

RESULTS OF STUDIES ON SEASON EXTENSION OF THE POLISH PRIMOCANE FRUITING RASPBERRY CULTIVARS

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AIM OF THE STUDIES

Extending the harvesting time of primocane fruiting raspberies in Central Poland by application of different cultural methods



> The studies were conducted in 2010-2013

> Plant material (cultivars):



The varieties were bred in the Experimental Orchard in Brzezna, by Dr. Jan Danek and registered into the Polish National List of Fruit Plant Varieties (PNLFPV) and the Plant Breeders' Rights (PBR) in the years 1991, 2003 and 2006.

MATERIALS AND METHODS

> Three cultivation techniques were compared:

- covering plants with perforated plastic cover (700 holes per 1 m²) and fibre cover (17 g/m²) in early spring, for a period of about 1 month (from the middle of March to the middle of April)
- mowing of young canes in the middle of May, with a height of about 40 cm growing from the crown, to delay fruiting
- Control combination were plants without covers and mowing, the traditional cultivation of raspberries



- The experiment was established in the autumn 2010 in a split-plot design, with four replications, each with 5 plants planted at a spacing of 0.5 x 3.75 m
- A total of 240 plants were planted in the experiment (3 cultivars x 4 cultivation methods x 4 replicates x 5 plants)



MEASUREMENTS AND OBSERVATIONS

- > The following measurements and observations were performed:
- plant growth vigour on a 1-5 rating scale, where 1 very low growth vigour, 5 – very strong growth vigour
- ✓ plant yielding (kg/plant, 7 canes were derived from each crown)
- mean fruit weight (g)
- ✓ fruit ripening time
- soluble solids content of fruit (using a Rudolph J-157 refractometer)
- vitamin C content of fruit (using an RQ-Easy reflectometer and Merck test strips)



Old canes are removed





control





perforated plastic cover





fibre cover



mowing of young canes





RESULTS 2011-2013



Plant growth vigour and fruit ripening time of three raspberry cultivars

(Pomological Orchard, Skierniewice, 2011-2013)

Cultivar / treatment	Plant growth vigour (1-5)*			Fruit ripening time		
	2011	2012	2013	2011	2012	2013
Polesie / control	3.5 de**	3.4 cd	3.3 de	05.07	09.07	12.07
Polesie / plastic cover	4.4 h	4.5 f	4.5 i	27.06	29.06	01.07
Polesie / fibre cover	4.1 g	4.2 e	4.2 h	30.06	02.07	03.07
Polesie / shoot mowing	3.4 cd	3.3 c	3.1 b-d	20.07	23.07	31.07
Average for cv. 'Polesie'	<u>3.9 с</u>	3.9 с	<u>3.8 с</u>	-	-	-
Polka / control	3.2 bc	3.0 b	3.1 b-d	05.07	09.07	12.07
Polka / plastic cover	3.9 fg	3.7 d	3.8 g	27.06	29.06	01.07
Polka / fibre cover	3.7 ef	3.5 cd	3.6 fg	27.06	29.06	01.07
Polka / shoot mowing	3.1 b	2.9 ab	3.0 a-c	20.07	23.07	31.07
Average for cv. 'Polka'	3.5 b	3.3 b	3.4 b	-	-	-
Polana / control	2.7 a	2.8 ab	2.9 ab	05.07	09.07	12.07
Polana / plastic cover	3.5 de	3.5 cd	3.4 ef	27.06	29.06	01.07
Polana / fibre cover	3.3 b-d	3.3 c	3.2 с-е	30.06	02.07	03.07
Polana / shoot mowing	2.6 a	2.7 a	2.8 a	18.07	20.07	29.07
Average for cv. 'Polana'	3.0 a	3.1 a	3.1 a	-	-	-

Explanation: * 1-5 rating scale, where 1 - very low growth vigour, 5 - very strong growth vigour

** means in columns followed by the same letter do not differ significantly at P=0.05 according to Duncan's multiple range test

In 2011-2013, the most vigorously growing plants were those of the cultivar 'Polesie', a little less vigorous were the plants of 'Polka', and the least vigorous those of 'Polana'. The use of covers (perforated plastic cover and fibre cover) brought forward the ripening of fruit of the tested cultivars by about 2 weeks.



Yielding of three raspberry cultivars (Pomological Orchard, Skierniewice, 2011-2013)

Cultivor / treatment	Yield (kg/plot)				
Cultivar / treatment	2011	2012	2013		
Polesie / control	15.2 f*	14.7 f	10.1 c		
Polesie / plastic cover	19.9 i	19.2 i	13.4 f		
Polesie / fibre cover	21.0 j	20.3 j	14.6 g		
Polesie / shoot mowing	13.6 c	13.1 c	8.2 b		
Average for cv. 'Polesie'	17.4 b	16.8 b	11.6 b		
Polka / control	18.4 h	18.2 h	12.5 e		
Polka / plastic cover	22.5 k	21.9 k	15.1 h		
Polka / fibre cover	23.1 l	22.5 l	16.2 i		
Polka / shoot mowing	15.7 g	15.2 g	10.1 c		
Average for cv. 'Polka'	19.9 с	19.5 с	13.5 с		
Polana / control	11.8 b	11.4 b	9.0 b		
Polana / plastic cover	14.3 d	13.6 d	11.4 d		
Polana / fibre cover	14.7 e	14.2 e	12.7 e		
Polana / shoot mowing	9.3 a	9.0 a	7.1 a		
Average for cv. 'Polana'	12.5 a	12.1 a	10.1 a		

