PRODUCTIVE VALUE OF NEW FOREIGN STRAWBERRY CULTIVARS EVALUATED IN 2007-2010

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ABSTRACT

The study was conducted in the 2007-2010 season, in the Pomological Orchard of the Research Institute of Pomology and Floriculture in Skierniewice, Poland. Under assessment was the productive value of 10 foreign strawberry cultivars: 'Camarosa', 'Gloria', 'Ventana', 'Albion' (USA), 'Susy', 'Vima Rina', 'Vima Xima', 'Elianny', 'Nancy' (the Netherlands) and 'Malling Pearl' (England). The standard cultivars were: 'Honeoye' and 'Elsanta'. The cultivars were evaluated in terms of fruit ripening time, marketable yield, fruit size and firmness, soluble solids and vitamin C content, the level of fruit infection by grey mould (*Botrytis cinerea*) and plant infection by leaf spot (*Mycosphaerella fragariae*), leaf scorch (*Diplocarpon earliana*) and powdery mildew (*Sphaerotheca macularis*).

The studies revealed that the earliest to ripen were the fruits of the cultivar 'Ventana' and the last those of 'Vima Xima'. The most productive were: 'Elsanta', 'Vima Xima' and 'Nancy'. The largest fruits were produced by: 'Elianny', 'Camarosa', 'Vima Xima', 'Gloria' and 'Albion'. The fruits of the cultivars 'Albion', 'Gloria' and 'Vima Rina' were notable for the highest firmness. The highest amounts of soluble solids were found in the fruits of 'Elianny' and 'Malling Pearl'. The highest amounts of vitamin C were in 'Albion', 'Ventana' and 'Nancy'. Most of the cultivars were characterized by low infection of leaf spot, leaf scorch and powdery mildew. Moderately infected by leaf scorch were: 'Ventana' and 'Vima Xima', and by powdery mildew – 'Nancy'.

Of all the evaluated cultivars the most useful for cultivation in central Poland is 'Vima Xima' because of its high productivity, high fruit quality and a ripening time that is later than in the other cultivars.

Key words: strawberry, yield, fruit quality, leaf spot, leaf scorch, powdery mildew

INTRODUCTION

In the cultivation of strawberry in Poland, 'Senga Sengana' is still the dominant cultivar, although its share in commercial production has been decreasing in favour of dessert varieties. Good quality and high attractiveness of the fruits of dessert cultivars, as well as their better keeping quality while being marketed, have contributed to their greater interest among producers and consumers. The most desirable are those cultivars that produce large, well-shaped fruits, with bright-red skin colour (Roudeillac and Trajkowski, 2004). The high firmness of dessert strawberries and low susceptibility to decay allow them to be transported over longer distances and stored for short periods of time (e.g. on shop shelves) without the risk of a quick deterioration in their quality and attractiveness.

The strawberry dessert cultivars, particularly those that were bred in countries which, in contrast to Poland, have a warmer climate, are often disappointing when grown in a conventional open field system in Poland. In winter, their plants are often damaged by frost, which causes weaker growth and a reduction in fruit yield and quality. In the case of the most susceptible cultivars frost damages can lead to dying of strawberry plants. New strawberry varieties distinguished by high productivity and fruit quality need to be introduced for cultivation. The Research Institute of Pomology and Floriculture in Skierniewice has been involved in research to assess the productive value and usefulness of new foreign cultivars for cultivation in Poland.

The aim of the studies was to assess the productive value of 10 foreign cultivars of strawberry bred in recent years in the USA, the Netherlands and England. The most valuable of them will be recommended for commercial cultivation in Poland. The best will be used as parental forms in the strawberry breeding programme at the Research Institute of Pomology and Floriculture in Skierniewice.

