

EVALUATION OF THE SUITABILITY OF POLISH BLACKCURRANT CULTIVARS FOR COMMERCIAL CULTIVATION

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A B S T R A C T

This paper presents results of the experiment aimed at assessing suitability of new Polish blackcurrant cultivars for commercial plantations with mechanical fruit harvesting. The cultivars under assessment were: 'Tisel', 'Tiben', 'Ores', 'Ruben' and 'Tines', bred at the Research Institute of Pomology and Floriculture (RIPF) in Skierniewice, Poland. Their performance was compared with standard cultivars 'Ojebyn' and 'Titania'. A field experiment was established at the Experimental Station in Dąbrowice, near Skierniewice, Central Poland, in the autumn of 2002. Measurements and observations were carried out in 2006-2008. The results showed that the largest bushes were produced by the standard cultivar 'Titania' and the new cultivar 'Tiben'. The other cultivars produced small or medium-size bushes. The earliest to ripen were berries of the cultivar 'Tisel', medium-early ripening were those of 'Tines', 'Ojebyn' and 'Titania' while 'Ores', 'Ruben' and 'Tiben' were classified as medium-late ripening cultivars. The new Polish cultivars: 'Tisel', 'Tiben' and 'Ruben', produced considerably higher yields than the standard cultivars. The largest berries were produced by 'Tines' and 'Ruben', medium-sized by 'Ores', 'Tisel' and 'Titania', and the smallest by 'Tiben' and 'Ojebyn'. The effectiveness of fruit collection by the harvester KPS-4b in 2006 ranged from 74.8 to 91.0%, in 2007 from 89.6 to 94.9%, with much higher values in 2008, from 97.3 to 98.8%. The smallest number of shoots damaged by the fruit harvester was recorded for 'Ojebyn' and 'Ores', followed by 'Ruben' and 'Tines', while the greatest damage suffered 'Titania', 'Tiben' and 'Tisel'. The most resistant to the main fungal diseases were the bushes of 'Tisel', 'Tines', 'Ruben', 'Ores' and 'Titania'.

Key words: blackcurrant, *Ribes nigrum* L., new cultivars, mechanical fruit harvest, yield, fruit size

INTRODUCTION

In Poland, the blackcurrant is an economically important small-fruit plant species, commonly grown on commercial plantations and in home gardens. For many years, Poland has been the largest producer and exporter of blackcurrant in the world. Domestic production of this fruit in recent years has ranged from 100 to 145 thousand tonnes (FAOSTAT, GUS, Rynek Owoców i Warzyw, 2007). Interest in the cultivation of blackcurrant has increased as a result of the implementation of new cultivars, development of new technologies of plant cultivation and maintenance of commercial plantations, and the use of mechanical fruit harvesters.

At present, production of blackcurrant in Poland is carried out in a very modern way. Almost all the fruit come from well-managed commercial plantations, where the berries are collected by mechanical harvesters. On properly set-up plantations, well-maintained in the agrotechnical sense, the use of various types of harvesters is possible already in the 3rd or 4th year after planting the bushes.

Analysing the trends in the development of blackcurrant production in Poland over the years one can observe a high variability in the profitability of that production. Blackcurrant producers have continually been looking for new cultivation technologies that would make possible to reduce production costs. A very important element in

the technology of blackcurrant production is the availability of modern cultivars that are better than those cultivated so far. The new cultivars should have a high production value, with their fruit being suitable for various methods of utilization. What is of particular importance here is regular yielding at a very high level, high fruit quality, suitability for processing and cold storage, and also plant resistance to economically important diseases and pests. Cultivars of this kind should also meet the basic requirements of mechanical fruit collection.

