The effect of polypropylene fleece covering on the yield of early potatoes

K. Hamouz[1], P. Dvořák[1], J. Čepl[2], J. Pivec[1]

[1]*Faculty of Agrobiology, Food and Natural Resources, Czech University of Agriculture in Prague, Prague, Czech Republic*
[2]*Potato Research Institute, Havlíčkův Brod, Czech Republic*

ABSTRACT: In 2000–2003 the effect of white fleece Pegas-agro 17 UV on the dynamics of yield formation in irrigated early potatoes (Adora and Impala varieties) was investigated in an early potato production region of the Czech Republic. The fleece was placed over the crops for 49 days (2000), 35 days (2001), 37 days (2002) or 45 days (2003) after the planting. The fleece significantly increased the yield of commercial tubers at early harvest (31. 5. 2000 to 121.3%, 7. 6. 2001 to 133.7% and 31. 5. 2002 to 134.5% in comparison with the control and on average of both varieties). Differences between the control variant and the fleece variant were insignificant during harvest at the end of June. In later sequential harvests differences between the fleece variant and the control variant diminished and at the end of June they were already insignificant. Between the varieties a greater yield effect was found in Impala variety in comparison with Adora variety. Favourable effects of the fleece on soil temperatures were demonstrated.

Keywords: early potatoes; fleece; yield; variety; soil temperature

Early potato growers in the Czech Republic in traditional regions of southern Moravia and lowland region of the Elbe River have always strived for early harvest of quality tubers since the end of May. It enables them to capture favourable exercise prices and to ensure a place in the market. Consequently they must take various technological measures that will make early harvest possible. According to horticultural literature a fleece covering of rows belongs to them.

The fleece of Agryl type could advance early potato harvest by 10–16 days and increase the yield by 20% and more (Jaša 1994). The cover of polypropylene fleece Pegas-agro 17 UV from planting to full emergence increased the marketable yield of tubers by 33% on average, and it increased the proportion of large tubers in total yield (Wadas, Jabłońska-Ceglarek 2000). Other authors also confirmed favourable effects of polypropylene fleece cover on yield and higher percentage of commercial tubers in early harvests (Bizer 1994; Lutomirska 1995; Prośba-Białczyk, Mydlarski 1998; Demmler 1998; Dvořák et al. 2004). The fleece creates an optimum climate for germination and plant growth and it maintains more favourable temperatures during cold weather (Bizer 1997; Prośba-Białczyk, Mydlarski 1998). If polypropylene sheets are used, potatoes germinate and begin their first growth stages faster and develop their photosynthetic apparatus earlier (Prośba-Białczyk, Mydlarski 1998; Hamouz, Dvořák 2004). Favourable economic results of the fleece use in early potato growing were reported by Prośba-Białczyk et al. (2000).

In the Czech Republic only some of the early potato growers are convinced about the advantages of this technology. The aim of this paper was to verify the efficiency of fleece cover for early potatoes under soil and climatic conditions in the lowland region of the Elbe River, to evaluate its influence on yield formation and on the proportion of commercial tubers, to monitor the effect of row covering on soil temperatures under the fleece and to verify its efficiency against spring frost.

MATERIAL AND METHODS

In precise field trials with four replications carried out from 2000 to 2003 we investigated the influence

Supported by the Ministry of Education, Youth and Sports of the Czech Republic, Grant No. 590/05 and Research Proposal No. 6046070901.