MATERIAL AND METHODS

The studies were conducted in the 2007-2010 seasons, in the Pomological Orchard of the Research Institute of Pomology and Floriculture in Skierniewice, Central Poland. In the experiment ten foreign cultivars of strawberry were evaluated: 'Camarosa', 'Gloria', 'Ventana', 'Albion' (American cultivars), 'Susy', 'Vima Rina', Vima Xima', 'Elianny', 'Nancy' (Dutch cultivars) and 'Malling Pearl' (an English cultivar). The standard cultivars were: 'Honeoye' and 'Elsanta'.

The experiment was carried out in two series. Series I was set up in the second half of April 2007. Prior to planting in the spring of 2007, a chemical analysis of the soil was carried out to determine soil pH and nutrient levels. The results were as follows: pH – 6.29, P – 13.4 mg/100 g of soil, K – 16.4 mg/100 g of soil, Mg – 7.85 mg/100 g of soil, B – 6.20 mg/1000 g of soil, Cu –

5.87 mg/1000 g of soil, Fe – 1821 mg/1000 g of soil, Mn – 117 mg/1000 g of soil, Zn – 31.9 mg/1000 g of soil. Because of the high levels of potassium and phosphorus, no PK fertilization was applied before planting. This series was set up with A frigo plants (with a crown diameter of 10-15 mm). Series II was set up in the same field at the beginning of September 2008, using potted plants. Both series of the experiment were established in a random block design, in four replications, each with 25 plants planted in one row at a spacing of 25 x 100 cm.

Maintenance treatments were carried out in accordance with the recommendations for commercial plantations. During each growing season, mechanical cultivation in the interrows was carried out several times. Weeds and runners were removed systematically. To control weeds, the herbicides Venzar 80 WP and Betanal Progress AM 180 EC were also used. Preventive treatments were carried out against the strawberry blossom weevil using Decis 2,5 EC (twice – one week before blooming and at the beginning of the blooming time) and against grey mould (three times at one week intervals – at the beginning, in the middle and at the end of the blooming time) using Signum 33 WG, Switch 62,5 WG and Thiram Granuflo 80 WG, recommended in the Program for the Protection of Fruit Plants. During rain-free periods, the plants were watered at least once a week by means of the self-propelled sprinkler Polymat 130.

The weather conditions over the course of the experiments varied. The winter of 2007/2008 was relatively mild; the highest recorded drop in temperature was down to -13°C. During the flowering and fruit ripening periods in 2008, it was quite warm and moderately wet. The winter of 2008/2009 was quite severe, with temperatures falling down to -23°C in January and -17°C in February. At the same time, between the periods of freezing temperatures, there were periods of thaw that created favourable conditions for the plants to unharden – up to +5 °C in January and +11 °C in February. The months of May and June of 2009 were warm and moderately wet, whereas July was cool and very rainy (more than 146 mm of rain were recorded). The winter of 2009/2010 was harsh – in December 2009 the temperature dropped to -21 °C in the presence of a very thin snow cover, in January 2010 to -28 °C, and in February to -15 °C. The flowering period in 2010 fell on cool and very rainy days (the total rainfall in May was 129 mm), whereas the ripening of fruit at the end of June and in July took place under very high temperatures (30-33 °C).

Measurements and observations:

- plant growth vigour (on a 1-5 ranking scale, where 1 – very poor growth, 5 – very strong growth);
- fruit ripening time (Faedi Index, representing the number of days from the beginning of the year until 50% of marketable yield has been obtained);

