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THE EFFECT OF STOCKS ON THE QUALITY OF YOUNG TREES AND THE NURSERY EFFICIENCY OF CHERRY TREES CV. 'ŁUTÓWKA'

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Abstract. Studies were conducted at the Experimental Station of the Agricultural University of Lublin in the years 1997–2000 the aim of which was to estimate the quality of young trees and the nursery eficiency of cherry trees on 6 stocks: P-HL 84 (A), P-HL 6 (C), Colt, F 12/1, mahaleb cherry (*Prunus mahaleb* L.) and sweet cherry (*Prunus avium* L.). The highest percentage of the taken buds was found on P-HL 84, P-HL 6 and F 12/1. The budding of the enumerated stocks every year makes it possible to achieve the greatest nursery efficiency. More than 78% of first quality trees were obtained on stocks Colt and mahaleb cherry. The worst quality cherry trees of cv. 'Łutówka' were obtained on vegetative clones P-HL 84 and 6 as well as F 12/1.

Key words: cherry, stock, quality of young trees, nursery efficiency

INTRODUCTION

Nursery material of high quality is the basic condition of intensive fruit growing [Poniedziałek 1996]. The number and quality of the obtained trees is related both to biological factors such as the stock [Webster and Hollands 1999] and the noble cultivar [Lipecki and Lipecki 1994] as well as agricultural treatments. A significant effect on the growth and quality of the young trees is exerted by the course of the weather, especially during the vegetation [Słowiński 2001, Baryła 2005].

A properly chosen stock significantly affects the trees growth, fructification period, fertility and the quality of the fruit [Wertheim et al. 1998]. According to Poniedziałek et al. [1997], a different effect of the stock on the growth of young trees in a nursery is observed as compared to the growth of trees in an orchard, which is connected with a short production cycle as well as various abilities of the stocks to overcome the stress.

The purpose of the studies was to find out the effect of stocks on cutting of the buds of the cherry cv. 'Łutówka', the quality of the trees and the nursery efficiency.

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MATERIAL AND METHODS

The studies were conducted at the Experimental Station of Felin of the Agricultural University of Lublin in the years 1997–2000. A field experiment was established on grey brown podsolic soil formed on marls from loess formations, classified as the second valuation class. Four types of rootstocks: P-HL 84 (A), P-HL 6 (C), Colt, F 12/1 and the seedlings of mahaleb cherry (*Prunus mahaleb* L.) and sweet cherry (*Prunus avium* L.) constituted the objects of studies. Clones P-HL were obtained from tissue culture, however Colt and F 12/1 by traditional mettod in the nursery. The stocks were planted in the nursery in early spring in the spacing of 90×25 cm (44 400 rootstocks · ha^{-1}). The budding was performed on 15 July by the method of applying the buds of cv. 'Łutówka'. No herbicides were used during the studies and the nursery was weeded mechanically or, if need arose, manually. No irrigation was applied, while fertilization and control were according to the up-to-date recommendations for the nurseries of stone fruit trees.

The experiment was set in random blocks. It comprised 6 combinations in 5 repetitions. The combinations were the kinds of stocks, whereas the repetitions were the plots where 20 plants grew on each. The measurements were performed on 10 randomly chosen young trees.

The paper evaluated the taking of bud expressed as the relation of the buds taken in spring in the second year of the nursery to the number of budded stocks. The number of buds shooting in the first half of May and in the first half of June in relation to the number of budded stocks was calculated. The nursery productivity was presented as the percentage of the number of the obtained young trees in relation to the number of planted and budded stocks. The number of trees obtained from the area of 1 ha with the density of planting 25×90 cm was also calculated. The quality of young trees was expressed as the percentage proportion of the trees of the first and second quality and non-commercial material in the total number of the obtained trees.

The results were statistically analyzed by means of variance analysis and Tukey's confidence intervals. The significance of differences was determined at $p = 0.05$.

RESULTS

The studies conducted in the years 1998–2000 did not show any significant effect of stocks on the cutting and shooting of buds cv. 'Łutówka' (tab. 1). On average, the greatest number of the taken buds – over 85% – was observed on rootstocks P-HL 84 and 6 as well as F 12/1, while the smallest – on the seedlings of mahaleb cherry (66.3%). P-HL series clones were characterized by the highest percentage of shooting buds in the first half of May. The highest number of buds shooting with delay was found out on rootstock F 12/1 and Colt: respectively 24.9% and 17.1%.

