

THE INFLUENCE OF AGRO-TECHNICAL METHODS USED IN THE NURSERY ON QUALITY OF PLANTING MATERIAL AND PRECOCITY OF BEARING IN YOUNG APPLE TREES IN THE ORCHARD

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(Received May 31, 2004/Accepted September 3, 2004)

A B S T R A C T

In the spring of 2002, two-year-old 'Delbarestivale', 'Ligol' and 'Pinova' apple trees, grafted on M.26 rootstocks, were planted 3.5 x 1.0 m apart. Beforehand, when the trees were one year old in the nursery, main leaders were pruned to height of 60 cm, and the plants were either pinched, sprayed with Arbolin 036 SL, sprayed with Arbostim 100 SL - at the beginning of July, or mulched with black non-woven polypropylene which was kept in place from May until October. Cultivar and nursery technique had a significant influence on the quality of plant material. 'Pinova' trees were higher and had more shoots than 'Ligol' trees. 'Delbarestivale' trees were very high, but smaller in diameter, and had fewer shoots longer than 20 cm than 'Ligol' and 'Pinova' trees. Trees which had been pinched were shorter. Trees which had been sprayed with Arbolin 036 SL had more branches. Cultivar and nursery technique also influenced the blossoming intensity. In the first year in the orchard, 'Pinova' had the most blossoms (about 10 per tree) and 'Delbarestivale' the least (about 1 per tree). Control plants and trees mulched with black non-woven polypropylene in the nursery, had the most blossoms. In the spring of 2003, 'Pinova' trees had the most blossoms. In the second year in the orchard, trees which had been sprayed with Arbolin 036 SL in the nursery bore the most blossoms. Even though 'Pinova' trees blossomed abundantly, they yielded the least fruit (1.2 kg per tree). 'Delbarestivale' and 'Ligol' trees each yielded about 1.5 kg per tree.

Key words: apple trees, branching, gibberellins, non-woven polypropylene, nursery, inflorescences, yield

INTRODUCTION

High quality nursery trees are essential for success in production systems where early production is the prime goal (Green, 1991). Planting well-branched, two-year-old trees ensures early cropping and high yields in the orchard. Lateral shoot formation depends on variety. Feathering depends on the apical dominance of the variety. 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, with positive results in many countries (Basak et al., 1994; Hrotkó et al., 1996; Jaumień et al., 2002). Pinching leaders or plucking young leaves can also overcome strong apical dominance (Wertheim, 1978). Pruning in the nursery is often sufficient to produce two-year-old trees with well-branched canopies, but branching agents need to be used with varieties which feather poorly (Gudarowska and Szewczuk, 2002). Branching agents initiate blossoming, which is important for early and abundant yields. Spraying young 'Gloster' trees with Paturyl containing 10% benzyladenine not only induces lateral branching, but has also stimulates flower bud formation in the third year in the orchard. Gibberellins may play a role in initiating blossoming (Basak et al., 1994).

The aim of this study was to examine how different nursery practices affect the quality of two-year-old apple trees and their blossoming and bearing capabilities during their first two years in the orchard.

MATERIAL AND METHODS

In the spring of 2002, two-year-old 'Delbarestivale', 'Ligol' and 'Pinova' apple trees on M.26 rootstock were planted 3.5 x 1.0 m apart. Beforehand, when the trees were one year old in the nursery, main leaders were pruned to height of 60 cm, and the plants were either pinched, sprayed with Arbolin 036 SL, sprayed with Arbostim 100 SL - at the beginning of July, or mulched with black non-woven polypropylene (30 g m²), which was applied in two 30 cm wide strips either side of each row and kept in place from May until October. Arbolin 036 SL (containing 18 mg gibberellins (GA₃) and 18 mg benzyladenine per liter) was applied once after dilution to 25 ml per liter of water. Arbostim 100 SL (containing 100 g gibberellins per liter) was applied once after dilution to 5 ml per liter of water.

Each tree was evaluated in the autumn of 2001. Diameter was measured 30 cm above ground level. The trees were grafted at a height of 15 cm using the chip-budding method.

In the nursery, the experiment was conducted in a randomised block design with six replicates. Each experimental plot consisted of five trees, each of which was assigned a number for the duration of the experiment (from Spring, 2001 to Autumn, 2003). Blossom count, yield, and mean weight were recorded for each tree.

In the orchard, the experiment was conducted in a randomised block design with five replications. Each experimental plot consisted of four trees, which were trained as slender spindles without pruning.