Since 1986, at the Fruit Plant Breeding Department of the Research Institute of Pomology and Floriculture (ISK) in Skierniewice, yet another stage of creative breeding of blackcurrant has been underway, the aim of which is to obtain new cultivars that would possess the above-mentioned usability traits (Pluta and Żurawicz, 1993; Żurawicz et al., 2000; Pluta, 2001). The work has resulted in obtaining five cultivars: 'Tiben', 'Tisel', 'Ores', 'Ruben' and 'Tines' (Pluta and Żurawicz, 2002; Pluta, 2003; Pluta and Żurawicz, 2006), which have been entered in the register of cultivars and the register of exclusive rights maintained by Centralny Ośrodek Badań Odmian Roślin Uprawnych (COBORU) in Słupia Wielka. Moreover, the new cultivars come under legal protection on the territory of the European Union until the year 2030. New Polish cultivars, just like these foreign-bred, are evaluated in terms of their production value in the

climatic and soil conditions of Poland, including their suitability for mechanical harvesting (Salamon, 1993; Pluta and Broniarek-Niemiec, 2000; Broniarek et al. 2000; Pluta and Markowski, 2001; Gwozdecki et al., 2002; Broniarek-Niemiec and Pluta, 2003).

The aim of the study was to assess the suitability of new Polish blackcurrant cultivars ('Tisel', 'Tiben', 'Ores', 'Ruben' and 'Tines') for use on commercial plantations where the fruit crop is collected by mechanical means.

MATERIAL AND METHODS

The research was carried out on a trial plantation (approx. 3.0 ha large), planted with the new Polish blackcurrant cultivars, located at the Experimental Fruit-Growing Station of the Research Institute of Pomology and Floriculture in Dąbrowice near Skierniewice, Central Poland. The plantation was set up in 2002 on a mineral, podzolic, humus-deficient soil of a mechanical composition corresponding to clayey sands, overlaying medium-clay bedrock, with pH 6.0-6.5. Blackcurrant plants of the five new Polish cultivars: 'Tisel', 'Tiben', 'Ores', 'Ruben' and 'Tines', as well as the two "old" cultivars 'Ojebyn' and 'Titania', were planted at a spacing of 3.8 x 0.5 m, separately in adjacent rows, each 225 m long and containing about 500 bushes. The experiment which began in 2006, had a random block layout with four plots (replicates) of 50 plants each. The plots were

randomly marked out along the rows of each cultivar. The cultivars 'Ojebyn' and 'Titania' were adopted as standard cultivars since they have been commonly grown on commercial plantations.

Chemical plant protection against the main fungal diseases of blackcurrant, plant fertilization and weed control were carried out in accordance with the recommendations of the Programme for the Protection of Fruit Plants.

Measurements and observations were performed in the years 2006-2008, i.e. in the 4th, 5th and 6th year after planting. Harvesting was carried out with the use of the self-propelled fruit harvester KPS-4b constructed at the Research Institute of Pomology and Floriculture. The following data were recorded:

- Fruit harvest date for each of the cultivars studied.
- Fruit yield (kg/plot). determined on the basis of the weight of berries collected from the experimental plots by KPS-4b harvester. Measurements were taken separately for each of the cultivars studied.
- Mean fruit weight (g) determined for each plot on the basis of 100 randomly chosen berries.
- Plant size (m²). This trait was calculated as the ratio of the bush height a width (perpendicular to the row) for each cultivar separately. This measurement was performed on a random sample of 5 successive bushes on each experimental plot.
- Fruit loss. Measurements of this trait were performed on a ran-

domly chosen sample of 5 consecutive bushes on each experimental plot immediately after the mechanical fruit collection. On such a sample, the weight of berries still remaining on the bushes and the weight of berries that had fallen to the ground following the mechanical harvest was recorded.

- Fruit-picking effectiveness (harvester effectiveness) (%). The percentage share of the berries collected by the harvester in the total fruit crop produced by a bush, calculated for each cultivar. This index describes how thoroughly the self-propelled harvester KPS-4b is able to collect the berries of the blackcurrant cultivars under assessment.
- Harvester-induced damage to plants. This trait was determined by counting wounded and broken skeletal and annual shoots in a random sample of 10 consecutive bushes on each experimental plot. This assessment was carried out for each cultivar after the harvester had collected the berries.
- Susceptibility to main fungal diseases: American gooseberry mildew (*Sphaerotheca morsuvae* Berk.), anthracnose (leaf spot) (*Drepanopeziza ribis* Kelb.) and white-pine blister rust (*Cronartium ribicola* Fish). This assessment was carried out in the middle of July and in the second half of August of each year of the study on each experimental plot using the method developed by

Karolczak et al. (1973). A 5-point ranking scale was adopted for the assessment (1 – no symptoms of infection, 3 – medium level of infection, 5 – very severe symptoms of infection).