On average, significantly more young trees were obtained for the period of three years on rootstocks P-HL as compared to the planted stocks (over 75%) than on the seedlings of mahaleb cherry (45.3%). On the other hand, no significant effect of the stocks was observed on the number of the obtained trees in relation to the budded stocks or on the number of young trees obtained from the area of 1 ha (tab. 2).

Table 1. The effect of the stocks on taking and shooting of the buds of cherry cv. 'Łutówka' in the years 1998–2000

Tabela 1. Wpływ podkładek na przyjmowanie i wybijanie oczek wiśni odmiany 'Łutówka' w latach 1998–2000

Stock Podkładka	Percentage of taken buds in relation to budded stocks Procent przyjętych oczek w porównaniu do zaokulizowanych podkładek	Percentage of shooting buds in the first period of May in relation to budded stocks Procent oczek wybijających w pierwszej połowie maja w porównaniu do zaokulizowanych podkładek	Percentage of shooting buds in the first period of June in relation to budded stocks Procent oczek wybijających w pierwszej połowie czerwca w porównaniu do zaokulizowanych podkładek
P-HL 84 (A)	90.0	81.6	8.4
P-HL 6 (C)	85.8	76.2	9.1
Colt	74.0	56.9	17.1
F 12/1	89.9	65.0	24.9
Punus mahaleb L.	66.3	56.0	10.3
Prunus avium L.	70.7	61.9	8.8
LSD NIR p=0.05	ns ni	ns ni	ns ni

In 1998 significantly more young trees were obtained on clones P-HL as compared to the planted stocks. In the second year a significantly greater percentage of trees were obtained on rootstocks F 12/1, P-HL 84 and 6 than on the seedlings of mahaleb cherry. In 2000 significant differences were observed between clone F 12/1 and the seedlings of mahaleb cherry and sweet cherry.

In 1998 and 1999 a significantly higher number of young trees were obtained on the Czech clone P-HL 84 as compared to the budded stocks and from the area of 1 ha than on the seedlings of mahaleb cherry and on rootstock Colt and sweet cherry in the first year. No significant differences were observed in the last year.

In the case of two stocks significant differences were observed between the production cycles in the number of the obtained trees as compared to the planted stocks. Colt differed between 1998 and 2000, while the mahaleb cherry differed between the first and the second production cycles on the one hand and the last one on the other.

No significant differences were found out in the Czech clones P-HL in the number of young trees obtained from the area of 1 ha or in the percentage of the obtained trees as compared to the budded stocks. The seedlings of mahaleb cherry differed significantly between particular years of studies, while rootstocks Colt and F 12/1 differed between the years 1999 and 2000. Sweet cherry significantly differed in the number of the obtained young trees between the first and the successive production cycles (tab. 2).

Statistical analysis made for the mean values from the years 1998–2000 did not show any significant effect of the stocks on the quality of the young cherry trees (tab. 3). The greatest number of first choice trees were obtained on rootstock Colt (84.5%) and the seedlings of mahaleb cherry (78.9%). The highest percentage of the second quality young trees and non-commercial trees was obtained from the budding of rootstocks: P-HL 84, P-HL 6 and F 12/1.

Table 2. The effect of the stocks on the nursery efficiency of cherry cv. 'Łutówka' in the years 1998–2000
Tabela 2. Wpływ podkładek na wydajność szkółki wiśni odmiany 'Łutówka' w latach 1998–2000

