

INFLUENCE OF VARIETY AND FERTILIZERS ON 1000-GRAIN WEIGHT IN WINTER WHEAT, UNDER CONDITIONS OF DOBROGEA

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ABSTRACT – 1000-grain weight is a polygene determinism trait, highly influenced by environment. Therefore, establishing a soil background on which 1000-grain weight is the highest, has a special importance. The genetic component involved in controlling the grain size was important in breeding this trait. In achieving 1000-grain weight, the specific interaction between variety x fertilization level pointed out the following aspects: some varieties, like Romulus and Dor, did not react at increased nitrogen and phosphorus rates; on $N_{80}P_{70}$ soil background, as compared to N_0P_0 , Alex and Flamura 85 varieties achieved bigger grains, with 2.3 g and 1.8 g, respectively, significantly assured differences, while the Rapid variety achieved bigger grains with 4.8 g, very significantly assured differences. On $N_{120}P_{70}$ soil background, as compared to N_0P_0 , Alex, Boema, Delabrad and Lovrin 34 varieties achieved bigger grains, with 1.8 and 2.2 g, respectively, significantly assured differences. As compared to unfertilized N_0P_0 background, only one variety, Lovrin 34 achieved the biggest grains with 2.0 g, significantly assured differences. The highest 1000-grain weight was obtained at the variant fertilized with $N_{80}P_{70}$ (41.7 g), and among varieties, we noticed Rapid, on $N_{80}P_{70}$ soil background.

Key words: 1000-grain weight, fertilization, soil background, wheat varieties

REZUMAT - Influența soiului și a îngrășămintelor asupra masei a 1000 de boabe la grâul de toamnă, în condițiile din Dobrogea. Masa a 1000 boabe este o caracteristică cu determinism poligenic, însă este puternic influențată de condițiile de mediu, motiv pentru care stabilirea unui agrofond, la care această caracteristică se realizează la maximum, prezintă importanță deosebită. Componenta genetică, implicată în controlul mărimii boabelor, are importanță în ameliorarea acestei însușiri. În realizarea masei a 1000 de boabe, interacțiunea

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specifică soi x nivel de fertilizare evidențiază următoarele aspecte: unele soiuri, Romulus și Dor, sunt lipsite de reacție la dozele crescânde de azot și fosfor; pe agrofondul $N_{80}P_{70}$, în comparație cu N_0P_0 , soiurile Alex și Flamura 85 realizează boabe mai mari cu 2,3 g și, respectiv, cu 1,8 g, diferențe semnificative, iar soiul Rapid realizează boabe mai mari cu 4,8 g, diferență foarte semnificativă; pe agrofondul $N_{120}P_{70}$, comparativ cu agrofondul N_0P_0 , soiurile Alex, Boema, Delabrad și Lovrin 34 realizează boabe mai mari cu 1,8 și, respectiv, 2,2 g, diferențe semnificative; pe agrofondul $N_{160}P_{70}$, în comparație cu agrofondul nefertilizat N_0P_0 , doar un singur soi, Lovrin 34, obține boabele cele mai grele, cu 2,0 g, diferență asigurată semnificativ. Cea mai mare masă a 1000 boabe s-a obținut în varianta fertilizată cu $N_{80}P_{70}$ (41,7 g), iar dintre soiuri s-a remarcat Rapid, pe agrofondul $N_{80}P_{70}$.

Cuvinte cheie: masa a 1000 de boabe, fertilizare, agrofond, soiuri de grâu

INTRODUCTION

The investigations conducted under different soil and climatic conditions from Romania have shown that, next to genetic factors, the technological factors also contributed to the modification of crop chemical composition and quality (Axinte et al., 2006; Borlan and Hera, 1973; Hera et al., 1979; Hera et al., 1971). The proper fertilization and the extension into growing of productive varieties are very important for increasing the mean wheat yield (Ceapoiu, 1975).

There is a direct connection between 1000-grain weight and yield; the varieties with higher grain weight have a higher production capacity, too.

The 1000-grain weight is a polygenic determinism trait, highly influenced by environment, therefore, establishing a soil background on which the 1000-grain weight is the highest, has a special importance.

The aim of this scientific paper is to study the influence of fertilization and variety on the 1000-grain weight, under conditions of Dobrogea.