The data obtained were elaborated statistically using the analysis of variance. Duncan's multiple range t-test at $p = 0.05$ was used to assess the significance of the differences between mean values. This assessment was carried out separately for each year of the study.

RESULTS AND DISCUSSION

The results relating to production value, fruit ripening time (harvest date), fruit weight, bush size, and the effectiveness of the mechanical collection of the berries of the blackcurrant cultivars evaluated in the experiment are presented in Tables 1-7.

The studied blackcurrant cultivars differed in terms of fruit-ripening time (Tab. 1). The earliest to ripen were the berries of the cultivar 'Tisel'; they were collected between the 2nd and 13th of July, depending on the year of the study. Next to be harvested (3-5 days later) were the berries of the standard cultivars ('Ojebyn' and 'Titania') and those of the cultivar 'Tines'. The remaining cultivars ('Ores', 'Ruben' and 'Tiben') were the last to ripen among the genotypes studied, which happened between the 12th and 24th of July (5-7 days later than of those from the preceding group).

Table 1. Harvest date and fruit yield (kg/plot) of blackcurrant cultivars collected by the harvester

Cultivar	Harvest date	Fruit yield [kg/plot]			Cumulative yield 2006-2008 [kg/plot]
	2006-2008	2006	2007	2008	
1. Ojebyn	5.07-17.07	33.9 a*	44.8 bc	76.4 a	155.1 a
2. Titania	7.07-17.07	51.0 b	39.3 b	81.3 a	171.6 b
3. Tisel	2.07-13.07	80.0 c	55.3 cd	136.1 d	271.4 d
4. Tines	5.07-15.07	59.8 b	23.8 a	96.0 b	179.6 b
5. Ores	12.07-21.07	35.8 a	51.0 cd	84.9 a	171.7 b
6. Ruben	12.07-21.07	73.3 c	56.5 d	113.9 c	243.7 cd
7. Tiben	12.07-24.07	73.1 c	51.0 cd	112.8 c	236.9 c

*mean values in the columns followed by the same letter do not differ significantly at $p = 0.05$ according to Duncan's multiple range t-test

The studied cultivars differed significantly in terms of the fruit yield collected from the bushes by the harvester KPS-4b (Tab. 1). The new Polish cultivars: 'Tisel', 'Tiben' and 'Ruben', produced significantly higher yields than the standard cultivars 'Ojebyn' and 'Titania'. The cumulative yield for the 3 years of the study (2006-2008) varied from 236.9 to 271.4 kg per a plot, which gives from 23.6 to 27.1 t per hectare ($7.9-9.0 \text{ t ha}^{-1}$ on average annually). For the standard cultivars, the yields amounted to 155.1 kg per a plot for 'Ojebyn' and 171.6 kg per a plot for 'Titania' (15.1 and 17.6 t ha^{-1} respectively of cumulative yield or an annual average of 5.0 and 5.9 t ha^{-1} , respectively). Thus the yields of the three new cultivars were from 34 to 53% higher than the yield from the cultivar 'Titania', and from 58 to as much as 80% higher than the yield from the cultivar 'Ojebyn'.

