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EFFICIENCY OF WHITE FLEECE DURING THE CULTIVATION OF EARLY POTATOES [1]

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Introduction

Early potatoes growers in the Czech Republic in the traditional regions of southern Moravia and lowland region of the Labe river have strived for early harvest of quality tubers since the end of May. It enables them to get favourable exercise prices and to ensure on place at the market. Consequently they must use various technological measures which enable an early harvest. According to the literature a row covering by a fleece belongs to them.

A fleece of Agryl type could advance early potatoes harvest by 10–16 days and increase a yield by 20% and more [JAŠA 1994]. Covering by polypropylene fleece Pegas Agro 17 from planting to full emergence increased the marketable yield of tubers by an average of 33% and increased the proportion of large tubers in the total yield [WADAS, JABŁOŃSKA-CEGLAREK 2000]. Also other authors confirmed favourable influence of covering by polypropylene fleece on yield and better percentage of commercial tubers in early harvests [BIZER 1994; LUTOMIRSKA 1995; PROŚBA-BIAŁCZYK, MYDLARSKI 1998; DEMMLER 1998]. The fleece creates optimum climate for germination and plant growth and maintenance more favourable temperature during cold weather [BIZER 1997; PROŚBA-BIAŁCZYK, MYDLARSKI 1998]. By using polypropylene sheets potatoes germinate and begin their first growth stages faster and also develop their photosynthetic apparatus earlier [PROŚBA-BIAŁCZYK, MYDLARSKI 1998]. Favourable economic results of the fleece use in early potatoes growing were found out by PROŚBA-BIAŁCZYK et al. [2000].

In the Czech Republic only some of the early potatoes growers are convinced about the advantages of this technology. The aim of this work was to verify the efficiency of the fleece for early potatoes under soil and climate conditions in the lowland region of the Labe river, to evaluate its influence on yield formation and on proportion of commercial tubers, to monitor influence of row covering on soil temperature under the fleece and to verify its efficiency against spring frost.

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Material and methods

In precise field trials with four replications carried out from 1999 to 2001 and in 2003 influence of white fleece Pegas-agro 17 UV on dynamics of yield formation in early irrigated potatoes was monitored. At „Přerov nad Labem" site (lowland region of the Labe river) very early potato cultivars Adora and Impala were grown according to the methodology of Central Institute for Supervising and Testing in Agriculture. The fleece was streched over the rows immediately after planting (30.03.1999, 04.04.2000, 05.04.2001 and 02.04.2003) and removed when the highest daily temperature was above 20°C, in particular on these days: 18.05.1999, 04.05.2000, 10.05.2001 and 17.05.2003. Herbicide Sencor 70 WP was applied on ridges at the rate of 0.5 kg·ha^{-1} after planting and before the fleece was placed. Plant ridging was performed twice every year in order to evaluate the level of yield elements in the terms stated in Table 1. Soil temperature in a ridge at the depth of 100 mm (dataloggers Tinytag ultra) was measured every 15 minutes during vegetation period in 2003.

Results and discussion

The obtained results confirm significantly a positive influence of the fleece on tuber yield at early harvesting terms. Tables 1 and 2 show that during the first collections (02.06.1999, 31.05.2000, 07.06.2001 and 04.06.2003) tuber yield for variants with the fleece exceeded the usual level for yield (minimum of 10–12 t·ha^{-1}) and in all cases statistically significantly exceeded the tuber yield of the control option (in cultivar Adora it was 146.5%, 114.9%, 124.4% and 519.0% in 1999, 2000, 2001 and 2003 respectively; in cultivar Impala it was 158.6%, 127.5%, 142.9% and 600% in 1999, 2000, 2001 and 2003 respectively).

Our results are consistent with other published data [BIZER 1994; LUTOMIRSKA 1995; DEMMLER 1998; PROŚBA-BIAŁCZYK, MYDLARSKI 1998; JAŠA 1994].