- marketable yield in g/plot (all Extra Class or Class I fruits – over 1.8 cm in diameter);
- weight of 100 fruits in g (the ratio of the yield and the number of healthy fruits collected);
- the level of infection by grey mould (percentage share of the fruits infected by grey mould in the total number of fruits);
- fruit firmness in N (measured with an INSTRON 5542 penetrometer, on the basis of 3 samples of 20 Extra Class fruits each, the fruits being uniform in size and well-coloured. These fruits were collected during three harvests at the height of fruiting – harvests no. 3, 4 and 5);
- extract in degrees Brix (soluble solids content; determined with Rudolph J-157 refractometer, on the basis of 3 samples of 20 Extra Class fruits each, collected during three harvests at the height of fruiting – harvests no. 3, 4 and 5);
- ascorbic acid content in mg/100 ml (measured with RQ-Easy reflectometer, on the basis of 3 samples of 20 Extra Class fruits each, collected during three harvests at the height of fruiting – harvests no. 3, 4 and 5);
- plant susceptibility to leaf spot (*Mycosphaerella fragariae*, on a 0-4 ranking scale, where 0 – no disease symptoms, 1 – low infection (below 25% of leaves with symptoms of infection), 2 – medium infection (25-50% of leaves with infection symptoms), 3 – strong infection (51-75% of leaves with symptoms of infection), 4 – very strong infection (more than 75% of leaves infected; plants dying as a result of the infection);
- plant susceptibility to leaf scorch (*Diplocarpon earliana*, using the scale 0-4 presented above);
- plant susceptibility to powdery mildew (*Sphaerotheca macularis*, using the scale 0-4 presented above).

The results were analyzed statistically by means of R.A. Fischer's analysis of variance, and the differences between mean values were assessed with Duncan's t-test at $p = 0.05$.

RESULTS AND DISCUSSION

The results of the experiment are shown in Tables 1-4. They indicate that the plants of the majority of the cultivars under evaluation were characterized by a varied but moderate growth vigour (Tab. 1). The strongest growth was recorded for 'Nancy' and 'Honeoye' plants, and also for 'Camarosa', 'Susy', and 'Vima Xima'. The weakest growth, in all the years of the studies, was shown by the plants of the everbearing cultivar 'Malling Pearl'. The weak growth of the plants of this cultivar was most likely caused by frost damage. Due to the long fruiting period, plants of this cultivar, like those of other everbearing cultivars, are poorly prepared for winter and thus easily affected by frost (Żurawicz et al., 2005).

The earliest fruit ripening time was recorded for the cultivar 'Ventana', just before that of the standard cultivar 'Honeoye' (Tab. 1). In 2009 and 2010, the fruits of both these

cultivars ripened at the same time. In 2008, 'Ventana' strawberries ripened as many as 3 days earlier than 'Honeoye' strawberries, despite the fact that according to Finn and Strik (2008) the cultivar 'Honeoye' is counted among the cultivars that ripen very early. Within the group of cultivars under evaluation, the last to ripen were the fruits of the cultivar 'Vima Xima', preceded by those of 'Susy'.

The highest yield was obtained from the standard cultivar 'Elsanta', followed by 'Vima Xima', 'Honeoye' and 'Nancy'. The least productive were the cultivars 'Malling Pearl', 'Ventana' and 'Albion' (Tab. 2). The high productivity of the cultivar 'Honeoye' was also reported by other authors such as Khanizadeh et al. (1992) and Ludvikova and Paprstein (2003). In 2008, the best yielding were three of the just mentioned cultivars: 'Elsanta', 'Nancy' and 'Vima Xima'. In 2009, the largest fruit crop was collected from the plants of the cultivar 'Vima Xima'. In comparison with the standard cultivars 'Honeoye' and 'Elsanta', the 'Vima Xima' crop was almost twice as large. In 2010, the two standard cultivars yielded best. The least productive cultivar in all the years of the studies was the everbearing cultivar 'Malling Pearl', which was most likely a result of its low resistance to frost.

The largest fruits were produced by: 'Elianny', 'Camarosa', 'Vima Xima', 'Gloria' and 'Albion' (Tab. 2). The last cultivar is commonly known to produce large fruits, which was also confirmed by American studies (Finn and Strik, 2008). In 2008, the fruits of the cultivars 'Albion' and 'Elianny' were significantly larger than both the fruits of the two standard cultivars and those of the other cultivars tested. Quite large fruits were also produced by the cultivars 'Nancy' and 'Gloria'. In 2009, the largest fruits were obtained from the cultivar 'Camarosa', followed by 'Vima Xima' and 'Gloria', whereas in 2010 from the cultivars 'Elianny', 'Camarosa', 'Susy' and 'Nancy'. The smallest fruits were produced by 'Vima Rina', 'Ventana' and 'Malling Pearl'.