MATERIALS AND METHODS

Nine winter wheat varieties, created at the Agricultural Research and Development Institute of Fundulea and the Agricultural Research and Development Station of Lovrin, were investigated. The varieties were tested at the Agricultural Research and Development Station of Valu lui Traian-Constanța, in a competition comparative crop, under non-irrigated.

As concerns the climatic conditions in this area, the mean annual temperature of air is of 11.15°C and the mean annual rainfall is of 791 mm. In the 2005-2006 crop year, determinations were done during September-November 2005, when a rainfall surplus of 198.6 mm was registered.

Investigations were carried out in a long-term experiment with winter wheat, placed in a five year-crop rotation. Soybean was the predecessor plant. The method used was two factor split-split plots: four graduation soil background (NoP_0 ; $N_{80}P_{70}$; $N_{120}P_{70}$; $N_{160}P_{70}$) and nine graduation (varieties Flamura 85, Fundulea 4, Lovrin 34, Rapid, Alex, Dor, Delabrad, Boema and Romulus).

1000-GRAIN WEIGHT IN WINTER WHEAT

Nitrogen fertilizers were applied in three stages and phosphorus was applied in autumn, before ploughing.

In order to determine the 1000-grain weight, we carried out three determinations of this yield component for each variety on the four fertilization levels.

RESULTS AND DISCUSSION

The experimental results have shown that the nine varieties gave the smallest grains, on unfertilized soil background.

On the average of the four soil backgrounds, Alex, Dor and Rapid varieties, as compared to Flamura 85, achieved the biggest grains (43.1 g, 42.9 g and 42.5 g, respectively). These varieties have obtained an additional grain weight, of 2.0 g, 1.8 g and 1.4 g, respectively.

Delabrad and Romulus varieties had the 1000-grain weight of 42.1 g and 41.9 g, respectively, higher with 1.0 g and 0.8 g, respectively, as compared to Flamura 85 variety, difference that exceeded the probability threshold $P=5\%$.

Smaller grains, as in case of Flamura 85, were found in Fundulea 4 and Lovrin 34 varieties (36.2 g and 35.7 g, respectively), with very significant statistically assured differences of 4.9 g and 5.4 g, respectively.

Table 1 - 1000-grain weight achieved by the nine varieties on four fertilization levels at Valu lui Traian, under non-irrigated, in the crop year 2005-2006

Varieties	Soil background				1000- grain weight average/variety (g)	Difference to the control	Signific.
	1000-grain weight (g)						
	N ₀ P ₀	N ₈₀ P ₇₀	N ₁₂₀ P ₇₀	N ₁₆₀ P ₇₀			
Flamura 85	40.5	42.4	42.2	39.3	41.4	Control	
Fundulea 4	34.8	36.3	37.5	36.3	36.2	-4.9	000
Lovrin 34	34.3	35.5	36.5	36.3	35.1	-5.4	000
Rapid	41.7	46.5	42.2	29.7	42.7	1.4	xx
Alex	42.0	44.3	43.8	42.3	43.9	2.0	xxx
Dor	42.5	44.2	43.3	41.7	42.8	1.8	xxx
Delabrad	41.0	42.7	43.2	41.3	42.6	1.0	x
Boema	39.5	40.8	41.7	40.3	40.3	-0.5	
Romulus	41.8	42.5	42.2	41.2	41.5	0.8	
Average	39.7	41.6	41.4	38.7			
	LSD 5%= 0.8 g		LSD 1%= 1.1 g		LSD 0.1%=1.4		

The behaviour of varieties, from the grain weight viewpoint, on the four soil backgrounds, has shown that there were no significant differences between varieties, determined by used fertilizers (*Table 2*). On N₀P₀ soil background from the studied germplasm, only Dor variety has achieved a greater 1000-grain weight with 2 g, a significant yield increase, while on N₈₀P₇₀ soil background, there were

another two varieties, Alex, with a yield increase of 2 g, significantly assured, and Rapid, with a yield increase of 4.2 g, very significantly assured. On N₀P₀ soil background, Flamura 85 variety exceeded Lovrin 34 and Fundulea 4 varieties with 6.2 g and 5.7 g, respectively.

