MASS OF 1,000 GRAINS IN SEVERAL WINTER WHEAT GENOTYPES, AT DIFFERENT DATES OF SOWING AND RATES OF NITROGEN FERTILIZER

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ABSTRACT

Four winter wheat varieties planted at three sowing dates and fertilized with five rates of nitrogen were investigated under field conditions. On average fixer all sowing dates and fertilizer rates, the highst mass of was grain (44 g) was recorded a the variety Pobeda, while the lowest (38 g) was found in the variety PKB–Lepoklasa (38 g). Highest mass of 1,000 grains in all varieties was recorded in 1999 when weather conditions were ideal from anthesis to maturity. Date of sowing and amount of nitrogen fertilizer had considerable influence on the mass of 1,000 grains.

Key words: wheat, mass of 1,000 grains, sowing, nitrogen.

INTRODUCTION

The mass of 1,000 grains or thousend kernels weight (TKW) is the weight of air-dried and not damaged grains. It is used as one of the parameters for assessing the quality of grain. Grains with higher TKW have better milling quality and ensure better emergence.

The mass of 1,000 grains as a final component of grain yield depends on many components that develop in the previous phases of ontogenesis. Because there is a hyper-production of all organs of the plant in each phase of wheat plant growth, it is possible to influence the mass of 1,000 grains by agro-ecological conditions, agrothechnical measures such as date and quality of sowing, mineral fertilizers and irrigation. TKW depends on the variety and veries widely. Unfavourable conditions during the growth of wheat plant can be partly compensated by creating favourable conditions that will increase mass of 1,000 grains.

It is expected that grain mass is in correlation with the parameters with increated activity after the spikes are formed.

Simpson (1968) proved a strong positive correlation of top leaf area, internodes and spike with grain mass and concluded that the selection for higher size of these parts of wheat plant is a selection for grain mass increase. In agro-ecological conditions of Serbia and in varieties, cultivated there the mass of 1,000 grains ranges from 33-45 g, 38 g on average (Šaric, 1993).

MATERIAL AND METHODS

Four varieties of winter wheat with different type of tillers, height, position of leaves, vegetation period, as well as quality and yield of grain, were studied.

The experiment was set up in the experimental field of the Institute „PKB-Agroekonomik" at P. Skela, Belgrade (1997/1998 to 1999/2000), on chernozem soil type, with split-plot system in four repetition. Sunflower preceded in all three years, usual agro-technology for wheat growing in the Republic of Serbia was used. The basic plot was 10 m^2 (2 x 5 m). The wheat was planted manually, three dates: on October 10^{th}, 25^{th} and November 10^{th}. Sowing density was 600 of germinating grains/m^2 in all years of investigation. Nitrogen fertilizers were applied in the following variants: 0, 60, 90, 120 and 150 kg/ha. Before the main cultivation the entire quantity of phosphorus (60 kg/ha) and potassium (40 kg/ha) as well as 30 kg of nitrogen were applied. The remaining quantity of 70% was applied in the beginning of the third phases of organogenesis and 30% in the beginning of the fifth phases.

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The wheat was harvested manually at full maturity, and threshed with combine. After that 1,000 grain mass was measured.

Statistical data processing, through analysis of variance was carried out at the Institute for Plant Protection and Environment. Variety, date of sowing and fertilizer rate were used as factors. The results were presented as a three year average.

RESULTS AND DISCUSSION

Grain mass depends on the date of sowing and harvest, quantity of nitrogen fertilizer, conditions for wheat growing, density of sowing, climate etc. An effective translocation of assimilative from leaves and straw into grain is especially important for obtaining the mass of 1,000 grains, and there an genetical differences between wheat varieties (Borojevic, 1971). Our results proved that the mass of 1,000 grains was reduced from the first to the third date of sowing in all investigated varieties (Table 1).

In the varieties PKB-Lepoklasa and Pobeda, the date of sowing had no effect on the mass of 1,000 grains while in the variety PKB-Arena TKW decreased in the second and the third date of sowing, as compared to the first date of sowing. In the variety Evropa-90 there was no difference between the first and the second date of sowing, while between the second and the third date of sowing a slight difference was observed (Table 1).

Table 1. Mass of 1,000 grains at different date of sowing and rates of nitrogen fertilizers in several winter wheat genotypes (3-year average)

Date of sowing (R)	Quantity of nitrogen (D)	Variety (S)					
		PKB-Lepoklasa	Pobeda	PKB-Arena	Evropa-90	RD_X	R_x
I	0	35	43	41	40	40	41
	60	38	45	43	42	42	
	90	37	45	43	41	41	
	120	37	44	42	41	41	
	150	36	43	41	40	40	
	RS_X	37	44	42	41		
II	0	35	44	41	40	40	41
	60	37	46	43	42	42	
	90	39	45	42	41	41	
	120	37	44	41	41	41	
	150	36	43	41	40	40	
	RS_X	36	44	42	41		
III	0	35	43	40	39	39	40
	60	38	45	42	41	41	
	90	37	45	41	41	41	
	120	37	44	41	40	40	
	150	36	44	40	40	40	
	RS_X	37	44	41	40	D_X	
DS_X	0	35	43	41	40	40	41
	60	38	45	43	42	42	
	90	37	45	42	41	41	
	120	37	44	41	41	41	
	150	36	43	41	40	40	
	S_X	36	44	41	40		
Significance levels		R	S	D	SR	RS	DR
LSD	5%	0.2	0.6	0.2	1.0	0.9	0.3
	1%	0.2	0.8	0.2	1.3	1.1	0.4
		DS	SD	RD	DRS	SRD	RSD
LSD	5%	0.3	0.6	0.3	0.6	1.1	6.6