Lower total yields, between 171.7 and 179.6 kg/plot ($17.2-18.0 \text{ t ha}^{-1}$) were obtained from the bushes of the remaining two new cultivars ('Ores' and 'Tines'). These yields were comparable to the yield produced by 'Titania', the better-yielding standard cultivar, but significantly higher than the yield of the other standard cultivar 'Ojebyn'. In 2007, all of the cultivars studied produced lower yields because of severe damage to flower buds and flowers caused by spring frosts. Despite that, as many as four of the Polish cultivars ('Tisel', 'Ores', 'Ruben' and 'Tiben') produced better yields than the standard cultivars 'Ojebyn' and 'Titania'. In the growing season of 2008, unfavourable weather conditions at the time of blooming, followed by a prolonged period of drought during fruit growth and ripening were the reason why all the cultivars in the experiment produced

Table 2. Weight of 100 berries of the blackcurrant cultivars

Cultivar	Weight of 100 berries [g]			Average fruit weight for 2006-2008 [g]
	2006	2007	2008	
1. Ojebyn	91.2 a*	89.3 a	79.6 a	86.7 a
2. Titania	117.7 c	129.5 b	93.9 b	113.7 bc
3. Tisel	110.9 bc	132.9 b	80.3 a	108.0 bc
4. Tines	147.4 e	153.8 c	120.2 c	140.5 d
5. Ores	130.1 d	126.5 b	84.2 ab	113.6 bc
6. Ruben	135.0 de	132.4 b	95.9 b	121.4 c
7. Tiben	100.1 ab	120.2 b	83.9 ab	101.4 ab

*Explanation, see Table 1

lower yields than expected. But even so, all of the Polish cultivars produced yields higher than the standard cultivars, with the exception of 'Ores', which yielded at a level similar as the standard cultivars 'Ojebyn' and 'Titania'.

The cultivars under assessment also differed significantly in terms of fruit size (fruit weight) (Tab. 2). As can be seen, the three-year average weight of 100 berries for the studied genotypes ranged from 86.7 to 140.5 g. The largest fruits were collected from the bushes of the new Polish cultivar 'Tines' (140.5 g). Medium-sized fruits (108.0-121.4 g) were produced by 'Tisel', 'Ores' and 'Ruben', and the standard cultivar 'Titania'. The smallest fruits were those of 'Tiben' (101.4 g) and the other standard cultivar 'Ojebyn' (86.7 g).

The results of bush size measurements (m^2) (height x width) are given in Table 3. Bush size is an important morphological trait of blackcurrant plants, representing plant growth vigour and also determining the effectiveness (thoroughness) of

fruit collection and the level of damage to shoots by the harvester (Salamon, 1993; Salamon and Cianciara, 1994). The size of the bushes in the experiment varied and depended on the cultivar. As expected, for the first 3 years of the study the largest bushes on average were produced by the standard cultivar 'Titania' ($2.54 m^2$) and the cultivar derived from it – 'Tiben' ($2.44 m^2$), while medium-size bushes were those of the cultivar 'Tisel' ($2.16 m^2$). The other standard cultivar – 'Ojebyn', and the remaining Polish cultivars, 'Ores', 'Ruben' and 'Tines', produced considerably smaller bushes ($1.85-1.95 m^2$) than those growing most vigorously.

The results related to the loss of fruit yield (berries still remaining on the bushes and those fallen to the ground during mechanical harvesting) are presented in Tables 4-6. The results show large variations within the cultivars studied and the years of the study. The largest amounts of uncollected fruit (left behind on the bushes) were recorded in 2006,

Table 3. Bush size (height x width) of the blackcurrant cultivars

Cultivar	Bush size [m ²]			Average bush size for 2006-2008 [m ²]
	2006	2007	2008	
1. Ojebyn	1.38 ab*	2.10 a	2.06 a	1.85 a
2. Titania	1.69 b	2.69 b	3.25 d	2.54 c
3. Tisel	1.33 ab	2.13 a	3.02 cd	2.16 b
4. Tines	1.03 a	1.97a	2.78 cd	1.93 ab
5. Ores	1.17 a	2.10a	2.23 ab	1.84 a
6. Ruben	1.13 a	2.16 a	2.54 bc	1.95 ab
7. Tiben	1.73 b	2.73 b	2.87 cd	2.44 c

