% BA + 1,8% GA_3), Paturyl (10% BA) i Promalin (1,8% BA + 1,8% GA_{4+7}) w stężeniu 5000 mg BA/l^{-1} oraz Paturylem + cięcie skracające pędów szkieletowych i cięciem pędów szkieletowych metodą Brunnera indukowały, odpowiednio 9,3, 13,6, 9,2, 15,4, 6,9 i 6,6 pędów/pęd szkieletowy. Pąki kontrolne indukowały średnio 7,1 pędów/pęd szkieletowy. Długość indukowanych pędów wynosiła od 42,1 do 58,9 cm, odpowiednio dla pąków traktowanych Arbolinem i Paturylem + cięcie skracające. Obserwacje dotyczące lokalizacji indukowanych pędów na pędach szkieletowych wskazują, że najbardziej równomierną ich dystrybucją charakteryzowały się pędy, których pąki traktowano Promalinem i Arbolinem.

Słwa kluczowe: cytokininy, dominacja wierzchołkowa, gibereliny, rozgałęzienia lateralne