

ŚLAWOMIR ŚWIERCZYŃSKI, ALEKSANDER STACHOWIAK,
MAŁGORZATA GOLCZ

EFFECT OF PROMALIN AND FOLIAR FERTILIZERS ON THE GROWTH OF MAIDEN TREES OF TWO APPLE CULTIVARS IN A NURSERY

*From Department of Dendrology and Nursery
The August Cieszkowski Agricultural University of Poznań*

ABSTRACT. In the experiment effects of Promalin and three foliar fertilizers on the growth and branching of maiden apple trees of the cultivars: 'Jonagold' and 'Idared' were compared. Additionally, the content of macroelements in the leaves of maiden apple trees of the cultivars mentioned above was assessed. The preparation Promalin significantly increased the number of long shoots of maiden trees of 'Jonagold' and the dwarf shoots of 'Idared' comparing with the control. At the same time it did not initiate the formation of flower buds. The foliar fertilizers used did not significantly differentiate the results of the growth and branching of maiden trees. However, they significantly increased the number of flower buds formed. The chemical agents applied via the foliage did not unambiguously influence the content of macroelements in the leaves of maiden apple trees cultivated in a nursery.

Key words: maiden apple trees, Promalin, foliar fertilization, growth, branching, content of mineral elements in the leaves

Introduction

After planting in an orchard, well-grown and branched maiden trees begin fructification early, which is of a great importance for the establishment of intensive orchards. Unfortunately, maiden trees of many cultivars form a small number of side shoots or did not form them at all. The superiority of branched maiden trees over unbranched ones was confirmed by many researchers (**Van Oosten** 1978, **Shepherd** 1979, **Poniedziałek et al.** 1993, **Włodarczyk** 1994, **Poniedziałek et al.** 1996, **Chelpiński et al.** 1998, **Czynczyk** 1998). Nowadays apple orchards are being established using mainly trees on dwarf rootstocks. Maiden trees on such rootstocks usually branch less (**Jaumień et al.** 1992, **Bootsma** 1995, **Słowiński and Sadowski** 1996).

In the experiment, the effects of Promalin and three foliar fertilizers on the growth, branching and content of macroelements in the leaves of maiden apple trees of two cultivars in a nursery were compared.

Material and methods

Experimental plant material consisted of one-year maiden apple trees of the cultivars 'Idared' and 'Jonagold' on the rootstock M 9. The experiment was carried out in the years 2003-2004, using a random block design with four replicates. In each of them, 25 plants were treated with Promalin and fertilized via the foliage with urea at the concentration of 0.5-1.0% (in the two latter dates the higher concentration was applied), Florovit at 0.5% and lime and magnesium saltpetre at 1.0%. Spraying with Promalin at a rate of 250 ml per 10 litres of water was conducted once in the third decade of June, when the maiden trees were about 60 cm high. The maiden trees were treated with foliar fertilizers five times in two-week intervals from mid-June to mid-August. In the second decade of August leaves from the middle part of long shoots were collected for chemical analyses of the content of macroelements. All the observations and measurements were performed for 25 maiden apple trees in each replicate. The height and the thickness of the trunk (30 cm above the ground) were measured. The numbers of long shoots, dwarf shoots and flower buds formed were counted. The statistical analysis of the data obtained was carried out using a two-factorial analysis of variance followed by Duncan's test at the probability level $\alpha = 0.05$.

Results and discussion

The results of the thickness of maiden apple trees of the cultivars 'Jonagold' and 'Idared' were not significantly differentiated depending on their treatment with Promalin and different fertilizers applied via the foliage as compared to the control. 'Jonagold' maiden apple trees sprayed with Florovit and lime and magnesium saltpetre were markedly thicker than the control 'Idared' maiden trees. The thickness of maiden trees depended to a larger degree on the apple cultivar budded.

A similar relation was observed for maiden trees' height. 'Jonagold' maiden trees affected by the preparation Promalin were significantly higher than the ones untreated with any chemical agent. For 'Idared' maiden trees the results of their height did not differ depending on the treatment. 'Jonagold' maiden trees were significantly higher than 'Idared' ones (Table 1).

'Jonagold' maiden trees treated with Promalin and of the control produced significantly less flower buds than the remaining treatments, whose results did not differ. A similar relation was observed in 'Idared' maiden trees. The number of flower buds did not differ depending on a cultivar within the same treatments. Foliar fertilization of maiden trees beneficially affected the number of flower buds formed.

Table 1

Thickness and height of maiden apple trees
Grubość i wysokość okulantów jabłoni

Chemical treatments Zastosowane środki chemiczne	Cultivars – Odmiany			
	thickness – grubość (mm)		height – wysokość (cm)	
	Jonagold	Idared	Jonagold	Idared
Promalin	12.2 bc*	11.1 ab	152.8 c	117.1 a
Urea – Mocznik	12.3 bc	11.5 ab	146.5 bc	116.7 a
Florovit	13.1 c	11.6 ab	141.7 bc	114.1 a
Lime and magnesium saltpetre Saletra Ca-Mg	13.2 c	11.5 ab	141.5 bc	115.0 a
Control – Kontrola	12.0 bc	10.2 a	139.0 b	109.1 a

*Means followed by the same letters within the characteristic do not differ significantly at $\alpha = 0.05$.