*Explanation, see Table 1

Table 4. Amount of berries left behind on the bushes after mechanical harvesting

Cultivar	Amount of berries left on bushes [kg/bush]		
	2006	2007	2008
1. Ojebyn	0.20 d*	0.04 a	0.05 a
2. Titania	0.06 a	0.02 a	0.02 a
3. Tisel	0.15 b-d	0.02 a	0.01 a
4. Tines	0.21 d	0.030 a	0.02 a
5. Ores	0.14 bc	0.06 a	0.03 a
6. Ruben	0.18 cd	0.06 a	0.03 a
7. Tiben	0.12 b	0.02 a	0.02 a

*Explanation, see Table 1

Table 5. Amount of berries collected from the ground after mechanical harvesting

Cultivar	Amount of berries fallen to the ground [kg/bush]		
	2006	2007	2008
1. Ojebyn	0.03 a*	0.04 a	0.01 a
2. Titania	0.04 a-c	0.04 a	0.02 a
3. Tisel	0.05 c	0.04 a	0.03 a
4. Tines	0.05 bc	0.03 a	0.03 a
5. Ores	0.03 ab	0.04 a	0.02 a
6. Ruben	0.05 bc	0.07 b	0.02 a
7. Tiben	0.04 a-c	0.04 a	0.02 a

*Explanation see Table 1

smaller in 2007, and decidedly the smallest in 2008. Only in the first year of the experiment (2006), the cultivars differed significantly in terms of this type of loss (Tab. 4). Similar differences among the cultivars and the years of the study were found for the berries that had fallen to the ground during mechanical harvesting (Tab. 5). As a share of the total fruit yield, however, this type of loss (fallen berries) was generally low and ranged from 0.06 to 0.21 kg/bush in 2006, and from 0.01 to 0.06 in the subsequent two years (2007-2008). This shows that the harvester used was very thorough in collecting the berries, and that the studied blackcurrant cultivars are highly suitable for mechanical harvesting. The total fruit losses (berries left on the bushes and those fallen to the ground together) during mechanical harvesting were the highest in 2006 (505-1288 kg ha⁻¹, depending on the cultivar). This was undoubtedly caused by the size of the young bushes that was still relatively small. As the plants grew older, however, these losses decreased. In 2007, fruit losses ranged from 280 to 650 kg ha⁻¹, and in 2008 they were considerably lower, from 95 to 260 kg ha⁻¹ (Tab. 6).

The effectiveness (thoroughness) achieved in harvesting the fruit from 4- to 6-year-old bushes of blackcurrant cultivars grown on the experimental plantation in Dąbrowice in 2006-2008 is presented in Table 7. An analysis of the results indicates that the effectiveness of the mechanical fruit harvest was the lowest in 2006, ranging from 74.8 to 91.0%. Higher

levels of thoroughness in collecting fruit, from 89.6 to 94.9%, were recorded for the cultivars studied in 2007. And a considerably higher efficiency of mechanical fruit collection was achieved in 2008, from 97.3 to 98.8%. This was due to the fact that in 2008 (the sixth year after planting) the bushes were older and larger, and met the requirements of mechanical harvesting better.

In 2006, the highest effectiveness in collecting fruit by the harvester KPS-4b was achieved with the cultivars 'Tisel' (88.6%) and 'Tiben' (90.0%) as well as the standard cultivar 'Titania' (91%), which produced relatively high fruit yield (1.02-1.60 kg/bush). The losses resulting from berries being left uncollected on the bushes and falling to the ground during the mechanical harvest were for these cultivars relatively low. Fruit-picking effectiveness in the range 80.5-86.5% was obtained with the new cultivars 'Ores', 'Tines' and 'Ruben', for which the amount of fruit collected by the harvester was at a low level ('Ores'), or at an intermediate level ('Tines' and 'Ruben'), with relatively high fruit losses. The lowest effectiveness of fruit collection (74.8%) was recorded for the other standard cultivar 'Ojebyn', marked by a low yield of the fruit collected (0.68 kg-/bush) and high fruit losses – berries left on the bush uncollected and fallen to ground.

