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EVALUATION OF YIELDING OF SEVERAL RHUBARB CULTIVARS IN YEARS 1996–2001

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ABSTRACT

Several rhubarb cultivars were investigated: ‘Koral’, ‘Karpow Lipskiego’, ‘Wczesny Hosera’, ‘Wiśniowy’ and ‘Purpurat’ of the cultivation of years 1996-2001. Essential differences in yielding of the investigated cultivars and between the years of cultivation were proved. The highest average petioles yield was obtained from the cultivation of ‘Karpow Lipskiego’, whereas the lowest from the cultivation of ‘Purpurat’. On average, the highest number of petioles was gathered from the plants of cultivars ‘Wiśniowy’, ‘Koral’ and ‘Karpow Lipskiego’, while the lowest from cultivar ‘Purpurat’. Cultivar ‘Karpow Lipskiego’ was distinguishable by petioles of decidedly greater average mass in comparison to other cultivars.

Key words: rhubarb, cultivars, yielding of rhubarb

INTRODUCTION

Rhubarb is a perennial vegetable, cultivated out of crop rotation. Rhubarb plantation is most often utilized for 8-10 years [5]. During many years’ utilization cyclical fluctuations in rhubarb yielding were discovered which depend on weather process [1] and three-years development of leaf-buds [3].

In a given year of the utilization of plantation the rhubarb yielding depends on the cultivar features, number of harvests, quantity of leaves broken off at once, the length of the harvest period and fertilization [1, 3, 7].

The aim of the investigation undertaken in the present research work was the evaluation of the height and structure of the yield of five rhubarb cultivars in succeeding years of the utilization of plantation.

MATERIALS AND METHODS

The experiment was carried out in years 1996-2001 in Experimental Plots of Agricultural University in Lublin on the rhubarb plantation established in spring, 1994. Before planting the rootstocks in autumn, 1993, the organic fertilization with manure (50 t ha⁻¹) as well as mineral: P – 40, K – 150 kg ha⁻¹ was applied. In years 1994-2001 the plants were fertilized each time after harvests with N – 50, P – 30, K – 100 kg ha⁻¹.

Five rhubarb cultivars were used in the experiment: 'Koral', 'Karpow Lipskiego', 'Wczesny Hosera', 'Wiśniowy' and 'Purpurat'. The plants of every cultivar were grown in the spacing of 2.0×1.5 m.

The experimental unit for the research was single plant. Ten plants out of each cultivar were chosen randomly for the examination. In every year of the experiment the research was done on the same plants, as it was assumed that the three-years period of the development of leaf-buds may affect the results of yielding. The leaves intended for harvesting were those with petioles more than 20 cm long and of a minimal cross-section of above 2.0 cm in the middle of the length. Several leaves were broken off one plant at once. With each investigated cultivar the leaves were gathered at the same time. The result of insufficiency of precipitations in May and June 2001 was that leaves were gathered only twice, whereas in other years – four times ([table 1](#)).

Table 1. Number and dates of rhubarb leaves harvests in years 1996-2001

Years	Dates of harvests				Number of harvests
1996	8.05	20.05	11.06	25.06	4
1997	5.05	17.05	25.05	16.06	4
1998	18.04	12.05	28.05	21.06	4
1999	26.04	17.05	25.05	20.06	4
2000	26.04	16.05	28.05	15.06	4
2001	10.05	23.05	–	–	2

The results of rhubarb yielding were worked out statistically using analysis of variance. The significance of differences (at 5% level of significance) was evaluated with the help of Tuckey's multiple reliance range.

RESULTS AND DISCUSSION

There were differences between the years of experiment as regards thermic and moisture conditions in the period of rhubarb vegetation ([table 2](#)). Decidedly unfavourable thermic conditions were in winter months (January, February, March) in 1996, when average monthly air temperatures were lower than the ones of many years'. Similarly, unfavourable thermic conditions occurred also in June 1997. In winter time of years 1998-2001 average monthly air temperatures were higher than or close to many years' average. Such good thermic conditions at that time (January-March) favoured the early beginning of rhubarb plants vegetation. In years 1996, 1998 and 2000, from April to June, higher air temperatures were stated in comparison to the many-years' average of that period. In June 2001 the average monthly air temperature was lower than the many-years' average by 1.2°C and, together with the insufficiency of precipitations, it caused that rhubarb leaves were gathered only twice. June 1997 was an exceptionally rainless month with precipitations lower by 59.9 mm than the average precipitations of many years'. Abundant precipitations occurred in April and June, 1999.