*Średnie oznaczone tymi samymi literami w obrębie analizowanych cech nie różnią się między sobą istotnie na poziomie $\alpha = 0,05$.

Maiden trees of ‘Jonagold’ cultivar after spraying with the preparation Promalin produced a significantly greater number of long shoots than the control and fertilized via the foliage with urea. The result of the last treatment did not significantly differ from the one obtained for the trees treated with Florovit and lime and magnesium saltpetre. The number of long shoots of trees of ‘Idared’ cultivar did not differ significantly depending on spraying of maiden trees or its lack. The cultivar significantly affected the number of long shoots. Strongly growing maiden trees of ‘Jonagold’ were more branched. A positive relationship between the growth of a given cultivar and the branching of maiden trees was observed. The relationship mentioned is stricter for a strongly branching cultivar, in this case: for ‘Jonagold’ than for a cultivar developing less side branches, i.e. ‘Idared’. A similar conclusion based on research was drawn by **Słowiński** and **Sadowski** (1996) and **Lipecki** and **Janisz** (1999).

Maiden trees treatment with different agents applied via the foliage did not affect the number of dwarf shoots of ‘Jonagold’ cultivar comparing with the control. However the number of dwarf shoots of ‘Idared’ cultivar of the control was significantly lower than for the remaining treatments. Markedly more dwarf shoots were obtained for ‘Jonagold’ maiden trees than for ‘Idared’ (Table 2).

On the basis of the performed chemical analyses of the content of macroelements in leaves no unambiguous impact of maiden trees spraying with Promalin and foliar fertilizers was observed. Only significantly lower content of nitrogen was noted for ‘Idared’ maiden trees treated with Florovit as compared to the remaining treatments. Also, the content of phosphorus in the leaves of ‘Jonagold’ maiden trees was significantly lower when the fertilizer was applied. Higher content of potassium in the leaves of the control of ‘Jonagold’ maiden trees, lower content of magnesium for maiden trees of both cultivars and calcium for the control of ‘Jonagold’ cultivar were noted.

Table 2

Average number of flower buds and long and dwarf shoots
Średnia liczba pąków kwiatowych, długopędów i krótkopędów

Chemical treatments Zastosowane środki chemiczne	Cultivars – Odmiany					
	number of flower buds liczba pąków kwiatowych		number of long shoots liczba długopędów		number of dwarf shoots liczba krótkopędów	
	Jonagold	Idared	Jonagold	Idared	Jonagold	Idared
Promalin	0.0 a*	0.2 a	6.4 c	1.9 a	11.4 c	2.4 b
Urea – Mocznik	3.3 c	2.0 bc	4.2 b	1.8 a	11.8 c	1.6 b
Florovit	3.0 c	2.2 c	5.6 bc	1.4 a	10.7 c	1.7 b
Lime and magnesium saltpetre Saletra Ca-Mg	2.4 c	2.1 c	5.5 bc	1.7 a	11.8 c	2.0 b
Control – Kontrola	0.8 ab	0.6 a	4.1 b	0.5 a	10.5 c	0.2 a

*Means followed by the same letters within the characteristic do not differ significantly at $\alpha = 0.05$.

*Średnie oznaczone tymi samymi literami w obrębie analizowanych cech nie różnią się między sobą istotnie na poziomie $\alpha = 0,05$.

Table 3

Content of mineral elements in the leaves of maiden apple trees (% d. m.)
Zawartość składników mineralnych w liściach okulantów jabłoni (% s. m.)

Chemical treatments Zastosowane środki chemiczne	Nitrogen Azot		Phosphorus Fosfor		Potassium Potas		Magnesium Magnez		Calcium Wapń	
	cultivar – odmiana									
	Jonagold	Idared	Jonagold	Idared	Jonagold	Idared	Jonagold	Idared	Jonagold	Idared
Promalin	2.09 ab*	2.63 e	0.44 abc	0.50 e	1.90 cd	1.86 bc	0.36 abc	0.36 abc	2.73 de	2.26 a
Urea Mocznik	2.14 ab	2.56 de	0.46 cd	0.47 d	2.03 e	1.80 ab	0.40 bc	0.36 abc	2.60 bcd	2.86 e
Florovit	2.16 b	2.40 c	0.41 a	0.47 d	1.96 de	1.80 ab	0.40 bc	0.40 bc	2.56 bc	2.53 b
Lime and magnesium saltpetre Saletra CaMg	2.15 ab	2.60 de	0.45 bcd	0.50 e	1.90 cd	1.86 bc	0.40 bc	0.43 c	2.70 cd	2.33 a
Control Kontrola	2.07 a	2.53 d	0.42 ab	0.50 e	2.16 f	1.76 a	0.26 a	0.30 ab	2.36 a	2.36 a

*Means followed by the same letters within the characteristic do not differ significantly at $\alpha = 0.05$.

*Średnie oznaczone tymi samymi literami w obrębie analizowanych cech nie różnią się między sobą istotnie na poziomie $\alpha = 0,05$.