Table 1; Tabela 1

Yield of commercial tubers of Adora cultivar
Plon handlowy bulw odmiany Adora

Year of cultivation Rok uprawy	Date of harvest Termin zbioru bulw	Yield; Plon (t·ha^{-1})			$LSD_{0.05}$ $NIR_{0.05}$	F : C A : K (%)
		control (C) kontrola (K)	fleece (F) agrowłóknina (A)	difference F – C różnica A – K		
1999	02.06.	11.76	17.23	5.47	2.02	146.5
	24.06.	32.64	31.77	–0.87	3.80	97.3
2000	31.05.	16.89	19.40	2.51	2.12	114.9
	28.06.	39.65	41.35	1.70	4.61	104.3
2001	07.06.	18.96	23.59	4.63	3.46	124.4
	27.06.	42.80	42.25	–0.55	6.03	98.7
2003	04.06.	3.44	17.84	14.40	1.95	519.0
	26.06.	28.34	42.50	14.16	5.68	150.0

Favourable influence of white fleece on the yield level at early terms of potato harvest was connected with microclimate conditions under the fleece, which advanced sprouting by four up to eight days as compared to the control and accelerated further growth and crop development when the weather conditions were less favourable for early potatoes. It is confirmed by the results of temperature measurements in the soil in 2003 (Fig. 1). Significantly higher values are apparent for daily maximum temperatures and also higher values of minimums for crops under the fleece. Our results concerning soil temperature under the fleece correspond well with the findings of PROŚBA-BIAŁCZYK, MYDLARSKI [1998].

Tables 1 and 2 indicate that a higher yield effect of fleece during 1999–2001 was observed in cultivar Impala (on average for three years the yield increment for Impala as compared to the control variant was 43.0% and for Adora it was 28.6%). Contradictory result in 2003 were distorted by the damage of the control crops by spring frosts. A different yield effect of the fleece for various cultivars in an experiment with four cultivars was also found by WADAS, JABŁOŃSKA-CEGLAREK [2000].

Results from 2003 were influenced by the cold weather with frequent ground frosts in the first and second decade of April (09.04. and 10.04. minimums around –7°C). Soil temperature at the depth of 100 mm (without the fleece) decreased three times below 0°C. Potatoes did not emerge at that time. Major quantity of sprouts on tubers of the control variant freezed, crops emerged with a large interspace and were irregular, other hills emerged with delay (some of them even in the middle of May). On the other hand the crops under the fleece emerged properly closed with regular hills. During critical days with the ground frosts heat insulating effect of the fleece manifested itself significantly (Fig. 1). Favourable heat insulating effect of the fleece against ground frosts is also confirmed by JAŠA [1994] and BIZER [1997].

Table 2; Tabela 2

Yield of commercial tubers for Impala cv.
Plon handlowy bulw odmiany Impala

Year of cultivation Rok uprawy	Date of harvest Termin zbioru bulw	Yield; Plon (t.ha^{-1})			$LSD_{0.05}$ $NIR_{0.05}$	F : C A : K (%)
		control (C) kontrola (K)	fleece (F) agrowłóknina (A)	difference F – C różnica A – K		
1999	02.06.	8.88	14.08	5.20	2.38	158.6
	24.06.	34.40	35.51	1.11	4.56	103.2
2000	31.05.	15.53	19.81	4.28	1.87	127.6
	28.06.	50.35	51.82	1.47	4.98	102.9
2001	07.06.	12.74	18.21	5.47	1.97	142.9
	27.06.	44.96	46.29	1.33	5.10	103.0
2003	*04.06.*	*2.45*	*14.89*	*12.44*	*2.12*	*608.0*
	26.06.	*32.70*	*39.92*	*7.22*	*6.60*	*122.0*

During the second collection in the last decade of June differences between the experimental and control variant in the individual years nearly equa-

lized (except for 2003) and did not exceed a limit of statistical significance. In 1999 and 2001 in cultivar Adora the control variant had a higher yield as compared to the experimental variant. Our results show that the fleece was important only for the yield increase of crops intended for an early harvest. During good weather conditions control crops started to have higher vitality and in June they nearly compensated the yield deficiency. The year 2003 was an exception.