The fruits of all the cultivars under evaluation were infected by grey mould only to a small extent (Tab. 2). In the most infected cultivars, such as 'Malling Pearl' and 'Honeoye', no more than 2% of rotted fruits were found in the total number of the fruits collected. The strongest infection by grey mould was observed in 2009. It was caused by weather conditions particularly favourable to the development of the *Botrytis cinerea* fungus, i.e. the cool and very rainy weather during the fruit ripening period (June). As a result, just a little over 5% of the collected fruits of the cultivar 'Malling Pearl' were showing symptoms of decay. In their experiments with 'Malling Pearl', Simpson et al. (2009) found a low percentage share of non-marketable fruits, including also those infected by grey mould, in the total number of the fruits collected from the plants of that cultivar.

The firmest fruits were produced by the cultivars 'Albion' and 'Gloria', followed by 'Vima Rina' (Tab. 3).

Table 1. Plant growth vigour and fruit ripening time (Faedi Index) of the evaluated strawberry cultivars (Skierniewice, 2007-2009)

Cultivar	Plant vigour*				Faedi Index			
	2007	2008	2009	**mean**	2008	2009	2010	**mean**
Honeoye	3.2 a	3.8 b	4.1 de	**3.7 c**	164.02 bc	155.98 a	168.25 a	**162.75 ab**
Elsanta	2.9 a	3.6 b	3.6 b-d	**3.4 bc**	165.74 b-d	157.48 ab	172.06 c	**165.09 d**
Camarosa	2.8 a	3.1 ab	4.6 e	**3.5 c**	166.29 cd	157.55 ab	167.39 a	**163.74 bc**
Gloria	2.4 a	3.1 ab	4.5 e	**3.3 bc**	164.16 bc	159.21 b	167.25 a	**163.54 bc**
Ventana	2.6 a	3.1 ab	3.8 cd	**3.1 bc**	160.49 a	157.30 ab	167.81 a	**161.87 a**
Susy	3.0 a	3.0 ab	4.5 e	**3.5 c**	167.52 de	161.38 c	173.80 d	**167.57 e**
Vima Rina	3.2 a	3.7 b	3.0 b	**3.4 bc**	165.17 b-d	157.49 ab	168.70 ab	**163.79 bc**
Vima Xima	3.2 a	3.5 b	3.8 cd	**3.5 c**	170.25 e	164.69 d	173.92 d	**169.62 f**
Elianny	2.6 a	3.3 ab	4.0 de	**3.3 bc**	165.26 b-d	158.63 b	169.87 b	**164.58 cd**
Malling Pearl	2.4 a	2.7 a	1.8 a	**2.4 a**	164.47 b-d	156.98 ab	168.53 ab	**163.33 bc**
Nancy	3.2 a	3.7 b	4.1 de	**3.7 c**	164.49 b-d	158.12 ab	167.50 a	**163.37 bc**
Albion	2.5 a	3.0 ab	3.1 bc	**2.9 ab**	162.84 ab	159.08 b	168.04 a	**163.32 bc**

Explanation: * Assessed on a 1-5 ranking scale, where 1 – weakest plant vigour, 5 – strongest plant vigour

Table 2. Productivity of the evaluated strawberry cultivars (Skierniewice, 2008-2010)