In the following year of the study (2007), the highest effectiveness of mechanical fruit collection was again obtained for the Polish cultivars

Table 6. Total amount of berries left on the bushes and fallen to the ground (total fruit loss) after mechanical harvesting

Cultivar	Total fruit loss [kg/bush]		
	2006	2007	2008
1. Ojebyn	0.23 cd*	0.08 ab	0.02 a
2. Titania	0.10 a	0.06 a	0.04 a
3. Tisel	0.21 b-d	0.06 a	0.04 a
4. Tines	0.26 d	0.06 a	0.05 a
5. Ores	0.17 bc	0.10 ab	0.05 a
6. Ruben	0.23 cd	0.13 b	0.05 a
7. Tiben	0.16 b	0.06 a	0.04 a

*Explanation, see Table 1

Table 7. Harvester effectiveness in collecting fruit of blackcurrant cultivars

Cultivar	Fruit yield collected by harvester [kg/bush]	Fruit yield loss ^y [kg ha ⁻¹]	Total yield ^z [kg/bush]	Effectiveness of harvester in collecting fruit [%]
2006				
1. Ojebyn	0.68	1143	0.91	74.8
2. Titania	1.02	505	1.12	91.0
3. Tisel	1.60	1030	1.81	88.6
4. Tines	1.20	1288	1.45	82.3
5. Ores	0.72	868	0.89	80.5
6. Ruben	1.47	1140	1.69	86.5
7. Tiben	1.46	810	1.62	90.0
2007				
1. Ojebyn	0.90	385	0.97	92.1
2. Titania	0.79	280	0.84	93.3
3. Tisel	1.11	300	1.17	94.9
4. Tines	0.48	278	0.53	89.6
5. Ores	1.02	278	1.12	91.4
6. Ruben	1.13	278	1.26	89.6
7. Tiben	1.02	313	1.08	94.2
2008				
1. Ojebyn	1.53	95	1.55	98.8
2. Titania	1.63	185	1.66	97.8
3. Tisel	2.72	198	2.76	98.6
4. Tines	1.92	245	1.97	97.5
5. Ores	1.70	235	1.74	97.3
6. Ruben	2.28	258	2.33	97.8
7. Tiben	2.26	215	2.30	98.1

^y – fruit left behind on bushes and fallen to the ground after mechanical harvesting^z – total yield of fruit collected by harvester, left on bushes and fallen to the ground

'Tiben' (94.2%) and 'Tisel' (94.9%), which yielded at a very high level (1.02 and 1.11 kg/bush). Fruit losses resulting from berries being left behind on the bushes and falling to the ground during the mechanical harvest were for both cultivars relatively low. Fruit-picking effectiveness for the standard cultivars was 93.3% for 'Titania', with a considerably lower yield (0.79 kg/bush) and at the same time low fruit losses, and 92.1% for 'Ojebyn', with a medium yield (0.90 kg/bush) and a relatively high amount of uncollected berries. A slightly lower effectiveness (91.4%) was achieved in collecting fruit of the new cultivar 'Ores', for which the weight of the berries collected by the harvester was at a high level (1.02 kg/bush), with fruit losses at a low level. The lowest fruit-picking effectiveness was obtained for the new cultivar 'Ruben' (89.6%), which produced the highest fruit yield (1.13 kg/bush) of all the cultivars studied and at a medium-size fruit loss, and the cultivar 'Tines' (also 89.6%), which gave the lowest yield (0.48 kg/bush), with fruit losses at an intermediate level.

In 2008, the effectiveness of the same harvester in collecting fruit was relatively high for all the cultivars. Once again, the highest effectiveness (over 98%) was obtained with the Polish cultivars 'Tiben' and 'Tisel', with high yields and medium fruit losses, and with the standard cultivar 'Ojebyn', which produced the lowest yields but also had the lowest fruit losses. Only a slightly lower fruit-picking effectiveness (97.3-97.8 %)

was obtained with the remaining cultivars, in which the weight of the fruit collected by the harvester was high or medium, with fruit losses at an intermediate or high level.

During the mechanical harvest of blackcurrant fruit the bushes (skeletal and annual shoots) were damaged by the self-propelled harvester KPS-4b (Tab. 8). Assessments of the damage were carried out in 2007-2008.

