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PRODUCTIVITY AND QUALITY OF SOME EARLY POTATO VARIETIES DEPENDING ON PLANTING RATE IN CONDITIONS OF MIDDLE PREDURALIE

SUMMARY

The article deals with the data about productivity and quality of early varieties of potato: "Zhukovskii early", "Red Scarlett", "Udacha", "Rosalind" depending on the planting rate. The trial was established on the sod-podzolic middle-loamy middle-cultivated soil in 2013 and 2014. The planned potato productivity of 35 t/ha was achieved in the variety Zhukovskii early and Rosalind 35.7 t/ha and 38.7 t/ha respectively, with the density of planting 71.4 thousand tubers/ha. Potato variety Rosalind also provided productivity of 35.8 t/ha in the variant with density of 57.1 thousand tubers/ha. Potato early maturity varieties Red Scarlett and Udacha formed up to 30 t/ha, and did not respond by the increase of tuber yield at densities from 41 to 71 thousand tubers/ha. The highest productivity was obtained by increasing the average potato tuber mass and increased density of potato plants on hectare.

The content of the marketable fraction in varieties did not differ and ranged from 76 to 81%. With planting overcrowding the varieties did not have a marketable fraction decrease in harvest. The starch content of the variants did not differ, and it was at the level of 11-13%.

Thus, it was found that on sod-podzolic middle-loamy soil to achieve the potato tuber yield of 35 t/ha in early potato variety Zhukovskii early the density of 71 thousand tubers/ha is needed, while for variety Rosalind density of 57 thousand tubers/ha is enough.

Key words: potato, productivity, density, variety

INTRODUCTION

Potato in the non-chernozem area of Russia is one of the major food and industrial crops. The average productivity of potatoes in Russia is 15-17 t/ha, while the biological potential of this crop allows to obtain 30-40 t/ha and more. Increase of potato productivity up to 35 t/ha and more allows to meet the needs of current population in potatoes (Dubinin, 2013; Simakov, 2013).

The optimal density of potato plants is determined by the soil and climatic conditions, peculiarities of the variety. On the high agricultural background and with sufficient moisture provision the higher density level is more possible than

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on poor soils and with unstable water conditions. However, the excessive number of potato plants leads to the decrease of growth of productivity, economic efficiency of technique and the output of marketable fractions of tubers. This leads to the selection of certain optimal density, the value of which depends on the planting rate (Zamotaev, Galeev, 1964; Siniagin, 1966; Pavlov, 1968; Adamov, Shpiltskevich 1977, Iakimenko, 1982, Iusupov, 1984; Dmitrieva, Tsadko, 1990 Vakulenko, 2013). For new potato varieties the optimum planting density is not yet established.

MATERIAL AND METHODS

In this regard in 2013-2014 we conducted the research, the purpose of which was to determine the optimum planting density of early potato varieties in order to reach the harvest of 35 t/ha. To achieve the goal the following tasks were done:

- To assess the variety reaction on planting density;
- Set the effect of planting density on the tubers quality.

To complete the tasks in the experimental field of Perm Agricultural Academy a two-factor field experiment was founded at the sod-podzolic middle-loamy soil with humus content of 4.2%, weak acid medium reaction (pHKCl 4.7), with a high content of mobile phosphorus and exchangeable potassium 181 mg/kg and 250 mg/kg of soil, respectively. Experimental design: Factor A – variety: A1 -Zhukovskii early (control); A2 - Red Scarlett; A3 – Udacha; A4 - Rosalind. Factor B - design (planting density), cm (thousands of tubers/ha): B1 - 70 × 35 (40.8 thousands of tubers/ha); B2 - 70 × 30 (47.6 thousands of tubers/ha) (control); B3 - 70 × 25 (57.1 thousands of tubers/ha); B4 - 70 × 20 (71.4 thousands of tubers/ha). Repeat 4 times. Experiment was carried out by method of split plots. The total area of the plot of the second order was 20 m2, accounting area was 15 m2. The length of the plot was 14.3 m, and the width of the plot 1.4 m (Dospekhov, 1985). The forecrop was barley. Agrotechnique was common for potatoes in the Permskii krai. Tillage included: in autumn - scuffing and underwinter plowing on a depth of arable layer; in spring - early spring harrowing and preplant cultivation with harrowing on a depth of 8-10 cm. Fertilizers were made in a dose of N90P90K120 for a pre-plant cultivation, the form of fertilizer is diammophoska (NPK 10:26: 26), ammonium nitrate (N-34), potassium chloride (K-60). Inter-cultivation included pre-emergence tillage and hilling. Harvesting was carried out manually with yellowing of lower leaves of potato.

Weather conditions in 2013 were unfavorable for the growth and development of the potato. Rainfall in June was near 60% of normal, and the temperature was higher than the long-term average annual value at 4.2 °C. In July the fallout was in large quantities, but uneven; it was hot weather; the temperature was higher than the long-term average annual value at 2.4 °C. In August rainfall and temperatures were close to long-term average annual values.

In general, the growing season was characterized by dry and hot weather, which negatively affected on the productivity of investigated early potato varieties.

Weather conditions in 2014 were favorable for the growth and development of the potato. Throughout the growing season cool weather with rainfall excess prevailed. The average monthly temperature in June was 15.0 °C, that on 1.4 °C is lower than normal, in July it was 14.4 °C, while normal is 18.4 °C, and in August it was at 2 °C higher than normal and was 17.1 °C. Rainfall in June was 84 mm, in July - 105 mm, which is 30% more than normal, in August - 58 mm. This has led to an increase in productivity of investigated early potato varieties.