RESULTS

Cultivar and nursery practices had a significant influence on the quality of trees. With ‘Delbarestivale’ and ‘Ligol’, cultivars in which it is difficult to induce lateral shoot formation, chemicals were the most effective in producing well-feathered planting material (Tab. 1). With ‘Delbarestivale’, trees which had not been treated and trees which had been mulched with non-woven polypropylene were of higher quality than those which had been pinched. With ‘Delbarestivale’ and ‘Ligol’, pinching of the terminal shoot produced only a few strong, narrow-angled lateral shoots, and reduced the diameter and height of two-year-old trees. With ‘Delbarestivale’, a late-bearing

Table 1. Influence of nursery technique on the quality of two-year-old trees of three apple cultivars (Autumn, 2001)

Treatment	Diameter [mm]	Height [cm]	Number of shoots < 20 cm	Number of shoots > 20 cm	Total shoot length [cm]
‘Delbarestivale’					
Control	14.4 ab*	183.7 b	2.9 bc	0.7 a	41.6 a
Non-woven polypropylene	14.6 b	180.9 b	2.0 b	1.2 a	68.1 a
Pinching	13.1 a	155.4 a	0.1 a	1.1 a	56.2 a
Arbolin 036 SL	14.7 b	177.8 b	4.9 c	5.3 b	230.2 b
Arbostim 100 SL	15.0 b	187.4 b	4.3 c	1.3 a	77.9 a
‘Ligol’					
Control	15.2 b	141.5 a	2.0 a	2.0 a	98.6 a
Non-woven polypropylene	16.1 bc	162.6 b	3.6 ab	2.8 a	163.2 ab
Pinching	13.6 a	142.5 a	2.5 a	2.6 a	99.1 a
Arbolin 036 SL	15.9 bc	154.8 b	4.7 b	5.8 b	173.1 ab
Arbostim 100 SL	16.9 c	160.1 b	2.8 ab	5.0 b	205.2 b
‘Pinova’					
Control	16.9 a	192.1 ab	4.6 a	3.0 a	147.9 a
Non-woven polypropylene	16.7 a	186.4 ab	7.7 b	1.9 a	129.8 a
Pinching	16.4 a	164.4 a	5.5 ab	3.2 a	169.6 a
Arbolin 036 SL	17.6 a	185.6 ab	7.5 b	9.0 b	349.2 b
Arbostim 100 SL	15.7 a	178.5 ab	5.7 ab	2.1 a	120.7 a

*Means followed by the same letter do not differ significantly at P = 0.05 according to Duncan’s t-test

cultivar, all treatments which improved feathering also increased blossoming (Tab. 2). Trees which had been pinched in the nursery bore the least fruit. With 'Ligol', an early-bearing cultivar, trees which were well feathered in the nursery had the most blossoms in their first year in the orchard; choice of nursery treatment did not affect blossoming counts in the second year in the orchard (Tab. 2).

Table 2. Influence of nursery technique on blossom count and yield of three apple cultivars

Treatment	Number of blossoms per tree		Number of fruit per tree 2003	Yield in kg per tree 2003
	2002	2003		
‘Delbarestivale’				
Control	2.1 b*	15.0 b	12.1 b	1.9 b
Non-woven polypropylene	1.1 ab	16.1 b	12.8 b	1.8 b
Pinching	0.7 a	4.8 a	2.7 a	0.4 a
Arbolin 036 SL	0.4 a	25.0 b	16.6 b	2.1 b
Arbostim 100 SL	0.7 a	22.3 b	14.4 b	1.8 b
‘Ligol’				
Control	9.2 b	6.2 a	9.1 a	1.5 a
Non-woven polypropylene	8.8 b	5.8 a	8.7 a	1.4 a
Pinching	5.2 a	11.1 a	9.7 a	1.3 a
Arbolin 036 SL	8.8 b	10.1 a	15.5 b	2.2 a
Arbostim 100 SL	10.7 b	7.3 a	11.2 a	1.5 a
‘Pinova’				
Control	14.5 b	10.4 a	5.9 a	0.7 a
Non-woven polypropylene	14.2 b	16.6 ab	12.1 bc	1.3 ab
Pinching	5.0 a	35.1 c	16.8 c	1.7 b
Arbolin 036 SL	6.9 a	31.2 bc	8.6 ab	0.9 a
Arbostim 100 SL	8.5 a	28.8 bc	11.2 abc	1.2 ab

*For explanation, see Table 1

In the nursery, ‘Pinova’ trees were tallest and best feathered. ‘Pinova’ produced the highest number of shoots longer than 20 cm when mulched with non-woven polypropylene. ‘Pinova’ produced the highest number of shoots of all lengths, and thus the greatest total shoot length, when treated with Arbolin 036 SL (Tab. 1). Despite the fact that ‘Pinova’ trees treated with Arbolin 036 SL were well branched, they had significantly lower blossom counts in their first year in the orchard than either control trees or trees mulched with non-woven polypropylene (Tab. 2). In their second year in the orchard, ‘Pinova’ trees which had been pinched or sprayed with chemicals in the nursery had the highest blossom counts. However, the trees which bore the most fruit were those which had been pinched, mulched with non-woven polypropylene, or sprayed with

Arbostim 100 SL, although the difference is significant only between trees which had been pinched, and those which were left untreated or sprayed with Arbolin 036 SL (Tab. 2).