Cultivar	Marketable yield [g/plot]				Weight of 100 fruits [g]				Percentage of decayed fruits [%]			
	2008	2009	2010	**mean**	2008	2009	2010	**mean**	2008	2009	2010	**mean**
Honeoye	8677 b-e	1354 bc	11600 f	**6933 d-f**	720 ab	1444 b	1001 a-c	**1055 ab**	0.8 ab	3.8 bc	0.7 a-c	**1.8 bc**
Elsanta	14710 f	1475 bc	10057 ef	**8088 f**	907 b-d	1311 b	1180 cd	**1133 bc**	0.6 ab	0.5 a	0.7 a-c	**0.6 ab**
Camarosa	6823 a-c	1700 c	6203 cd	**4523 bc**	839 b-d	2122 e	1268 de	**1409 de**	0.1 a	0.3 a	0.2 ab	**0.2 a**
Gloria	6815 a-c	1510 bc	4631 bc	**4066 bc**	1013 d	1844 de	1128 b-d	**1328 d**	0.3 a	2.7 a-c	0.2 ab	**1.0 a-c**
Ventana	5052 ab	295 a	8940 de	**4708 bc**	967 cd	826 a	1151 cd	**982 a**	2.0 b	1.1 ab	0.9 bc	**1.3 a-c**
Susy	6375 a-c	1372 bc	8535 de	**5427 c-e**	777 a-c	1390 b	1229 de	**1132 bc**	0.3 a	1.1 ab	0.0 a	**0.5 a**
Vima Rina	9851 c-e	1495 bc	5009 bc	**5165 cd**	628 a	1325 b	945 a	**966 a**	0.9 ab	2.7 a-c	0.0 a	**1.2 a-c**
Vima Xima	11606 d-f	2575 d	8210 de	**7124 ef**	929 cd	1955 de	1033 a-c	**1306 d**	0.1 a	1.2 ab	1.3 c	**0.9 a-c**
Elianny	7918 a-d	1598 bc	4676 bc	**4731 bc**	1244 e	1760 cd	1387 e	**1464 e**	0.1 a	1.6 ab	0.1 ab	**0.6 ab**
Malling Pearl	4273 a	218 a	1082 a	**1858 a**	775 a-c	1204 b	970 ab	**983 a**	0.3 a	5.4 c	0.0 a	**1.9 c**
Nancy	12000 ef	979 b	7273 cd	**6751 d-f**	1021 d	1293 b	1258 de	**1190 c**	0.7ab	2.3 ab	0.1 ab	**1.0 a-c**
Albion	4825 ab	1146 bc	3295 ab	**2899 ab**	1289 e	1495 bc	1163 cd	**1316 d**	1.2 ab	2.0 ab	0.3 ab	**1.2 a-c**

Table 3. Fruit quality of the evaluated strawberry cultivars (Skierniewice, 2008-2010)

Cultivar	Firmness (N)				Soluble solids content (°Brix)				Vitamin C content [mg/100 ml]			
	2008	2009	2010	**mean**	2008	2009	2010	**mean**	2008	2009	2010	**mean**
Honeoye	2.0 a	2.3 a-c	1.7 a-d	**2.0 ab**	10.3 cd	10.4 a-c	8.6 a-c	**9.8 cd**	99.7 a-c	62.0 a-c	46.0 a	**69.2 a**
Elsanta	2.5 a-d	1.8 ab	1.5 ab	**1.9 ab**	9.1 ab	10.6 a-c	7.8 ab	**9.2 b**	106.0 a-c	89.0 d	57.7 ab	**84.2 b-e**
Camarosa	3.0 cd	2.8 cd	1.8 b-d	**2.5 c-e**	10.4 cd	9.9 ab	8.7 a-c	**9.7 cd**	79.7 a	63.0 a-c	55.3 ab	**66.0 a**
Gloria	2.9 cd	3.4 de	1.8 b-d	**2.7 e**	9.4 a-c	9.7 ab	8.9 a-c	**9.3 bc**	119.0 a-c	65.7 a-c	50.3 ab	**78.3 a-d**
Ventana	3.2 d	2.5 a-c	1.7 a-d	**2.4 c-e**	9.6 a-d	10.9 bc	8.5 a-c	**9.7 cd**	125.0 bc	82.3 cd	52.3 ab	**86.6 c-e**
Susy	2.2 ab	2.1 a-c	1.5 ab	**1.9 ab**	10.0 b-d	9.6 a	8.5 a-c	**9.4 bc**	101.3 a-c	67.3 a-c	52.3 ab	**73.7 a-c**
Vima Rina	2.5 a-d	3.6 e	1.9 d	**2.7 e**	8.6 a	9.7 ab	7.6 a	**8.6 a**	101.7 a-c	75.0 a-d	58.0 ab	**78.2 a-d**
Vima Xima	2.6 a-d	2.2 a-c	1.7 a-d	**2.2 bc**	9.0 ab	10.6 a-c	9.7 c	**9.8 cd**	93.3 ab	60.7 ab	59.7 ab	**71.2 ab**
Elianny	2.3 a-c	2.0 a-c	1.4 a	**1.9 ab**	10.6 d	10.7 a-c	9.9 c	**10.4 e**	91.0 ab	78.0 b-d	65.0 b	**78.0 a-d**
Malling Pearl	2.6 a-d	2.6 bc	1.7 a-d	**2.3 b-d**	10.5 d	11.3 c	9.8 c	**10.5 e**	96.7 ab	57.0 a	49.7 ab	**67.8 a**
Nancy	2.0 a	1.7 a	1.6 a-d	**1.8 a**	10.1 b-d	10.5 a-c	8.9 a-c	**9.8 cd**	115.7 a-c	89.7 d	62.0 ab	**89.1 de**
Albion	2.9 cd	3.7 e	1.9 d	**2.8 e**	10.3 cd	10.7 a-c	9.2 bc	**10.0 de**	144.3 c	82.7 cd	56.0 ab	**94.3 e**