Table 1. Yield of commercial tubers in Adora variety

Date of harvest	Yield (t/ha)			LSD (α = 0.05)	F/C (%)
	control (C)	fleece (F)	difference F–C		
31. 5.2000	16.89	19.40	2.51	2.12	114.9
28. 6. 2000	39.65	41.35	1.70	4.61	104.3
7. 6. 2001	18.96	23.59	4.63	3.46	124.4
27. 6. 2001	42.80	42.25	–0.55	6.03	98.7
31. 5. 2002	19.11	23.59	4.40	2.21	123.4
27. 6. 2002	44.08	42.69	–1.39	4.29	96.8
4. 6. 2003	3.44	17.84	14.40	1.95	519.0
26. 6. 2003	28.34	42.50	14.16	5.68	150.0

Table 2. Yield of commercial tubers in Impala variety

Date of harvest	Yield (t/ha)			LSD (α = 0.05)	F/C (%)
	control (C)	fleece (F)	difference F–C		
31. 5. 2000	15.53	19.81	4.28	1.87	127.6
28. 6. 2000	50.35	51.82	1.47	4.98	102.9
7. 6. 2001	12.74	18.21	5.47	1.97	142.9
27. 6. 2001	44.96	46.29	1.33	5.10	103.0
31. 5. 2002	12.67	18.45	5.78	2.02	145.6
27. 6. 2002	45.24	46.50	1.26	4.05	102.8
4. 6. 2003	2.45	14.89	12.44	2.12	608.0
26. 6. 2003	32.70	39.92	7.22	6.60	122.0

of white fleece Pegas-agro 17 UV on dynamics of yield formation in irrigated early potatoes. At Přerov nad Labem site (lowland region of the Elbe River) very early potato varieties Adora and Impala were grown according to the methodology of Central Institute for Supervising and Testing in Agriculture. The fleece was stretched over the rows immediately after planting (4. 4. 2000, 5. 4. 2001, 28. 3. 2002 and 2. 4. 2003) and removed when the highest daily temperature was above 20°C, in particular on these

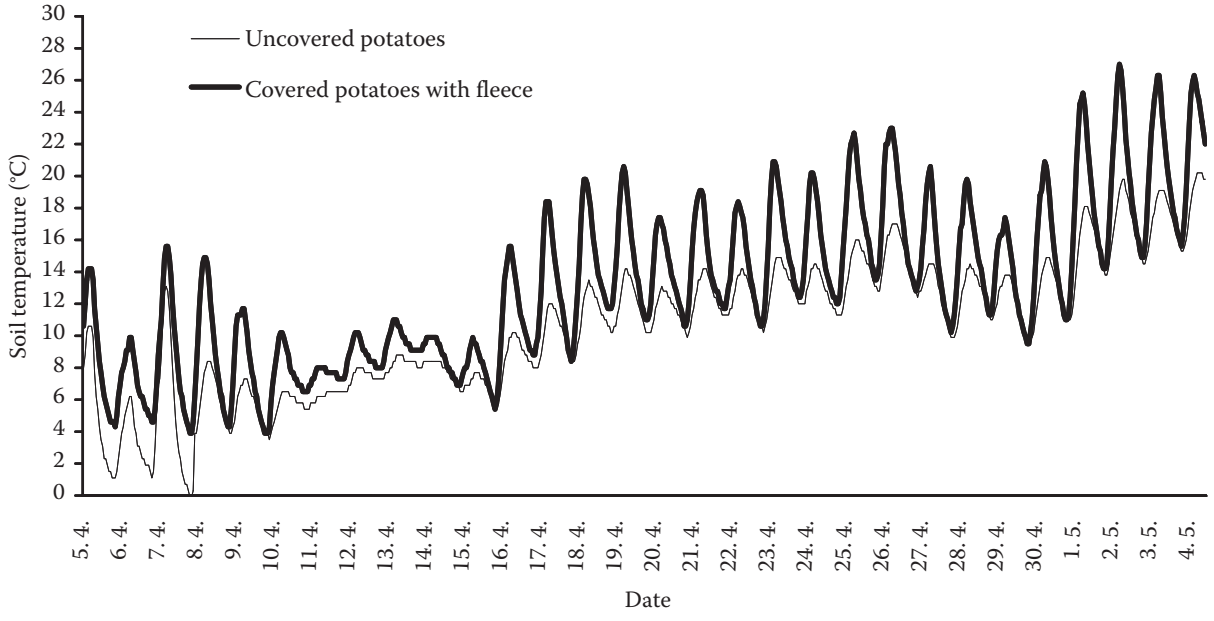

Fig. 1. Soil temperatures for uncovered potatoes and for potatoes covered with fleece