DISCUSSION

Preliminary results have confirmed that Arbolin 036 SL promotes branching in nursery trees. Arbolin is highly effective in producing both well-branched maiden trees (Jaumień et al., 2002) and two-year-old trees (Gudarowska and Szewczuk, 2002). Mulching with black non-woven polypropylene in the nursery can be difficult in practice because of technical problems, but improves the quality of nursery stock moreso than pinching. Arbostim 100 SL also produces high quality planting material in cultivars in which it is difficult to induce lateral shoot formation. Nursery technique also influenced blossoming in the first two years in the orchard. With cultivars such as 'Pinova', which tend to feather spontaneously and to blossom in the first year in the orchard, cytokines in combination with gibberellins can reduce blossom counts in the first year. This is important for cultivars which after blossom and fruiting in the first year could start to biennial yielding. With cultivars such as 'Ligol', which is early-bearing and does not feather easily, methods which improve the quality of planting material cause more abundant blossoming in the first year in the orchard. With cultivars such as 'Delbarestivale', which bears later and does not feather easily, methods which stimulate feathering improve blossoming in the second year in the orchard.

Using chemicals to improve branching is more effective than pinching the leaders of maiden trees. Chemicals are very useful with cultivars with strong apical dominance, such as 'Ligol' and 'Delbarestivale'. Using agents containing plant hormones in the nursery can reduce blossoming in the first year in the orchard. Plant hormones clearly improve blossoming in 'Delbarestivale' and 'Pinova'. However, the high blossom counts in two-year-old nursery trees can mean fewer blossoms in the second year in the orchard.

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WPLYW ZABIEGÓW AGROTECHNICZNYCH ZASTOSOWANYCH W SZKÓLCE NA JAKOŚĆ OTRZYMANEGO MATERIAŁU SZKÓLKARSKIEGO I WCZESNOŚĆ WEJŚCIA W OKRES OWOCOWANIA MŁODYCH DRZEW JABŁONI W SADZIE

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S T R E S Z C Z E N I E

Wiosną 2002 roku dwuletnie drzewka odmian: 'Delbarestivale', 'Ligol' i 'Pinova' na podkładce M.26 posadzono do sadu w rozstawie 3,5 x 1,0 m. W trakcie cyklu produkcyjnego drzewek dwuletnich zastosowano w szkółce różne czynniki agrotechniczne. Wiosną 2001 roku jednoroczne okulany w szkółce przycięto na wysokości 60 cm nad ziemią. Wyrastający po przycięciu przewodnik prowadzono następującymi metodami: uszczykiwano wierzchołek pod drugim liściem, opryskiwano preparatem Arbolin 036 SL, opryskiwano preparatem Arbostim 100 SL oraz ściółkowano rzędy drzew w szkółce, od maja do października, czarną włókniną. Bioregulatory i uszczykiwanie wierzchołków zastosowano na początku lipca. Odmiana oraz zastosowane w szkółce metody produkcji miały wpływ na jakość otrzymanego materiału szkółkarskiego i kwitnienie drzew po posadzeniu do sadu. Dwuletnie drzewka odmiany 'Pinova' były wyższe i silniej rozgałęzione niż drzewka odmiany 'Ligol'. Drzewka odmiany 'Delbarestivale' były bardzo wysokie, ale miały mniejszą średnicę i mniej długopędów niż drzewka odmian 'Ligol' i 'Pinova'. Drzewka uszczykiwane w szkółce były najniższe, a opryskane preparatem Arbolin 036 SL – najlepiej rozgałęzione. W pierwszym roku wzrostu w sadzie najwięcej kwiatostanów miały drzewa odmiany 'Pinova' (około 10 szt./drz.), a najmniej drzewa odmiany 'Delbarestivale' (około 1 szt./drz.). Drzewa kontrolne oraz te ściółkowane w szkółce miały najwięcej kwiatostanów w roku sadzenia drzew do sadu. W drugim roku po posadzeniu drzew najwięcej kwiatostanów miały drzewa odmiany 'Pinova' oraz te drzewa, które opryskano w szkółce preparatem Arbolin 100 SL. Pomimo najbardziej obfitego kwitnienia drzewa odmiany 'Pinova' wydały tylko 1,2 kg owoców z drzewa, a odmiany 'Delbarestivale' i 'Ligol' – 1,5 kg owoców z drzewa.

Słowa kluczowe: jabłoń, rozgałęzienie, gibereliny, włóknina, szkółka, kwiatostany, plon