Table 4. Plant infection of the evaluated strawberry cultivars by fungal leaf diseases (Skierniewice, 2007-2010)

Cultivar	Leaf spot*					Leaf scorch*					Powdery mildew*				
	2007	2008	2009	2010	**mean**	2007	2008	2009	2010	**mean**	2007	2008	2009	2010	**mean**
Honeoye	0.00 a	0.00 a	0.00 a	0.00 a	**0.00 a**	1.57 c	1.25 a	1.04 cd	0.32 a	**1.04 a**	0.63 bc	0.00 a	1.78 ef	0.21 a-c	**0.66 cd**
Elsanta	0.32 ab	0.00 a	0.00 a	0.00 a	**0.08 a**	0.53 a	1.15 a	0.63 a-c	0.11 a	**0.60 a**	1.15 c	1.57 b	1.57 de	0.42 b-d	**1.18 e**
Camarosa	0.21 ab	0.00 a	0.00 a	0.00 a	**0.05 a**	0.42 a	0.94 a	0.42 a-c	0.42 a	**0.55 a**	0.42 ab	0.21 a	1.04 cd	0.11 ab	**0.44 bc**
Gloria	0.00 a	0.00 a	0.00 a	0.00 a	**0.00 a**	0.42 a	1.36 a	0.42 a-c	0.11 a	**0.58 a**	0.32 ab	0.00 a	0.63 bc	0.11 ab	**0.26 ab**
Ventana	0.21 ab	0.00 a	0.00 a	0.00 a	**0.05 a**	1.36 bc	3.23 c	0.53 a-c	1.78 d	**1.73 b**	0.11 ab	0.00 a	0.21 ab	0.00 a	**0.08 a**
Susy	0.21 ab	0.00 a	0.00 a	0.00 a	**0.05 a**	0.32 a	1.46 ab	0.32 ab	0.42 a	**0.63 a**	0.63 bc	0.42 a	1.78 ef	0.53 cd	**0.83 d**
Vima Rina	0.21 ab	0.00 a	0.00 a	0.00 a	**0.08 a**	0.73 ab	1.67 ab	0.28 ab	0.42 a	**0.91 a**	0.00 a	0.00 a	0.00 a	0.00 a	**0.00 a**
Vima Xima	0.32 ab	0.00 a	0.00 a	0.00 a	**0.08 a**	0.83 ab	2.50 bc	1.46 d	1.25 cd	**1.52 b**	0.00 a	0.00 a	0.42 ab	0.00 a	**0.11 a**
Elianny	0.11 ab	0.00 a	0.00 a	0.28 ab	**0.06 a**	0.53 a	1.67 ab	0.53 a-c	0.42 a	**0.78 a**	1.04 c	1.46 b	2.29 fg	0.53 cd	**1.33 e**
M. Pearl	0.53 b	0.53 b	0.00 a	0.28 c	**0.39 b**	0.94 ab	0.94 a	0.15 a	0.00 a	**0.58 a**	0.00 a	0.00 a	0.00 a	0.00 a	**0.00 a**
Nancy	0.32 ab	0.00 a	0.00 a	0.00 a	**0.08 a**	0.63 a	0.73 a	0.32 ab	0.53 ab	**0.55 a**	1.98 d	3.02 c	2.50 g	0.73 d	**2.06 f**
Albion	0.11 ab	0.00 a	0.11 b	0.21 bc	**0.11 a**	0.32 a	1.46 ab	1.94 b-d	1.04 bc	**0.94 a**	0.00 a	0.00 a	0.00 a	0.00 a	**0.00 a**