RESULTS AND DISCUSSION

Planned productivity of early potato varieties of 35 t/ha was achieved at *Rosalind* variety with density of 57 thousand tubers/ha (planting scheme 70 × 25 cm) and amounted to 35.8 t/ha, and at the varieties of *Zhukovskii early* and *Rosalind* at a planting rate of 71.4 thousand tubers/ha (planting scheme 70 × 20 cm) and amounted to 35.7 and 38.7 t/ha, respectively (Table 1).

Table 1. Productivity of potato early varieties depending on planting density, t/ha, 2013-2014

Planting rate, thousand tubers/ha (B)	Variety (A)				Average on B
	Zhukovskii early (control)	Red Scarlett	Udacha	Rosalind	
40.8	27.7	25.1	20.3	27.9	25.2
47.6 (control)	31.4	26.0	28.1	29.8	28.8
57.1	31.4	29.3	30.3	35.8	31.7
71.4	35.7	30.6	30.8	38.7	33.9
Average on A	31.5	27.7	27.3	33.0	-
LSD_{05} individual differences	On factor A	10.2			
	On factor B	5.7			
LSD_{05} main effects	On factor A	5.1			
	On factor B	2.9			

Particular differences in planting rate revealed a significant increase in the productivity of 8.9 t/ha (LSD_{05} - 4.6 t/ha) in *Rosalind* variety with a planting density of 71.4 thousand tubers/ha (planting scheme 70 × 20 cm) compared with the control rate of 47.6 thousand tubers/ha (planting scheme 70 × 30 cm). A significant decrease of productivity in comparison with the control, of 3.7 and 7.8 t/ha occurred in the variants with the planting rate 40.8 thousand tubers/ha (planting scheme 70 × 35 cm) by the varieties *Zhukovskii early* and *Udacha*, respectively. Variety reaction on planting density is defined. Varieties *Zhukovskii early* and *Udacha* had the biggest yield at the planting rate of 47.6-71.4 thousand

tubers/ha, variety *Red Scarlett* - 40.8-71.4 thousand tubers/ha, and variety *Rosalind* - 57.1-71.4 thousand tubers/ha.

The main effects on the planting rate revealed a significant increase on 5.1 t/ha in the variant with a planting density of 71.4 thousand tubers/ha and a significant reduction in productivity on 3.6 t/ha in the variant with the planting density of 40.8 thousand tubers/ha (planting scheme 70 × 35 cm) in comparison with the control –47.6 thousand tubers/ha.

Data about productivity is confirmed by indicators of its productivity structure (Table 2).

Table 2. Productivity structure of early ripening varieties of potato depending on planting rate, t/ha, 2013-2014

Variety (A)	Planting rate, thousand/ha, (B)	Number of stems, pcs/m^2	Number of primary stems	Tuber mass from a potato plant, g	Number of tubers in a potato plant, pcs	Average tuber mass , g	Average tuber number per plant pcs
Zhukovskii early	(40.8)	110.2	2.9	829	7.6	130	2.3
	(47.6) (c)	153.9	2.9	859	7.3	132	1.8
	(57.1)	148.5	2.8	724	6.5	133	2.1
	(71.4)	208.8	3.2	760	7.2	141	1.9
Red Scarlett	(40.8)	158.1	3.6	746	7.5	124	1.5
	(47.6) (c)	200.8	4.1	726	7.9	120	1.4
	(57.1)	252.7	3.9	694	7.9	120	1.2
	(71.4)	360.6	4.1	686	7.7	113	1.1
Udacha	(40.8)	114.4	3.1	716	7.0	105	2.4
	(47.6) (c)	172.6	3.5	786	7.3	113	1.7
	(57.1)	197.0	3.2	758	6.8	109	1.7
	(71.4)	228,5	3.0	670	6.7	98	1.8
Rosalind	(40.8)	121.4	2.8	765	6.7	120	1.8
	(47.6) (c)	128.5	2.7	740	6.9	134	1.7
	(57.1)	182.7	3.0	694	6.7	116	1.7
	(71.4)	189.2	2.9	754	7.3	122	2.2
Average on A_1		155.3	2.9	793	7.1	134	2.0
Average on A_2		243.0	3.9	713	7.8	119	1.3
Average on A_3		178.1	3.2	732	7.0	107	1.9
Average on A_4		155.5	2.9	738	6.9	123	1.8
LSD_{05} individual differences	On factor A		0.85	165	1.9	32	0.6
	On factor B		0.67	108	1.4	13	0.4
LSD_{05} main effects	On factor A		0.42	83	1.0	16	0.3
	On factor B		0.33	54	0.7	7	0.2

In the best variants of productivity – varieties of potato *Zhukovskii early* (40.5 t/ha) and *Rosalind* (43.3 t/ha), with a maximum density (71.4 thousand tubers/ha) as well as *Rosalind* at a density of 57 thousand tubers/ha with

productivity 41.8 t/ha, the maximum productivity is obtained by means of the mass of tubers from the potato plant, as well as higher average weight of a tuber. Density of stems in these cases is the maximum in the experiment - 208.8 and 189.2 thousand stems/ha, respectively. The content of the marketable fraction in varieties did not differ and ranged from 76 to 81%. With overcrowding of planting the varieties are not marketable with marketable fraction decrease in harvest. The starch content of variants was not different and was at the level of 11-13%.

CONCLUSIONS

It was found out that on sod-podzolic middle-loamy middle-cultivated soil of Preduralie of Russia the early potato varieties Zhukovskii early and Rosalind provide the planned productivity not less than 35 t/ha with a planting rate 71.4 and landing 57.1-71.4 thousand tubers/ha, respectively.

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