Explanation: * means in columns followed by the same letter do not differ significantly at P=0.05 according to Duncan's multiple range test

The highest marketable yield was obtained from the cultivar 'Polka' in the combinations with the fibre cover and perforated plastic cover. Slightly lower yields from the same combinations were obtained for the cultivar 'Polesie', with the cultivar 'Polana' being the lowest-yielding cultivar. For the cultivar 'Polesie', in the combination with the fibre cover, the yield per plot was from 38% in 2011 and 2012 to 44% in 2013 higher than in the control. In the case of the cultivar 'Polana', the increase in yield, depending on the year, ranged from 25% to 41%, and in the cultivar 'Polka' from 23% to 30%.



Fruit weight of three raspberry cultivars (Pomological Orchard, Skierniewice, 2011-2013)

Cultiver / treatment	N	lean fruit weight (g)
Cultivar / treatment	2011	2012	2013
Polesie / control	4.9 cd*	4.7 d	4.6 c
Polesie / plastic cover	5.2 e	5.1 f	5.0 d
Polesie / fibre cover	5.1 de	5.0 ef	4.8 cd
Polesie / shoot mowing	4.8 c	4.8 de	4.7 c
Average for cv. 'Polesie'	5.0 c	4.9 c	4.8 c
Polka / control	4.1 b	4.0 c	3.9 b
Polka / plastic cover	4.3 b	4.2 c	4.1 b
Polka / fibre cover	4.2 b	4.2 c	4.2 b
Polka / shoot mowing	4.1 b	4.1 c	4.0 b
Average for cv. 'Polka'	4.2 b	4.1 b	4.1 b
Polana / control	2.9 a	2.8 a	2.9 a
Polana / plastic cover	3.1 a	3.2 b	3.1 a
Polana / fibre cover	3.0 a	3.0 ab	3.1 a
Polana / shoot mowing	3.0 a	3.1 b	3.0 a
Average for cv. 'Polana'	3.0 a	3.0 a	3.0 a

Explanation: * means in columns followed by the same letter do not differ significantly at P=0.05 according to Duncan's multiple range test

The largest berries were produced by the cultivar 'Polesie' (4.6-5.2 g), slightly smaller ones by 'Polka' (3.9-4.3 g), and the smallest by 'Polana' (2.8-3.2 g).



Measurement of the fruit extract (soluble solid content) (by using a Rudolph J-157 refractometer)



Measurement of the ascorbic acid content (by using an RQ-Easy reflectometer and Merck test strips)



Fruit quality of three raspberry cultivars (Pomological Orchard, Skierniewice, 2011-2013)

Cultivar / treatment _	Soluble solids content (Brix)			Ascorbic acid content (mg/100 ml)		
	2011	2012	2013	2011	2012	2013
Polesie / control	11.28 f*	11.12 d	10.89 h	81 h	82 d	80 d
Polesie / plastic cover	11.47 h	11.35 h	11.31 f	87 i	88 e	85 e
Polesie / fibre cover	11.19 e	11.17 e	11.24 e	85 i	84 d	82 d
Polesie / shoot mowing	10.95 c	11.23 f	11.09 c	79 gh	81 d	80 d
Average for cv. 'Polesie'	11.22 b	11.22 b	11.13 b	83.0 c	83.8 b	81.8 b
Polka / control	11.33 g	11.24 f	11.15 d	72 bc	71 a	70 a
Polka / plastic cover	11.52 i	11.43 i	11.47 g	78 fg	77 c	75 c
Polka / fibre cover	11.27 f	11.33 h	11.35 f	75 de	74 a-c	73 bc
Polka / shoot mowing	11.13 d	11.28 g	11.24 e	70 ab	73 ab	71 ab
Average for cv. 'Polka'	11.31 с	11.32 с	11.30 с	73.8 b	73.8 a	72.3 a
Polana / control	10.98 c	10.91 a	10.82 a	71 a-c	72 ab	70 a
Polana / plastic cover	11.19 e	11.11 d	11.08 c	76 ef	74 a-c	73 bc
Polana / fibre cover	10.87 b	10.96 b	10.94 b	73 cd	75 bc	72 ab
Polana / shoot mowing	10.75 a	11.03 c	10.90 b	69 a	72 ab	70 a
Average for cv. 'Polana'	10.95 a	11.00 a	10.94 a	72 a	73.3 a	71.3 a

Explanation: * means in columns followed by the same letter do not differ significantly at P=0.05 according to Duncan's multiple range test

Berries of the cultivar 'Polka' contained the most soluble solids (extract) – from 11.13% to 11.47%, whereas those of the cultivar 'Polesie' were the richest in vitamin C (79-88 mg of vitamin C in 100 ml of juice).



- The use of low covers (perforated plastic cover and fibre cover) advanced the fruit ripening of the tested cultivars by about 2 weeks.
- The covers of raspberry plants also increased significantly yield of the early fruit (harvested in July and August) compared with the control.
- The investigated techniques can be proposed for implementation and use on commercial plantations of 'primocane-fruiting' raspberry in order to achieve early fruiting and thus increase their production potential in the summer-autumn period.

Instytut Ogrodnictwa





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