Explanation: *Assessed on 0-4 ranking scale, where 0 – no disease symptoms, 1 – low infection (below 25% of leaves with symptoms of infection), 2 – medium infection (25-50% of leaves with infection symptoms), 3 – strong infection (51-75% of leaves with symptoms of infection), 4 – very strong infection (more than 75% of infected leaves; plants dying as a result of the infection)

In 2008, strawberries with the highest firmness were obtained from 'Ventana', followed by 'Camarosa', 'Albion' and 'Gloria'. The high fruit firmness of both 'Ventana' and 'Camarosa' cultivars, was also emphasized in a study by Bartual et al. (2004). In 2009, the firmest fruits were those of the cultivars 'Albion' and 'Vima Rina', and also 'Gloria'. The year 2010 had a considerably higher rainfall than usual, with the effect that the fruits of all the cultivars were characterized by lower firmness than in 2008 and 2009. However, like in 2009, the fruits of the cultivars 'Albion' and 'Vima Rina' were notable for having the highest firmness. Fruits of the lowest firmness were produced by 'Nancy', and also 'Elsanta', 'Susy', 'Elianny' and 'Honeoye'.

The highest soluble solids (extract) content was found in the fruits of 'Elianny' and 'Malling Pearl', and then 'Albion' (Tab. 3). In 2008, besides the two cultivars mentioned, the fruits of 'Honeoye' and 'Camarosa' were also rich in solids. In world literature, however, the fruits of the 'Camarosa' cultivar are considered to be rather poor in soluble solids in comparison with other cultivars such as, for example, 'Sweet Charlie' or 'Carmine' (Ozkaya and Dundar, 2009). In 2009, the highest amounts of soluble solids were found in the fruits of 'Malling Pearl', while in 2010 – in 'Malling Pearl', 'Elianny' and 'Vima Xima'. The lowest amounts of soluble solids were contained in the fruits of 'Vima Rina'.

The richest in ascorbic acid (vitamin C) were the fruits of the cultivars 'Albion', 'Ventana', 'Gloria' and 'Nancy' (Tab. 3). In addition, in 2009, a high vitamin C content was found in the fruits of the standard cultivar 'Elsanta', while in 2010 – 'Elianny'. The studies of Skupień and Oszmiański (2004) also showed a considerably higher vitamin C content in the fruits of the cultivar 'Elsanta' in comparison with such cultivars as 'Kent', 'Selva', 'Elkat', 'Dukat' and 'Senga Sengana'.

The evaluated cultivars were characterized by a low infection level by leaf spot (Tab. 4). Minor symptoms of the leaves being infected by the disease were observed in 2007 in all the cultivars except for the plants of 'Honeoye' and 'Gloria' which did not show any symptoms. In 2008, some symptoms of leaf spot were found on the leaves of 'Malling Pearl', in 2009 – on the plants of 'Albion', and in 2010 – on the leaves of 'Malling Pearl', 'Albion' and 'Elianny'. The low susceptibility to leaf spot of the cultivar 'Elianny' was also reported by Pfeiffer and Brockamp (2010).