Table 2 - 1000-grain weight achieved by some winter wheat varieties, on different soil backgrounds at Valu lui Traian, under non-irrigated, in the crop year 2005-2006

Soil background	Variety	1000-grain weight (g)		Difference to the control	Significance
		Average (g)	%		
N ₀ P ₀	Flamura 85	40.5	100	Control	
	Fundulea 4	34.8	85.9	-5.7	000
	Lovrin 34	34.3	84.7	-6.2	000
	Rapid	41.7	102.9	1.2	
	Alex	42.0	103.7	1.5	
	Dor	42.5	104.9	2.0	x
	Delabrad	41.0	101.2	0.5	
	Boema	39.5	97.5	-1.0	
	Romulus	41.8	103.2	1.3	
LSD 5% = 1.7 g		LSD 1% = 2.2 g		LSD 0.1% = 2.9 g	
N ₈₀ P ₇₀	Flamura 85	42.3	100	Control	
	Fundulea 4	36.3	85.8	-6.0	000
	Lovrin 34	35.5	83.4	-6.8	000
	Rapid	46.5	109.9	4.2	xxx
	Alex	44.3	104.7	2.0	x
	Dor	44.2	104.5	1.9	x
	Delabrad	42.7	100.9	0.4	
	Boema	40.8	96.4	-1.5	
	Romulus	42.5	100.5	0.2	
LSD 5% = 0.8 g		LSD 1% = 1.1 g		LSD 0.1% = 1.4 g	
N ₁₂₀ P ₇₀	Flamura 85	42.2	100	Control	
	Fundulea 4	37.5	88.8	-4.7	000
	Lovrin 34	36.5	86.5	-5.7	000
	Rapid	42.2	100.0	0	
	Alex	43.8	103.8	1.6	
	Dor	43.3	102.6	1.1	
	Delabrad	43.2	102.4	1.0	
	Boema	41.7	98.8	-0.5	
	Romulus	42.2	100.0	0	
LSD 5% = 0.8 g		LSD 1% = 1.1 g		LSD 0.1% = 1.4 g	
N ₁₆₀ P ₇₀	Flamura 85	39.3	100	Control	
	Fundulea 4	36.3	92.4	-3.0	000
	Lovrin 34	36.3	92.4	-3.0	000
	Rapid	39.7	101.0	0.4	
	Alex	42.3	107.1	3.0	xxx
	Dor	41.7	106.1	2.4	xx
	Delabrad	41.3	105.1	2.0	x
	Boema	40.3	102.5	1.0	
	Romulus	41.2	104.8	1.9	x
LSD 5% = 0.8 g		LSD 1% = 1.1 g		LSD 0.1% = 1.4 g	

1000-GRAIN WEIGHT IN WINTER WHEAT

At the unfertilized variant, N_0P_0 , Rapid, Alex, Dor and Romulus varieties have exceeded the 1000-grain weight with a non-significant difference of 1.2 g, 1.5 g, 2.0 g and 1.3 g, respectively, in comparison with the 1000-grain weight in Flamura 85 control.

On $N_{80}P_{70}$ soil background, Fundulea 4 and Lovrin 34 have exceeded the 1000-grain weight with 6.8 g and 6.0 g, respectively; on $N_{120}P_{70}$, they have exceeded the 1000-grain weight with 5.7 g and 4.7 g, respectively. On $N_{160}P_{70}$, both varieties have exceeded the 1000-grain weight with 3.0 g.

On $N_{120}P_{70}$ soil background, no variety had the 1000-grain weight higher than Flamura 85 control, and on $N_{160}P_{70}$, Delabrad and Romulus varieties had a higher 1000-grain weight with 2.0 g and 1.9 g respectively, statistically significant assured yield increases. Dor variety has exceeded Flamura 85 with 2.4 g, this increase exceeding the probability threshold for LSD 1%. On this soil background, only Alex variety has achieved grains which 1000-grain weight exceeded Flamura 85 with 3.0 g, the difference being very significant.

CONCLUSIONS

The 1000-grain weight is a trait for each variety, which is influenced by environment. Fertilization has a good influence on the 1000-grain weight, according to variety.

The highest 1000-grain weight was obtained at the $N_{80}P_{70}$ fertilized variant (41.7 g), and among varieties, we noticed Rapid on $N_{80}P_{70}$ soil background. $N_{120}P_{70}$ soil background has contributed with 4 % to the increase of grain weight (1.6 g), a distinctively significant difference.

$N_{160}P_{70}$ soil background did not result in a significant yield increase, being obtained values similar to the ones on unfertilized soil background. The 1000-grain weight is a main yield component, which has to be studied together with the grain number/individual.

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