An analysis of the data in Table 8 indicates that the total number of damaged shoots (the number of wounded and broken annual and skeletal shoots) following the collection of fruit with KPS-4b harvester was higher in 2007 than in 2008. An assessment of the damage to bushes (shoots) revealed that the lowest number of damaged shoots was found in the standard cultivar 'Ojebyn'. Bushes of the cultivars 'Ores', 'Ruben', 'Tines' and 'Tiben' suffered damage to a medium degree. The highest number of damaged shoots was found in the bushes of the new cultivars 'Tiben' and 'Tisel' and the standard cultivar 'Titania'. The degree of damage to the shoots is therefore highly related to the growth vigour of the bushes of the studied blackcurrant cultivars.

The assessed genotypes showed differences in terms of their resistance to the economically important fungal diseases: American gooseberry mildew, anthracnose (leaf spot) and white-pine blister rust. The results of the assessment of the susceptibility of the blackcurrant cultivars to these diseases in field conditions are presented in Table 9.

Table 8. Average number of skeletal and annual shoots damaged by KPS-4b blackcurrant harvester

Cultivar	Number of damaged shoots ^z				Total number of damaged shoots
	wounded skeletal shoots	wounded annual shoots	broken skeletal shoots	broken annual shoots	
2007					
1. Ojebyn	9	22	0	5	36
2. Titania	49	65	6	5	125
3. Tisel	71	60	11	9	151
4. Tines	22	35	9	7	73
5. Ores	55	37	1	5	98
6. Ruben	28	37	7	7	79
7. Tiben	57	64	1	2	124
2008					
1. Ojebyn	10	12	5	1	28
2. Titania	26	82	2	7	117
3. Tisel	30	57	13	7	107
4. Tines	21	40	7	11	79
5. Ores	6	24	0	8	38
6. Ruben	23	10	4	9	46
7. Tiben	31	22	4	2	59

^z – number of damaged shoots in a randomly chosen 20-m-long section of a row (4 replications x 5 m), or in 40 bushes (4 x 10 bushes)

Table 9. Susceptibility of blackcurrant cultivars to fungal diseases; average values for 2006-2008

Cultivar	Susceptibility of plants to fungal diseases (ranking scale 1-5) ^y		
	American gooseberry mildew	Anthraxnose (leaf spot)	White-pine blister rust
1. Ojebyn	1.0 a*	3.8 e	3.0 d
2. Titania	1.0 a	2.5 b	1.0 a
3. Tisel	1.0 a	2.7 bc	1.0 a
4. Tines	1.0 a	2.0 a	1.5 b
5. Ores	1.0 a	2.7 bc	1.0 a
6. Ruben	1.0 a	2.9 c	1.0 a
7. Tiben	1.0 a	3.4 d	2.0 c

*Explanation see Table 1

^y 1-5 ranking scale: 1 – no symptoms of infection, 3 – medium level of infection, 5 – very severe symptoms of infection

As can be seen, all the cultivars studied showed a high resistance to the pathogen *S. mors-uvae* responsible for American gooseberry mildew; no symptoms of the disease were found on all the bushes. The cultivars were, to varying degrees, susceptible to anthracnose (leaf spot). Bushes that became infected to the lowest degree were those of the cultivar 'Tines' (2.0 on a 5-point ranking scale); medium level of infection symptoms were recorded for 'Titania' (2.5), 'Ores' and 'Tisel' (both 2.7), and also on 'Ruben' (2.9). By contrast, the most severe symptoms of anthracnose were found on the leaves of the standard cultivar 'Ojebyn' (3.8), and on the cultivar 'Tiben' (3.4). The level of infection by *C. ribicola*, the agent causing white-pine blister rust, was relatively low in the cultivars under assessment. No symptoms of that disease were found on the leaves of the new Polish cultivars: 'Tisel', 'Ores' and 'Ruben', and on the standard cultivar 'Titania'. A few symptoms of infection with this pathogen were recorded on the leaves of the cultivar 'Tines' (only 1.5 on a 5-point ranking scale), and a few more in 'Tiben' (2.0). The highest level of infection was found on the bushes of the standard cultivar 'Ojebyn' (3.0).