The results of chemical analysis of the leaves of maiden apple trees presented in Table 3 did not confirm the results obtained earlier by **Szwedo** and **Murawska** (1999). The authors mentioned noted in the leaves of 'Jonagold' maiden trees higher content of nitrogen (on average 2.5% dry matter), lower content of phosphorus (0.15-0.20% dry matter) and magnesium (0.23-0.28% dry matter) depending on the year and the time of collecting leaf samples. The most similar results were obtained in the case of the content of potassium (on average 2.0% dry matter). On the basis of the observation it can be stated that the foliar fertilization does not always exhibit direct impact on the content of macroelements in the leaves of maiden apple trees in a nursery.

Conclusions

1. Promalin caused the most intensive branching of maiden trees, but at the same time reduced to a greater extent the number of flower buds formed. It did not affect the thickness and height of maiden trees.
2. From among the foliar fertilizers applied none of them affected markedly the growth and formation of side shoots. However, all of them increased the number of flower buds formed comparing to the control.
3. The treatment of maiden trees with the preparation Promalin and foliar fertilizers did not affect unambiguously the content of macroelements in leaves.

References

- Bootsma J.** (1995): Plantmaterial appel. Voorsprongmettweejarigebomen. *Fruiteelt* 85 (47): 16-17.
- Chelpinski P., Ostrowska K., Czarnik J.** (1998): Zależność między wskaźnikiem wzrostu młodych drzew wiśni i śliwy. *Zesz. Nauk. AR Krak.* 333: 401-406.
- Czyńczyk A.** (1998): Podkładki słabo rosnące podstawowym czynnikiem intensyfikacji sadów. In: 37 Og.-pol. Nauk. Konf. Sadown. ISiK, Skierniewice 25-27 sierpnia: 101-110.
- Jaumień F., Czarnecki B., Mitrut T., Poniedziałek W.** (1992): Very similar effects of a mixture of GA3 and BA (6-benzylaminopurine) and of GA3+7 and BA on branching of some apple cultivars in nursery. *Acta Hort.* 329: 35-42.
- Lipecki J., Janisz A.** (1999): Zależność między cechami charakteryzującymi wzrost okulantów jabłoni. *Zesz. Nauk. AR Krak.* 351: 67-71.
- Poniedziałek W., Nosal K., Porębski S.** (1993): Wpływ rozgałęziania się drzewek jabłoni w szkółce na ich wzrost i owocowanie w sadzie. *Zesz. Nauk. AR Krak. Ser. Ogrodn.* 21: 59-67.
- Poniedziałek W., Porębski S., Gąstoł M.** (1996): Korelacja między pomiarami fitometrycznymi okulantów odmian Melrose i Gloster, a ich wzrostem i plonowaniem. In: 35 Og.-pol. Nauk. Konf. Sadown. ISiK, Skierniewice: 137-142.
- Shepherd H.R.** (1979): Effect of tree quality at planting time on orchard performance. *Ann. Rep. East Malling Res. Sta. For 1978*: 40.
- Słowiński A., Sadowski A.** (1996): Wzrost i rozgałęzianie się drzewek trzech odmian jabłoni w szkółce w zależności od użytej podkładki. In: II Og.-pol. Symp. „Nowe rośliny i technologie w ogrodnictwie”. T. II. AR, Poznań: 262-265.
- Szwedo J., Murawska D.** (1999): Zawartość składników mineralnych w liściach jednorocznych okulantów jabłoni w zależności od terminu pobierania prób *Zesz. Nauk. AR Krak.* 351: 77-80.

- Włodarczyk P.** (1994): Wpływ jakości wysadzonych drzewek na wzrost i plonowanie jabłoni odmiany Elstar na podkładce M 9. Szkółkarstwo, Numer specjalny: 38-39.
- Van Oosten H.J.** (1978): Effect of initial tree quality at planting on yield. Acta Hort. 65: 123-125.

WPŁYW PREPARATU PROMALIN ORAZ NAWOZÓW
STOSOWANYCH DOLISTNIE
NA WZROST OKULANTÓW DWÓCH ODMIAN JABŁONI W SZKÓŁCE

S t r e s z c z e n i e

Badania przeprowadzono w latach 2003-2004 na terenie Rolniczego Zakładu Doświadczalnego w Baranowie. Porównano w nich wpływ stosowania preparatu Promalin i trzech nawozów stosowanych dolistnie na wzrost i rozgałęzianie się okulantów jabłoni odmiany 'Jonagold' i 'Idared'. Preparat Promalin zwiększył istotnie liczbę długopędów odmiany 'Jonagold' i krótkopędów odmiany 'Idared' w stosunku do kontroli. Jednocześnie nie inicjował zakładania pąków kwiatowych. Stosowane nawozy dolistne nie różnicowały istotnie wyników określających wzrost okulantów oraz ich rozgałęzianie się. Zwiększyły natomiast istotnie liczbę zawiązanych pąków kwiatowych. Podawane drogą dolistną środki chemiczne nie miały jednoznacznego wpływu na zawartość makroskładników w liściach okulantów jabłoni rosnących w szkółce.