	Stock Podkładka	1998	1999	2000	Mean Średnio	Differences between production cycles Różnice między cyklami produkcyjnymi			LSD NIR p = 0.05
Percentage of young trees in relation to planted stocks Procent okulantów w porównaniu do posadzonych podkładek	P-HL 84 (A)	87.0 a	76.0 a	81.0 abc	81.3 a	ns ni	ns ni	ns ni	ns ni
	P-HL 6 (C)	74.0 a	77.0 a	76.0 abc	75.7 a	ns ni	ns ni	ns ni	ns ni
	Colt	52.0 bc	58.0 ab	85.0 ab	65.0 ab	B	AB	A	30.4
	F 12/1	-	83.0 a	87.0 a	-	-	ns ni	ns ni	ns ni
	Prunus mahaleb L.	35.0 d	40.0 b	61.0 c	45.3 b	B	B	A	7.2
	Prunus avium L.	49.0 cd	65.0 ab	63.0 bc	59.0 ab	ns ni	ns ni	ns ni	ns ni
	LSD – NIR p = 0.05	16.1	35.2	22.5	27.7				
Percentage of young trees in relation to budded stocks Procent okulantów w porównaniu do zaokulizowanych podkładek	P-HL 84 (A)	87.6 a	91.4 a	86.8	88.6	ns ni	ns ni	ns ni	ns ni
	P-HL 6 (C)	80.4 ab	80.2 abc	92.4	84.3	ns ni	ns ni	ns ni	ns ni
	Colt	67.0 bc	59.0 c	91.4	72.5	AB	B	A	30.1
	F 12/1	-	83.8 abc	86.6	-	-	B	A	12.6
	Prunus mahaleb L.	40.0 d	62.2 bc	89.4	63.9	C	B	A	13.5
	Prunus avium L.	49.6 cd	77.0 abc	81.0	69.2	B	A	A	16.1
	LSD – NIR p = 0.05	17.4	27.7	ns ni	ns ni				
Number of obtained young trees per 1 ha Liczba okulantów uzyskanych z powierzchni 1 ha	P-HL 84 (A)	38 900 a	40 600 a	38 500	39 300	ns ni	ns ni	ns ni	ns ni
	P-HL 6 (C)	35 700 ab	35 600 abc	41 000	37 400	ns ni	ns ni	ns ni	ns ni
	Colt	29 700 bc	26 200 c	40 600	32 200	AB	B	A	13.3
	F 12/1	-	37 200 abc	42 900	-	-	B	A	5.6
	Prunus mahaleb L.	17 800 d	27 400 bc	39 700	28 400	C	B	A	6.2
	Prunus avium L.	22 000 cd	34 200 abc	36 000	30 700	B	A	A	7.1
	LSD – NIR p = 0.05	7700	12 400	ns ni	ns ni				

Means followed by the same letter are not significantly different at α = 0.05
Big letters mark significant differences between production cycles at α = 0.05
Średnie oznaczone tymi samymi literami nie różnią się istotnie przy α = 0,05
Dużymi literami oznaczono istotne różnice między cyklami produkcyjnymi przy α = 0,05

Table 3. The effect of the stocks on the quality of cherry cv. 'Łutówka' in the years 1998–2000
Tabela 3. Wpływ podkładek na jakość okulantów wiśni odmiany 'Łutówka' w latach 1998–2000

Stock Podkładka	Percentage of the first quality trees Procent drzewek pierwszego wyboru			Differences between production cycles Różnice między cyklami produkcyjnymi			LSD NIR p = 0.05	Quality of trees means of the years 1998-2000 Jakość drzewek wiśni średnia z lat 1998-2000		
	1998	1999	2000					Percentage of first quality trees Procent drzewek I wyboru	Percentage of second quality trees Procent drzewek II wyboru	Percentage of non-commercial trees Procent drzewek niehandlowych
P-HL 84 (A)	81.6 b	16.6 b	4.0 c	A	B	B	15.9	34.1	32.4	33.5
P-HL 6 (C)	85.0 ab	5.0 b	7.8 bc	A	B	B	13.8	32.6	28.7	38.5
Colt	98.0 a	79.6 a	76.0 a	A	B	B	13.1	84.5	12.0	3.4
F 12/1	-	31.2 b	23.2 bc	-	ns ni	ns ni	ns ni	27.2	35.3	37.4
Prunus mahaleb L.	95.6 ab	72.8 a	65.2 a	A	B	B	13.4	78.9	16.2	4.8
Prunus avium L.	91.8 ab	31.0 b	25.6 b	A	B	B	31.1	59.5	26.4	14.1
LSD – NIR p = 0.05	14.2	30.2	21.1					ns ni	ns ni	ns ni

For explanation: see table 2
Objaśnienie: patrz tabela 2

In 1998 significantly more young trees of first quality were obtained on Colt rootstock than on P-HL 84. In the other two years a significantly greater percentage of first quality trees were found on rootstock Colt and the seedlings of mahaleb cherry.

Differences were found out between the production cycles. A significantly better quality of young trees of cv. 'Łutówka' were obtained in the firs year of studies, independently of the stock type, the proportion of the first selection trees did not exceed 81%. In the case of rootstock F 12/1 no significant differences were observed (tab. 3).

DISCUSSION

Stocks differ between each other with a number of genetic features, which are manifested in a varied effect on the cultivar [Gruca 1995]. The interaction of both components is a complex process that has not been studied in detail so far and it lasts throughout the life of the trees. Young cherry trees produced in Poland are mainly (90% of the trees) on the seedlings of sweet cherry (*Prunus avium* L.) and mahaleb cherry (*Prunus mahaleb* L.), while the dominating cultivar has been 'Łutówka' for years [Smaczyński 2005].