CONCLUSIONS

1 The study has confirmed high productivity of the new Polish cultivars: 'Tisel', 'Tiben', 'Ruben' and 'Ores'.

2 The cultivars assessed differ in terms of fruit size (fruit weight). The largest berries are produced by the new cultivar 'Tines'. Of medium size are those of 'Tisel', 'Ores' and 'Ruben', and of the standard cultivar 'Titania'. The other cultivars, 'Ojebyn' and 'Tiben', produce small berries.

3 The new Polish cultivars show good suitability for mechanical fruit collection with KPS-4b harvester. In terms of the effectiveness of the harvester and the extent of damage that it causes, the new cultivars are not inferior to the standard cultivar 'Ojebyn', and are superior to the standard cultivar 'Titania'.

4 Bushes of the Polish cultivars are highly resistant to dangerous fungal diseases. Implementation of such cultivars in fruit production will make it possible to limit the plant protection programme and reduce not only production costs but also the risk of polluting the environment.

5 It is highly appropriate to continue the programme of creative breeding of black-currant cultivars at the Research Institute of Pomology and Floriculture in Skierniewice, which has already resulted in many new, valuable cultivars. Introduction of new and reliable home-bred cultivars to commercial production will have a great effect on the optimization of the production of this fruit in Poland and on the strengthening the position of Polish producers on the world market.

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OCENA PRZYDATNOŚCI POLSKICH ODMIAN PORZECZKI CZARNEJ DO UPRAWY TOWAROWEJ

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S T R E S Z C Z E N I E

W pracy przedstawiono wyniki przydatności nowych, polskich odmian porzeczki czarnej do maszynowego zbioru owoców przez kombajn KPS-4b. Ocenianymi odmianami były: 'Tisel', 'Tiben', 'Ores', 'Ruben' i 'Tines', wyhodowane w Instytucie Sadownictwa i Kwiaciarstwa (ISK) w Skierniewicach. Jako odmiany standardowe użyto 'Ojebyn' i 'Titania'. Doświadczenie polowe założono jesienią 2002 roku w Sadzie Doświadczalnym ISK w Dąbrowicach k. Skierniewic, centralna Polska. Pomiar i obserwacje przeprowadzono w latach 2006-2008. Uzyskane wyniki wykazały, że największe krzewy wytwarzały odmiany standardowa 'Titania' oraz 'Tiben'. Pozostałe odmiany miały małe albo średniej wielkości krzewy. Najwcześniej dojrzewały owoce odmiany 'Tisel', średnio wcześniej 'Tines', 'Ojebyn' i 'Titania', a najpóźniej 'Ores', 'Ruben' i 'Tiben'. Nowe polskie odmiany 'Tisel', 'Tiben' i 'Ruben' wydawały znacznie wyższe plony niż odmiany standardowe. Największe jagody wytwarzały 'Tines' i 'Ruben', średniej wielkości owoce miały 'Ores', 'Tisel' i 'Titania', a najmniejsze 'Tiben' i 'Ojebyn'. Efektywność zbioru owoców przez kombajn KPS-4b w 2006 roku wynosiła od 74,8 do 91,0%, w 2007 roku od 89,6 do 94,9%, a znacznie wyższe wartości uzyskano w 2008 roku – od 97,3 do 98,8%. Najmniejszą liczbę pędów uszkodzonych przez kombajn stwierdzono u odmian 'Ojebyn' i 'Ores', następnie u 'Ruben' i 'Tines', a największą u 'Titania', 'Tiben' i 'Tisel'. Najbardziej odporne na główne choroby grzybowe były rośliny odmian 'Tisel', 'Tines', 'Ruben', 'Ores' i 'Titania'.

Słowa kluczowe: porzeczka czarna, *Ribes nigrum* L., nowe odmiany, zbiór maszynowy owoców, plon, wielkość owoców