Most of the cultivars showed low infection by leaf scorch (Tab. 4). Moderate symptoms of this disease were observed on the leaves of cultivars 'Ventana' and 'Vima Xima'. The most pronounced symptoms of the plants of these cultivars being infected by leaf scorch occurred especially in 2008. Both of the two standard cultivars showed low infection by leaf scorch, which is in an agreement with earlier observations by Masny and Żurawicz (2005, 2009).

Almost all of the cultivars were characterized by a low level of leaf

infection by powdery mildew (Tab. 4). Among the evaluated cultivars, the most affected by the disease (to a moderate level) in all the years of the studies were the plants of 'Nancy'. The standard cultivars 'Elsanta' and 'Honeoye' were characterized by low infection of powdery mildew. The low susceptibility of the plants of these cultivars to the disease was already reported by Meszka and Bielenin (2007). Plants of the everbearing cultivars: 'Vima Rina', 'Malling Pearl' and 'Albion' did not show any symptoms of infection by powdery mildew.

CONCLUSIONS

The experiment revealed that among the evaluated cultivars the most useful for cultivation in central Poland was the cultivar 'Vima Xima' because of its high productivity, high fruit quality and later fruit ripening time in comparison with the other cultivars. In terms of the level of productivity this cultivar is not inferior to the standard cultivar 'Elsanta' and produces larger and firmer fruits with a higher soluble solids content; moreover, plants of this cultivar are less infected by the powdery mildew.

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WARTOŚĆ PRODUKCYJNA NOWYCH ZAGRANICZNYCH ODMIAN TRUSKAWKI OCENIANYCH W LATACH 2007-2010

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

Badania prowadzono w latach 2007-2010 w Sadzie Pomologicznym Instytutu Sadownictwa i Kwiaciarstwa im. Szczepana Pieniążka w Skierniewicach. Oceniano wartość produkcyjną 10 zagranicznych odmian truskawki: 'Camarosa', 'Gloria', 'Ventana', 'Albion' (USA), 'Susy', 'Vima Rina', Vima Xima', „Elianny', 'Nancy' (Holandia) oraz 'Malling Pearl' (Anglia). Odmianami standardowymi były: 'Honeoye' i 'Elsanta'. Oceniano: termin dojrzewania owoców, plon handlowy, wielkość i jędrność owoców, zawartość substancji rozpuszczalnych i witaminy C, a także stopień porażenia owoców przez szarą pleśń (*Botrytis cinerea*) i roślin przez białą plamistość liści (*Mycosphaerella fragariae*), czerwoną plamistość (*Diplocarpon earliana*) i mączniaka prawdziwego truskawki (*Sphaerotheca macularis*).

Badania wykazały, że najwcześniej dojrzewały owoce odmiany 'Ventana', najpóźniej – 'Vima Xima'. Najbardziej plenne były: 'Elsanta', 'Vima Xima' i 'Nancy'. Największe owoce wytwarzały: 'Elianny', 'Camarosa', 'Vima Xima', 'Gloria' i 'Albion'. Najwyższą jędrność miały owoce odmian 'Albion', 'Gloria' i 'Vima Rina'. Najbardziej bogate w substancje rozpuszczalne były owoce 'Elianny' i 'Malling Pearl', a w witaminę C – 'Albion', 'Ventana' i 'Nancy'. Większość badanych odmian charakteryzowała się małym porażeniem roślin przez białą i czerwoną plamistość liści oraz mączniaka prawdziwego truskawki. Umiarkowanie porażone przez czerwoną plamistość były rośliny odmian 'Ventana' i 'Vima Xima', a przez mączniaka – 'Nancy'.

Spośród badanych odmian najbardziej przydatna do uprawy w warunkach Polski centralnej jest odmiana 'Vima Xima', z uwagi na obfite plonowanie, wysoką jakość owoców i późniejszą niż pozostałe odmiany porę dojrzewania owoców.

Słowa kluczowe: truskawka, plon, jakość owoców, biała plamistość liści, czerwona plamistość liści, mączniak prawdziwy truskawki