

INFLUENCE OF FERTILIZATION ON WINTER WHEAT YIELD, UNDER THE ECOLOGICAL CONDITIONS FROM THE AGRICULTURAL RESEARCH STATION OF VALU LUI TRAIAN, CONSTANȚA COUNTY

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ABSTRACT – Winter wheat is a crop, which capitalizes very efficiently high fertilizer levels. Therefore, applying 80 kg/ha active ingredient of N, together with 70 kg/ha active ingredient of P, has resulted in a statistically assured very significant yield increases of 1550 kg/ha (143 %), the average of the nine tested wheat varieties. Maintaining a constant phosphorus soil background (70 kg/ha active ingredient), corroborated to the application of other two nitrogen levels, higher with 40 kg/ha active ingredient of N, led to significant yield increases. From the N₀P₀ unfertilized background to the N₈₀P₇₀ background, a yield increase of 1550 kg/ha can be achieved. It diminished until 1090 kg/ha between N₈₀P₇₀ and N₁₂₀P₇₀ soil background and until 430 kg/ha between N₁₂₀P₇₀ and N₁₆₀P₇₀ soil background. The interaction between wheat varieties and fertilization rates pointed out the Alex Variety and the N₁₆₀P₇₀ fertilization rate, with a yield of 7800 kg/ha.

Key words: winter wheat, soil background, unfertilized, variant, yield

REZUMAT – Influența fertilizării asupra producției la grâul de toamnă în condițiile ecologice de la SCDA Valu lui Traian, jud. Constanța. Cultura grâului de toamnă face parte din categoria plantelor de cultură, care valorifică cu eficiență maximă nivelurile crescânde de fertilizare. În acest fel, la alocarea a 80 kg/ha s.a. N, împreună cu 70 kg/ha s.a. P, s-a realizat un spor de producție foarte semnificativ, asigurat statistic, de 1550 kg/ha (143 %), media celor

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nouă soiuri de grâu experimentate. Menținerea, în continuare, a unui agrofond constant de fosfor (70 kg/ha s.a.), coroborat cu alocarea a încă două niveluri de azot mai mari cu 40 kg/ha s.a. N, a condus la creșteri substanțiale de producție. De la agrofondul nefertilizat N_0P_0 la agrofondul $N_{80}P_{70}$ s-a realizat un spor de producție de 1550 kg/ha. Acesta s-a redus la 1090 kg/ha între agrofondul $N_{80}P_{70}$ și $N_{120}P_{70}$, și la 430 kg/ha între agrofondurile $N_{120}P_{70}$ și $N_{160}P_{70}$. Interacțiunea dintre soiurile de grâu și dozele de fertilizare a evidențiat varianta cu soiul Alex și doza de fertilizare $N_{160}P_{70}$, cu o producție de 7800 kg/ha.

Cuvinte cheie : grâu de toamnă, agrofond, nefertilizat, variantă, producție

INTRODUCTION

Wheat is a very significant cereal, being cultivated since ancient times. Nowadays, it is the most important food cereal worldwide, wheat bread being the main aliment for most of the world population (Mihăilă, 1992).

Among all the measures meant to contribute to the increase in the cereals yield and, thus, to a better food supply, next to the creation of well-adapted varieties to the ecological and growing conditions, fertilization has a positive influence both on yield and on quality.

The investigations conducted until today in Romania and abroad have shown that nitrogen was the main factor in increasing winter wheat yield (Hera et al., 1971; Hera et al., 1984; Mihăilă et al., 1980). They have also demonstrated the presence of a positive interaction between nitrogen and phosphorus fertilizers, which results in increasing the coefficient of using both elements (Axinte et al., 2006; Toncea, 1985).

MATERIALS AND METHODS

Investigations were conducted at the Agricultural Research Station of Valu lui Traian-Constanța County in the crop year 2005 - 2006. We have studied nine winter wheat Romanian varieties, created at the Agricultural Research Institute of Fundulea and at the Agricultural Research Station of Lovrin and tested in competitive comparative crops. Experiments were set up according to the split-split plot method with two factors: the soil background with four graduations (N_0P_0 ; $N_{80}P_{70}$; $N_{120}P_{70}$; $N_{160}P_{70}$) and the variety with nine graduations (Flamura 85, Fundulea 4, Lovrin 34, Rapid, Alex, Dor, Delabrad, Boema and Romulus).

Nitrogen fertilizers were applied in three stages, and the phosphorus ones, in autumn, before ploughing. As concerns the thermal regime, the crop year 2005-2006 was good for wheat growing. The rainfall regime was also favourable for wheat, a surplus of 365.9 mm being found. Therefore, the obtained yields were higher than the yields of the previous year were.

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RESULTS AND DISCUSSION

Wheat is a crop that capitalizes the most efficiently high fertilization levels. As concerns the specific response to the application of fertilizers on different fertilization levels, we found out that there were clear genetic differences among the nine tested genotypes about the capitalization of nitrogen and phosphorus fertilizers (*Table 1*).

Table 1 – Yields obtained in winter wheat at the Agricultural Research Station of Valu lui Traian, during 2005-2006

Soil background Varieties	Yields (kg/ha)				Average per varieties		Difference kg/ha	Signif.
	N ₀ P ₀	N ₈₀ P ₇₀	N ₁₂₀ P ₇₀	N ₁₆₀ P ₇₀	kg/ha	%		
Flamura 85	3570	5080	6180	6370	5300	100.0	Control	
Fundulea 4	3510	4940	6060	6570	5270	99.4	-30	
Lovrin 34	3000	4260	5140	5550	4488	84.6	-812	000
Rapid	3450	4860	5890	6380	5145	97.0	-155	00
Alex	4220	6050	7200	7800	6318	119.2	1018	xxx
Dor	3710	5270	6410	6850	5560	104.9	260	xxx
Delabrad	3790	5430	6550	7000	5690	107.3	390	xxx
Boema	3910	5630	6830	7220	5898	111.2	598	xxx
Romulus	3580	5160	6230	6610	5395	101.8	95	
Average soil background	3637	5186	6276	6705				
%	100.0	142.5	172.5	184.3				
Difference	Control	1549	2639	3078				
Significance		xxx	xxx	xxx				
	LSD 5% = 100 kg/ha		LSD 1% = 130 kg/ha		LSD 0.1% = 160 kg/ha			

Among these varieties, we noticed Dor, Delabrad, Boema and Alex with very significant yield increases and values comprised between 260 and 1018 kg/ha (average of soil backgrounds).