dates: 4. 5. 2000, 10. 5. 2001, 4. 5. 2002 and 17. 5. 2003. Herbicide Sencor 70 WP was applied onto ridges at a rate of 0.5 kg/ha after planting and before the fleece was placed. Plant ridging was performed twice every year in order to evaluate the level of yield elements on dates shown in Table 1. The soil temperature in a ridge at a depth of 100 mm (Tinytag ultra data loggers) was measured every 15 minutes during the vegetation period in 2002.

RESULTS AND DISCUSSION

The results confirm significantly positive effects of the fleece on tuber yield on early harvesting dates. Tables 1 and 2 show that during the first harvests tuber yield in the fleece variants highly outreached the usual level of yield commencement (minimum of 10–12 t/ha) and in all cases it exceeded the tuber yield of control variant statistically significantly (in Adora variety it was 114.9%, 124.4%, 123.4% and 519.0% in 2000, 2001, 2002 and 2003, respectively; in Impala variety it was 127.5%, 142.9%, 145.6% and 607.8% in 2000, 2001, 2002 and 2003, respectively).

Our results are consistent with published data (Bizer 1994; Lutomirska 1995; Demmler 1998; Prośba-Białczyk, Mydlarski 1998; Jaša 1994).

Favourable effects of white fleece on the yield level on early dates of potato harvest were connected with microclimatic conditions under the fleece, which advanced sprouting by four up to eight days compared to the control and accelerated further growth and crop development when weather conditions were less favourable for early potatoes. It is confirmed by the results of temperature measurements in soil in 2002 (Fig. 1). Significantly higher values of daily temperature maximums and also higher values of minimums for crops under the fleece were registered. Our results concerning soil temperatures under the fleece correspond well with the findings of Prośba-Białczyk and Mydlarski (1998).

Tables 1 and 2 indicate that the higher yield effect of fleece in 2000–2002 was found out in Impala variety (on average of three years a yield increment for Impala compared to the control variant was 38.7% and for Adora it was 20.9%). A contradictory result in 2003 is distorted by damage to control crops caused by spring frosts. Different yield effects of the fleece for various varieties in an experiment with four varieties were also reported by Wadas and Jabłońska-Ceglarek (2000).

The results from 2003 were influenced by cold weather with frequent ground frosts in the first and second decade of April (9. 4. and 10. 4. minimums around –7°C). The soil temperature at a depth of 100 mm (without the fleece) decreased three times below 0°C. Potatoes did not emerge at that time. A higher number of sprouts on tubers of the control variant froze, crops emerged with large interspace and were irregular, other hills emerged with delay (some of them even in the middle of May). On the other hand, crops under the fleece emerged properly closed with regular hills. During critical days with ground frosts the heat-insulating effect of the fleece manifested itself significantly (Table 3). Favourable heat-insulating effects of the fleece against ground frosts were also confirmed by Jaša (1994) and Bizer (1997).

Table 3. Absolute extremes (t_{min}, t_{max}) and average values ($t_{average}$) of ground air temperature in potato growth unprotected and protected by the fleece from the 6th April to the 19th April 2003

Variant	t_{min}	t_{max}	$t_{average}$
With fleece	–5.2	31.2	8.4
Without fleece	–7.3	23.3	5.8

During the second harvest in the last decade of June differences between the experimental and control variant in the individual years nearly equalized (except for 2003) and did not exceed the level of statistical significance. In 2001 and 2002 in Adora variety the control variant had a higher yield compared to the experimental variant. Our results show that the fleece was important only for the yield increase of crops intended for early harvest. In good weather conditions control crops started to show higher vitality and nearly compensated yield deficiency in June. The year 2003 was an exception.