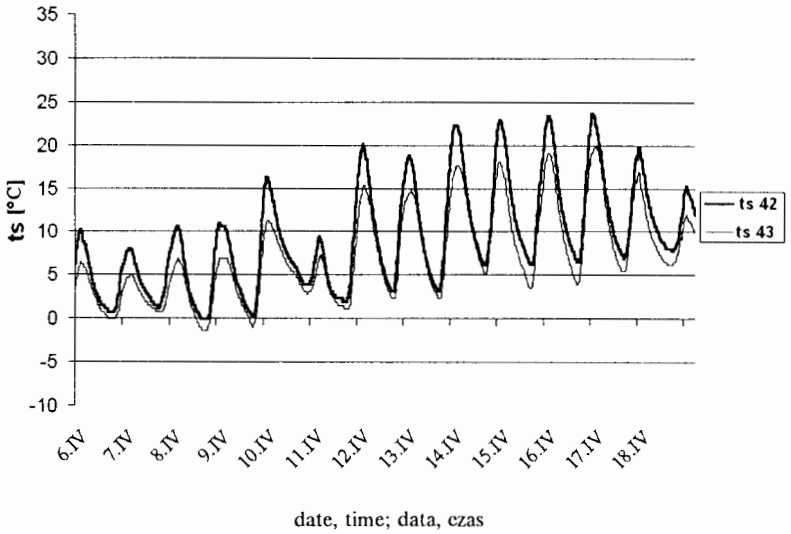

Fig. 1. Soil temperatures for uncovered potatoes (ts 43) and for potatoes covered with fleece (ts 42)

Rys. 1. Przebieg temperatur gleby w łanie ziemniaka bez osłony (ts 43) i pod osłoną z agrowłókiny (ts 42)

Conclusions

The achieved results proved that the use of white fleece is an important intensification factor for watered early potato cultivation for early harvest terms. In our experiments in May and June during three years the average of both cultivars the fleece increased the yield by 35.8% as compared to the control. The yield effect is influenced by weather conditions of the year (higher effect in years with cold weather in spring) and by cultivar (cultivar Impala had higher yield gain as compared to cultivar Adora). A favourable influence of the fleece on temperatures of the soil at the depth of 100 mm during the whole period of covering was demonstrated. Also a significant heat insulating effect of the fleece during ground frosts was proved.

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Key words: early potatoes, fleece, yield, culivars, soil temperature

Summary

During 1999–2001 and in 2003 the effect of white fleece Pegas-agro 17 UV on the yield formation in the early irrigated potatoes (Adora and Impala cvs) was investigated in an early potatoes region of the Czech Republic. The fleece was placed over the crops for 30 days (1999), 49 days (2000), 35 days (2001) or 45 days (2003) after the planting. The fleece significantly increased yield of commercial tubers in the early harvest (02.06.1999 – 52.5%, 31.05.2000 – 21.3%, 07.06.2001 – 33.7% and 04.06.2003 – 463% in comparison with the control in average values of both cultivars). In the later sequential harvests the differences between the variant with fleece and the control variant diminished and at the end of June they were already nonsignificant. Between cultivars the greater yield effect was found in Impala as compared with Adora cv. A favourable influence of the fleece on the soil temperatures was demonstrated and also the heat insulating effect of the fleece during ground frosts was proved.

WPŁYW AGROWŁÓKNINY NA PRODUKCYJNOŚĆ ZIEMNIAKÓW WCZESNYCH

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Słowa kluczowe: ziemniak wczesny, agrowłókniną, plon, odmiana, temperatura gleby

Streszczenie

W latach 1999–2001 i 2003, w rejonach korzystnych do uprawy ziemniaków wczesnych w Republice Czeskiej, prowadzono badania nad plonowaniem wczesnych odmian Adora i Impala pod osłoną z agrowłókniny Pegaz-agro 17 UV. Poletka agrowłókniną okryte były od wysadzenia ziemniaków przez 30 dni w roku 1999, 49 dni w roku 2000, 35 dni w 2001 i 45 dni w roku 2003. Zastosowanie agrowłókniny zwiększało plon ziemniaków we wczesnych terminach zbioru, średnio dla obu odmian, w stosunku do plonu uzyskanego bez okrycia, w kolejnych latach badań odpowiednio o 52,2%, 21,3%, 33,7% i nawet 463%. Podczas zbioru w końcu czerwca różnice były już nieistotne. Większy efekt zastosowania agrowłókniny uzyskano u odmiany Impala, niż u odmiany Adora. Stwierdzono pozytywny wpływ agrowłókniny na temperaturę gleby szczególnie w czasie przygruntowych przymrozków.

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