According to Gąstoł and Poniedziałk [1998] a significant effect decisive of the usefulness of the stock is its effect on the result of budding. The best taken cherry buds were observed on rootstocks P-HL 84, F 12/1 and P-HL 6, while the worst were found out of mahaleb cherry. In the budding of cherry cultivar similar results concerning P-HL clones were achieved by Ostrowska and Chełpiński [1999]. Baryła and Kapłan [2006] compared different times and methods of cherry budding and they obtained more taken buds on sweet cherry from the budding on 15 July than on the seedlings of mahaleb cherry. It was observed during the three years of studies that much more buds shot on clones P-HL than on other stocks. The greatest percentage of buds shooting with delay was observed on rootstocks F 12/1 and Colt.

The most important thing for plant-breeding nursery is the final result of production, which is the number and quality of the obtained trees. The present paper shows that the nursery efficiency was related to the stock and it changed in particular years. The highest number of young trees was obtained in 2000. Significantly more trees, on average, as compared to the planted stocks were obtained on clones P-HL, while the smallest percentage was observed on the seedlings of mahaleb cherry. In 1998 and 1999 a significantly greater number of young trees from the area of 1 ha and the number of trees as compared to the budded stocks was obtained on P-HL 84 than on the seedlings of mahaleb cherry and Colt than on sweet cherry in the first year. Comparing clones P-HL, Ostrowska and Chełpiński [1999] achieved the greatest nursery efficiency on rootstock P-HL 6. Stachowiak and Świerczyński [1999], who budded cherry trees on Colt rootstock, achieved about 75% young trees. Slightly worse results on this stock were achieved in the discussed studies on cherry tree.

The stock is one of the basic factors decisive of the quality of the trees [Poniedziałek et al. 1997]. In each year a significantly higher percentage of first quality trees were obtained on Colt rootstock and on the seedlings of mahaleb cherry in 1999 and 2000. The greatest number of second quality young trees and non-commercial trees were

obtained from the budding of rootstocks: P-HL 84, F 12/1 and P-HL 6. The best quality cherry trees cv. 'Łutówka' were obtained in the first production cycle.

CONCLUSIONS

1. In the years 1998–2000 no significant effect of stocks on the taken and shot cherry buds was shown. The greatest number of taken buds of cv. 'Łutówka' (more than 85%) was found out on clones P-HL 84, F 12/1 and P-HL 6, while the smallest – on the seedlings of mahaleb cherry (66.3%). Rootstocks F 12/1 and Colt showed the greatest tendency to delay the bud shooting.

2. The highest nursery efficiency in each year of studies was achieved on rootstocks of series P-HL and F 12/1, while the lowest was observed on the seedlings of mahaleb cherry and sweet cherry.

3. A higher percentage of first selection trees were obtained on the rootstocks of Colt than on the other stocks (in the last two years it was the highest).

4. Although the Czech rootstocks P-HL and clone cherry F 12/1 gave the highest number of taken buds and high nursery efficiency, they should not be recommended in cherry tree production due to the poor quality of young trees (more than 33% of non-commercial trees).

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WPŁYW PODKŁADEK NA JAKOŚĆ OKULANTÓW I WYDAJNOŚĆ SZKÓŁKI WIŚNI ODMIANY 'ŁUTÓWKA'

Streszczenie. W latach 1997–2000 w Gospodarstwie Doświadczalnym Felin Akademii Rolniczej w Lublinie, przeprowadzono badania mające na celu ocenę jakości okulantów oraz wydajności szkółki wiśni na 6 podkładkach: P-HL 84 (A), P-HL 6 (C), Colt, F12/1, antypka (*Prunus mahaleb* L.) i czereśnia ptasia (*Prunus avium* L.). Największy procent przyjętych oczek stwierdzono na P-HL 84, P-HL 6 i F 12/1. Okulizacja wymienionych podkładek w każdym roku pozwalała na uzyskanie największej wydajność szkółki. Na podkładce Colt i antypka otrzymano ponad 78% drzewek pierwszego wyboru. Najgorszej jakości okulanty wiśni odmiany 'Łutówka' uzyskano na wegetatywnych klonach P-HL 84 i 6 oraz F 12/1.

Słowa kluczowe: wiśnia, podkładka, jakość okulantów, wydajność szkółki

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