Table 2. Monthly air temperatures and precipitations from January to June in years 1996-2001

Month	Many years (1951-2000) average monthly air temperature (°C)	Years					
		1996	1997	1998	1999	2000	2001
		Differences in air temperatures (°C) in relation to many years average					
January	-3.6	-3.2	-2.5	+3.2	+1.7	+0.2	+2.7
February	-2.8	-3.9	+3.0	+5.0	-0.4	+2.9	+1.8
March	1.0	-4.1	+0.8	-0.6	+1.8	+0.8	+1.2
April	7.5	+0.3	-3.6	+2.0	+1.1	+3.6	+1.0
May	13.0	+2.6	+0.9	+0.8	-1.5	+1.2	+0.9
June	16.5	+0.2	+0.3	+1.0	+2.1	+0.5	-1.2
	Many years (1951-2000) average monthly total precipitation (mm)	Differences in precipitation (mm) in relation to many years average					
January	21.7	-11.3	-20.1	-2.1	-5.5	+5.2	+7.8
February	24.8	+2.1	-12.3	-1.5	+17.0	+7.9	-6.4
March	25.8	-0.6	-9.6	-3.3	-8.8	+39.1	+8.0
April	40.6	-25.2	+0.2	+23.3	+41.0	+29.2	+24.3
May	58.3	+57.2	+24.8	-8.7	-12.4	-7.6	-38.4
June	65.8	-37.8	-59.9	-4.3	+95.1	-29.4	-18.2
Total January-June	237.0	-15.6	-76.9	+3.4	+126.4	+44.4	-22.9

The process of rhubarb yielding in succeeding years of cultivation is shown in [table 3](#). Significant differences between the rhubarb cultivars as well as between the years of cultivation were proved as regards the height of leaves and petioles yield and as regards the average mass of a petiole and the number of petioles. Among the evaluated rhubarb cultivars the highest average leaves and petioles yield was obtained from the plants of the cultivar 'Karpow Lipskiego' (19.1 and 12.5 kg plant⁻¹ respectively). At the same stage of cultivation no significant differences were pointed out in the height of leaves and petioles harvest between cultivars 'Koral' and 'Wiśniowy'. The lowest average leaves yield (11.8 kg plant⁻¹) and petioles yield (7.5 kg plant⁻¹) was obtained from the cultivation of 'Purpurat'. High petioles yield from the cultivation of 'Karpow Lipskiego' in comparison to other cultivars was also obtained in earlier research by Buczkowska and Sałata [2] as well as by Kmiecik [4] in the conditions of Southern Poland.