	1%	0.4	0.8	0.4	0.8	1.5	1.4

Increasing the quantity of nitrogen fertilizer, up to 60 kg per ha in the investigated varieties, the mass of 1,000 grains increased, and with further increase of nitrogen quantity, the mass of 1,000 grains decreased. In the variety PKB-Lepoklasa it was 38 g when 60 kg of nitrogen was used, and 36 g with 150 kg of nitrogen. The mass of 1,000 grains in the variety Pobeda was 45 g with 60 kg of nitrogen, and 43 g with 150 kg of nitrogen.

In the variety PKB-Arena the mass of 1,000 grains was 43 g with the use of 60 kg of nitrogen, and 41 g with 150 kg. The mass of 1,000 grains in the variety Evropa-90 with the use of 60 kg of nitrogen was 41 g (Table 1).

The mass of 1,000 grains averaged for all dates of sowing and quantities of nitrogen ranged from 36 g (PKB-Lepoklasa) to 44 g (Pobeda) (Table 1).

The mass of 1,000 grains was 7,6 g bigger in the variety Pobeda than in the variety PKB-Lepoklasa, which is significant difference, while the variety Pobeda in relation to the variety PKB-Arena had bigger 1,000 grain mass for 2,7 g that is also significant difference. 1,000 grain mass differed in different years of investigation, so that in PKB-Lepoklasa in the first year of investigation and with 60 kg of nitrogen it was 35 g, in the second year 41 g, and in the third year it was 38 g. In the variety Pobeda in the first year of investigation the mass of 1,000 grains was 42 g, in the second year 47 g, and in the third 47 g. 1,000 grain mass in the variety Evropa-90 was 39 g in the first, 44 g in the second and 41 g in the third year (Table 1).

Drezgic et al. (1974; 1975), Dancic (1961) and Scepanovic (1979), as well as many other investigators, also registered similar effect of nitrogen fertilizer. Our studies did not prove significant difference in 1,000 grain mass between the first and the third date of sowing. According to Borojevic (1965), the mass of 1,000 grains is the characteristic that varies more in the varieties capable to develop larger number of grains in a spike, then in those with smaller number of grains.

Using the method of multiple linear regression, Hassan et Saad (1996) proved that the mass of grains per spike, the mass of 1,000 grains and the number of grains per spike were the most important components of yield, and that they could be used as a selection criteria to increase the wheat grain yield.

Kaushik et al. (1996) proved that the mass of 1,000 grains was in significant positive correlation with the mass of grain per plant and biological yield per plant.

A significant positive correlation between 1,000 grain mass and yield of grain was found by Sarkar et al. (1988), Pawar at al. (1989), Collaku (1989), Hadjichristodoulou (1989), Raut and Khorgade (1989), Singh et al., (1995).

Zonjic and Jovanovic (1966) found that the average 1,000 grain mass had a positive effect on the increase of grain yield. According to the investigation of Protic et al. (1988), Protic (1999), the mass of 1,000 grains had a strong effect on test weight, poor effect on productive tillering, and slightly higher effect on the number of spikes per m^2. According to Borojevic (1963), when large seeds were used for sowing, plants of equal size were obtained. In that way, one of the first causes of variability of yield, caused by unequal size of seeds, was eliminated.

In comparison with the small rate of 60 kg nitrogen/ha, the biggest decrease of 1,000 grain mass was with 120 kg/ha and 150 kg/ha of nitrogen. In the variety PKB-Lepoklasa TKW was 95.6%, in Pobeda, 96.8%, while PKB-Arena had 94.8% and Evropa-90, 96.1 %, from the value at 60 kg nitrogen/ha. The biggest mass of 1,000 grains was obtained with moderate quantities of nitrogen of 60 and 90 kg/ha (Table 1).

CONCLUSIONS

The investigation proved that the date of sowing and the quantity of nitrogen fertilizers had considerable effect on the mass a 1,000 grains. Our study proved that the variety Pobeda had the biggest mass of 1,000 grains (44 g) on average

over the investigated date of sowing, quantitus of nitrogen fertilizer and during three years of investigation, while the variety PKB-Lepoklasa had the smallest mass (36 g). The biggest mass of 1,000 grains in all investigated varieties was in 1999, with ideal conditions from fertilization up to full maturation. In the investigated varieties, the mass of 1,000 grains decreased from the first to the third date of sowing. The biggest mass of 1,000 grains was obtained with the use of 60 kg nitrogen/ha, with the increase of the quantity of nitrogen, the mass of 1,000 grains decreased.

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