As compared to the control (Flamura 85), Rapid and Lovrin 34 varieties have shown a production deficit of 155 and 812 kg/ha, respectively, statistically distinctive and very significant. Romulus and Fundulea 4 varieties have shown insignificant yield differences.

Studying the behaviour of varieties at high chemical fertilizer rates, we found out that in all the nine tested varieties, very significant yield increases were obtained. Thus, on a soil background fertilized with P 70 kg/ha active ingredient and at the nitrogen rates comprised between 80 and 160 kg/ha active ingredient, yield increases were between 1549 and 3078 kg/ha (average of the varieties) and the greatest differences were found at high nitrogen rates.

The interaction variety x fertilization has determined very significant yield increases in all the varieties and on all the fertilization levels, comprised between 510 and 4050 kg/ha (*Table 2*).

Table 2 - Influence of the interaction variety x fertilization on winter wheat yield in the crop year 2005-2006

Soil background	Variety	Yield		Difference towards the control	Significance
		kg/ha	%		
N ₀ P ₀	Flamura 85	3750	100	Control	
	Fundulea 4	3510	98	-60	
	Lovrin 34	3000	84	-570	000
	Rapid	3450	97	-120	
	Alex	4220	118	650	xxx
	Dor	3710	104	140	
	Delabrad	3790	106	220	x
	Boema	3910	110	340	xxx
	Romulus	3580	100	10	
N ₈₀ P ₇₀	Flamura 85	5080	135	1330	xxx
	Fundulea 4	4940	131	1190	xxx
	Lovrin 34	4260	113	510	xxx
	Rapid	4860	129	1110	xxx
	Alex	6050	161	2300	xxx
	Dor	5270	140	1520	xxx
	Delabrad	5430	144	1680	xxx
	Boema	5630	150	1880	xxx
	Romulus	5160	137	1410	xxx
N ₁₂₀ P ₇₀	Flamura 85	6180	164	2430	xxx
	Fundulea 4	6060	161	2310	xxx
	Lovrin 34	5140	137	1390	xxx
	Rapid	5890	157	2140	xxx
	Alex	7200	192	3450	xxx
	Dor	6410	170	2660	xxx
	Delabrad	6550	174	2800	xxx
	Boema	6830	182	3080	xxx
	Romulus	6230	166	2480	xxx
N ₁₆₀ P ₇₀	Flamura 85	6370	169	2620	xxx
	Fundulea 4	6570	175	2820	xxx
	Lovrin 34	5550	148	1800	xxx
	Rapid	6380	170	2630	xxx
	Alex	7800	208	4050	xxx
	Dor	6850	182	3100	xxx
	Delabrad	7000	186	3250	xxx
	Boema	7220	192	3470	xxx
	Romulus	6610	176	2860	xxx
LSD 5% = 190 kg/ha		LSD 1% = 360 kg/ha		LSD 0.1% = 470 kg/ha	

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The best response to fertilization was found in the Alex Variety, which had yield increases of 2300 kg/ha (61 %) on the $N_{80} P_{70}$ soil background, of 3450 kg/ha (92 %) on the $N_{120} P_{70}$ soil background and of 4050 kg/ha (108 %) on the $N_{160} P_{70}$ soil background.

Close values of the yield increases were also found in Boema (50 – 92 %), followed by Delabrad (44 – 86 %) and Dor (40 – 82 %).

The lowest response to fertilization was found in the Lovrin 34 Variety, which had yield increases of 510 kg/ha (13 %) on the $N_{80} P_{70}$ soil background, of 1390 kg/ha (37 %) on the $N_{120} P_{70}$ soil background and of 1800 kg/ha (48 %) on the $N_{160} P_{70}$ soil background.

When no fertilizers were applied, the evolution was similar, so that the Lovrin 34 Variety has obtained the lowest yields, with a deficit of 570 kg/ha against the control, followed by Rapid (-120 kg/ha) and Fundulea 4 (-60 kg/ha), while Alex (650 kg/ha) and Boema (340 kg/ha), very significant yield increases.

CONCLUSIONS

The crop year 2005-2006 was favourable to wheat growing, under non-irrigated, because of the registered rainfalls, which were by 365.9 mm over the multiannual mean, during September – November 2005 (125.3 mm), in March (41.2 mm) and May (35.2 mm) 2006.

The Alex Variety had the best response to fertilization, registering yield increases of 61 % on $N_{80} P_{70}$ soil background, of 92 % on $N_{120} P_{70}$ soil background and of 108 % on $N_{160} P_{70}$ soil background. Close yield increases were obtained in Boema (50 – 92 %), Delabrad (44 – 86 %) and Dor (40 – 82 %) varieties.

The Lovrin 34 Variety had the lowest response to fertilization, with yield increases of 13 % on $N_{80} P_{70}$ soil background, of 37 % on $N_{120} P_{70}$ soil background and of 48 % on $N_{160} P_{70}$ soil background.

In the absence of fertilization, the classification of varieties according to achieved yields had a similar behaviour.

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