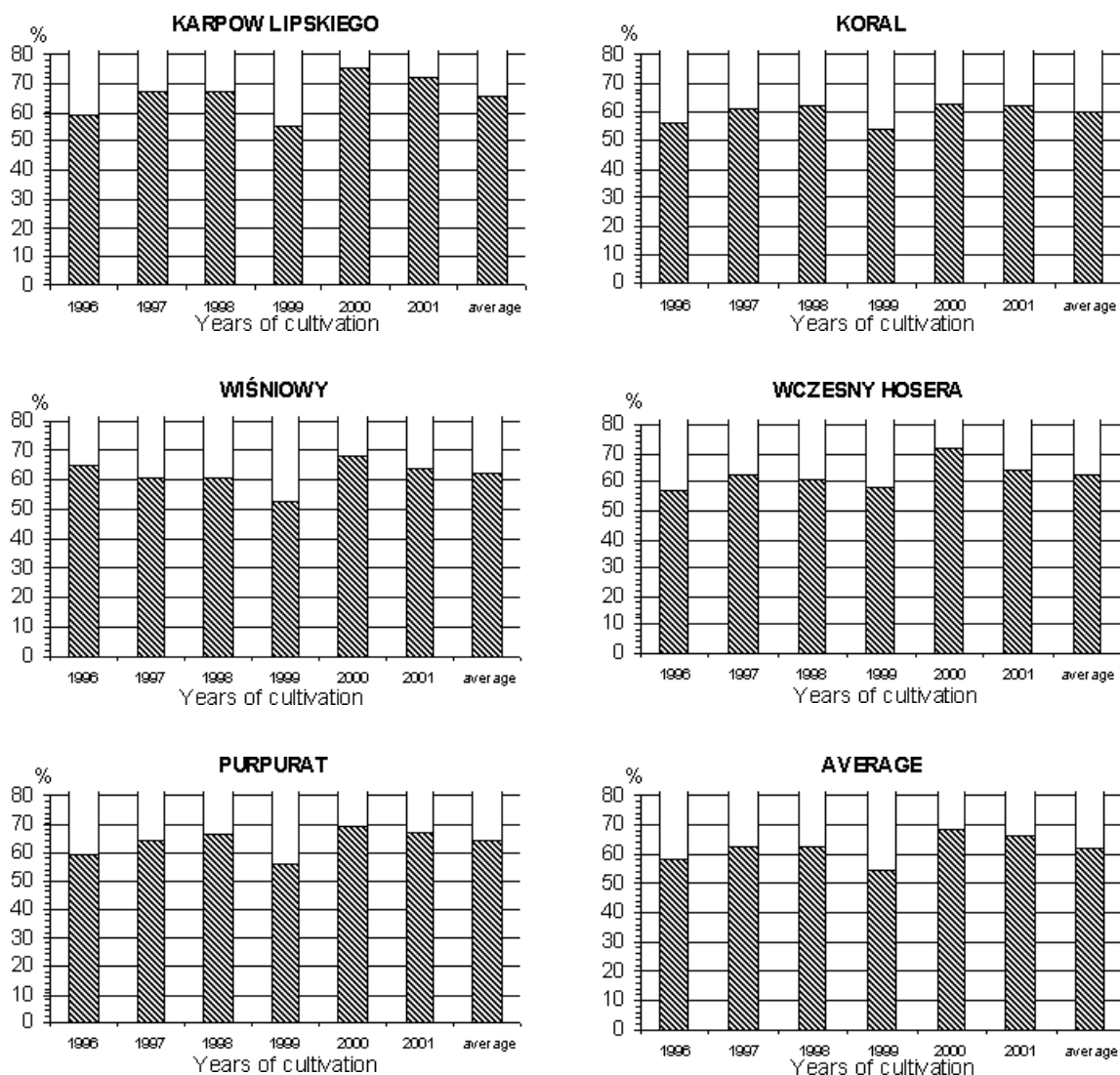
Table 3. Yielding of five rhubarb cultivars in years 1996-2001

Cultivar	Years	Total leaves yield (kg plant ⁻¹)	Marketable yield of petioles (kg plant ⁻¹)	Number of petioles in marketable yield (per plant)	Average weight of petiole (g)
Karpow Lipskiego	1996	13.1	7.7	77.0	100.6
	1997	20.6	13.7	70.0	197.7
	1998	13.8	9.3	68.5	130.9
	1999	28.6	15.7	139.7	112.2
	2000	17.5	13.3	76.7	175.2
	2001	21.1	15.1	70.2	216.7
	average	19.1	12.5	83.7	155.6
Koral	1996	16.7	9.4	86.5	110.9
	1997	9.9	6.0	59.5	98.2
	1998	14.0	8.7	89.2	99.7
	1999	25.1	13.6	104.7	129.5
	2000	14.7	9.3	83.5	110.9
	2001	18.9	11.7	91.2	129.5
	average	16.5	9.8	85.7	113.1
Wiśniowy	1996	12.9	8.4	92.5	95.1
	1997	12.4	7.6	70.7	108.4
	1998	16.3	10.0	101.7	100.0
	1999	14.2	7.6	75.5	100.5
	2000	15.3	10.4	96.2	108.7
	2001	22.2	14.3	98.5	144.7
	average	15.5	9.7	89.2	109.6
Wczesny Hosera	1996	14.3	8.1	87.7	92.4
	1997	11.2	6.9	65.5	105.9
	1998	13.6	8.3	90.0	92.3
	1999	11.5	6.7	68.7	97.2
	2000	13.4	9.7	65.7	147.5
	2001	19.9	12.9	88.7	147.5
	average	14.0	8.8	77.7	113.8
Purpurat	1996	10.0	5.9	46.5	130.7
	1997	8.9	5.7	48.5	118.8
	1998	8.8	5.8	58.0	101.7
	1999	14.3	8.0	60.2	133.0
	2000	12.8	8.8	55.7	159.3
	2001	16.0	10.7	79.2	134.7
	average	11.8	7.5	58.0	118.9
Average	1996	13.4	7.9	78.0	105.9
	1997	12.6	8.0	62.8	125.8
	1998	13.3	8.4	81.5	92.0
	1999	18.7	10.3	89.8	114.5
	2000	14.7	10.3	75.6	140.3
	2001	19.6	12.9	85.6	154.6
	average	15.4	9.6	78.9	122.2
LSD _{0.05}					
cultivar (a)		2.24	1.45	10.76	12.64
years (b)		2.57	1.66	12.32	14.48
interaction (a×b)		7.24	4.67	34.72	40.79