References

BIZER E., 1994. Fruhkartoffelanbau unter Vlies und Folie. Kartoffelbau, *45*: 462–466.

BIZER E., 1997. Ernteverfruhung durch Vliesabdeckung. Kartoffelbau, *48*: 60–61.

DEMMLER D., 1998. Vergleich von Folie und Vlies zur Ernteverfruhung in Fruhkartoffeln. Kartoffelbau, *49*: 429–430.

DVOŘÁK P., HAMOUZ K., ČEPL J., PIVEC J., 2004. The non-woven fleece as an implement for acceleration of early potatoes harvest. Scientia Agriculturae Bohemica, *35*: 127–130.

HAMOUZ K., DVOŘÁK P., 2004. Influence of white fleece on the yield formation of early potatoes. Proceedings of the 39th Croatian Symposium on Agriculture, Opatija, Croatia, 17.–22. 2004: 395–396.

JAŠA B., 1994. Využití netkaných textilií v zahradnictví. Znojmo, Blažek a Vrátil: 20–21.

LUTOMIRSKA B., 1995. Stosowanie agrowłókniny dla przyśpieszania plonowania ziemniakow. Ziemniak Polski, *3*: 14–19.

PROŚBA-BIAŁCZYK U., MYDLARSKI M., 1998. Uprawa ziemniaków na wczesny zbiór przy zastosowaniu osłony z agrowłókniny. Fragmenta agronomica, *15*: 74–84.

PROŚBA-BIAŁCZYK V., PALUCH F., MYDLARSKI M., 2000. Efektywność ekonomiczna produkcji ziemniaków wczesznych pod agrowłókniną przy zróżnicowanej obsadzie. In: Ziemniak spożywczy i przemysłowy oraz jego przetwarzanie. Konferencja naukowa, Polanica-Zdrój, 8–11. V. 2000: 187–188.

WADAS W., JABŁOŃSKA-CEGLAREK R., 2000. Effect of covers in early crop potato cultivation. Annales Universitatis Mariae Curie Sklodowska, Sectio EEE, Horticultura, *8*: Supplementum 137–142.

Received for publication February 2, 2005
Accepted after corrections April 4, 2005

Vliv nastýlky polypropylenové textilie na výnos raných brambor

ABSTRAKT: V letech 2000–2003 byl v ranobramborářské oblasti ČR zkoumán vliv bílé netkané textilie Pegas-agro 17 UV na dynamiku tvorby výnosu raných zavlažovaných brambor odrůd Adora a Impala. Textilie byla ponechána na porostu 49 dní (2000), 35 dní (2001), 37 dní (2002) a 45 dní (2003) od výsadby. Použití textilie prokazatelně zvýšilo výnos tržních hlíz v časných termínech sklizně asi 60 dní po výsadbě (31. 5. 2000 na 121,3 %, 7. 6. 2001 na 133,7 % a 31. 5. 2002 na 134,5 % v porovnání s kontrolní variantou a v průměru obou odrůd). Při dalších postupných sklizních se výnosový rozdíl mezi pokusnou a kontrolní variantou snižoval a na konci června již byl neprůkazný. V porovnání obou odrůd byl zaznamenán vyšší výnosový efekt textilie u odrůdy Impala. Byl zjištěn příznivý vliv nakrytí porostů netkanou textilií na teplotu půdy.

Klíčová slova: rané brambory; textilie; výnos; odrůda; teplota půdy

Corresponding author:

Doc. Ing. Karel Hamouz, CSc., Česká zemědělská univerzita v Praze, Fakulta agrobiologie, potravinových a přírodních zdrojů, 165 21 Praha 6-Suchdol, Česká republika
tel.: + 420 224 382 548, fax: + 420 224 382 535, e-mail: hamouz@af.czu.cz