Significant differences were also noticed between the years of research in the height of average yield of leaves and petioles. The highest average leaves yield was obtained from rhubarb plants in 1999 (18.7 kg plant⁻¹) and in 2001 (19.6 kg plant⁻¹), whereas the highest petioles yield – in 2001 (12.9 kg plant⁻¹). At the initial stage of rhubarb cultivation (years 1996-1998) no major differences in yielding between the years of cultivation were noticed.

The percentage of petioles in total leaves yield is shown in [figure 1](#). On the basis of the graphic data it was proved that ‘Karpow Lipskiego’ was characterized by a large share of petioles yield in leaves yield (about 75%) in 2000 and 2001. Irrespective of the cultivar, much greater share of marketable yield in total yield was noticed in 2000 (71%) and in 2001 (66%) in comparison to 1999 (55%). On the basis of the results achieved and the observations made it can be inferred that the number of leaves gathered from one plant and the mass of a petiole, which is the features connected with the cultivar determine the share of marketable yield in total yield. In this research it has been proved that the petioles of the cultivar ‘Karpow Lipskiego’ considerably exceed the petioles of other cultivars ([table 2](#)) in respect of their average mass (155.6 g). Average mass of a petiole of those cultivars was much smaller and ranged from 109.6 g (‘Wiśniowy’) to 118.9 g (‘Purpurat’). Irrespective of the cultivar, the petioles of the largest average mass were produced by rhubarb plants in 2000 and 2001, whereas the petioles of considerably smallest mass – in 1998. The results of earlier research on rhubarb yielding show that the structure of the yield, to a high degree, depends on the cultivar characteristic [5, 6, 7].

Fig. 1. The percentage of petioles in total leaves yield of five rhubarb cultivars in years 1996-2001



In the present research work the most leaves were gathered from the plants of cultivars 'Wiśniowy', 'Koral' and 'Karpow Lipskiego' (from 89.2 to 83.7 per plant⁻¹ on average). Considerably less leaves were obtained from the plants of the cultivar 'Purpurat' (58.0 per plant⁻¹). Other authors stated earlier that the height of rhubarb petioles yield to a high degree, depends on the number of leaves gathered [2, 3]. The results of this research have confirmed this interdependence. From the cultivars which produced the highest yield also the most leaves were obtained.

CONCLUSIONS

1. In years 1996-2001 the average petioles yield ranged from 7.9 to 12.9 kg plant⁻¹.
2. In years 1996-2001 significant differences in yielding of five rhubarb cultivars were pointed out.
 - The highest average petioles yield was obtained from the cultivation of 'Karpow Lipskiego' (12.5 kg plant⁻¹), whereas the lowest from 'Purpurat' (7.5 kg plant⁻¹).
 - On average, the most petioles were gathered from the plants of cultivars 'Wiśniowy', 'Koral' and 'Karpow Lipskiego' (89.2-83.7 per plant-1), whereas the fewest from the cultivar 'Purpurat' (58.0 per plant-1).
 - The cultivar 'Karpow Lipskiego' was distinguishable by petioles of decidedly greater average mass (155.6 g) in comparison to other cultivar (109.6-118.9 g).
3. In respect of the quantity of marketable yield and reliability in cultivation, the cultivar 'Karpow Lipskiego' appeared to be the most useful for the cultivation with the petioles being intended for direct consumption.

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