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EFFECT OF DIFFERENT NITROGEN DOSES IN DIFFERENT WINTER WHEAT PRODUCTION

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Abstract

One of the important ways to increase production of wheat is the application of fertilizers. Grain production at wheat is largely determined by the administration of nitrogen fertilizers, in close interdependence with the specific conditions of the year, the state of vegetation in winter entrance and its resumption in spring. Noteworthy is the fact that from the unfertilized agricultural fund N_0P_0 (mt) to the $N_{80}P_{70}$ was obtained an increase of 1628 kg/ha. This increase is reduced to 1144 kg/ha between $N_{80}P_{70}$ and $N_{120}P_{70}$ agricultural fund and 452 kg/ha between $N_{120}P_{70}$ and $N_{160}P_{70}$. With regard to the specific reaction at fertilizers application of different levels of fertility, Otilia variety had best capitalizes on the increasing nitrogen, achieving an increase (the average of the three agricultural funds) of 1068 kg/ha compared to Pitar control variety. The interaction between wheat varieties and fertilization doses revealed the Otilia variety and the $N_{160}P_{70}$ fertilization dose, with a yield of 8190 kg/ha. Concerning the behavior of varieties at increasing doses of chemical fertilizers, we find that the nine analyzed varieties obtain very significant production increases.

Key words*: winter wheat varieties, production, fertilization.*

INTRODUCTION

One of the world's largest grain crops is wheat, plant that provides the most nutritious food for humans and animals in the highest proportion.

Along with genetic factors, technological factors and above all, mineral fertilization is another way to increase and stabilize production of winter wheat production.

The results obtained worldwide shows that fertilization is one of the main factors in the growth of productions.

Productions obtained are linked and correlated with the quantities of fertilizers used. Without proper fertilization it is not possible to realize the productive potential of the new varieties created by geneticists and breeders (Hera Cr., 1984).

Wheat is known as a plant which reacts very well to the application of mineral and organic fertilizers, although the specific consumption of nutrients is relatively low: 2.3-3.3 kg N; 1.1-1.8 kg P_2O_5; 1.9-3.7 kg K_2O/l00 kg related berries + straw (Bîlteanu Gh., 1991).

Wheat is pretentious to fertilization due to particularities, namely: poorly developed root system, exploring a volume of soil on a low solubility depth and absorption of soil nutrients as well as the high need for fertilizers within a reduced interval (the flowering phase).

During the flowering wheat plants extract about 80% of the total amount of nitrogen and phosphorus as well as 85% of the total amount of potassium.

Of the technological factors, mineral fertilization is the main driving element of production and wheat quality management (Hera et al., 1971; Popescu et al., 1979).

The use of mineral fertilizers positively influences the quality indices and wheat production, by balancing the nutrients and in terms of optimal pedoclimatic conditions. Under normal water supply conditions, correct fertilization of wheat may increase protein content by 4-6% (Hera, 1979).

Quantities of mineral fertilizers to be used in the crop of winter wheat are imposed not only by climate and soil conditions, but also by the variety's ability to harness nutrients, his resistance to falling and diseases.

Production variations generated by the variation of climatic conditions can be reduced by practicing alternation of crops in the frame of the crop and a proper fertilization corresponding to the requirements of crops. (Sin Gh., Partal E., 2010)

The investigations carried out aimed to establish behavior of some winter wheat varieties created at NARDI Fundulea depending on some technological factors in Dobrogea pedoclimatic conditions.
Reduced production and poor harvest quality are often the result of poor quality technology but also insufficient fertilization or lack thereof failure to abstain and, last but not least, the use of inappropriate genotypes for the area where they are grown (Ceclan O.A. et al,.2015).

MATERIALS AND METHODS

Objectives of the researches carried out:
- checking the production potential of autumn wheat varieties lately created in Romania and choosing the most productive for Dobrogea;
-tracking the effect of different doses of mineral fertilizers on the productive potential of autumn wheat varieties.
The experience was placed on vermic chernozem from Agricultural Research and Development Station of Valu lui Traian, Constanta, according to the subdivided parcel method by two factors:
Factor A - Fertilization with 4 graduations:
- a_1 - N_0P_0;
- a_2 - $N_{80}P_{70}$;
- a_3 - $N_{120}P_{70}$
- a_4 - $N_{160}P_{70}$

Factor B - The winter wheat varieties:
- b_1 - Pitar; b_2 - Litera; b_3 - Voevod;
- b_4 - Pajura; b_5 - Otilia; b_6 - Miranda;
- b_7 – Izvor; b_8 - Glosa; b_9 - Boema

Production dates were calculated and interpreted according to the current statistical analysis of variance analysis.
The study of winter wheat varieties was done with the purpose to highlight the most appropriate in terms of production capacity, the constant of the productions from one year to the next, for their zoning in Dobrogea.
The pedoclimatic conditions in Dobrogea are relatively similar to those in the brown-red forest soil area of Fundulea, therefore the varieties tested have the origin of NARDI Fundulea.
A number of 9 winter wheat varieties have been tested, to determine the most suitable for expansion in Dobrogea agriculture. These winter wheat varieties tested are the result of the recombination of a very diverse germplasm.

RESULTS AND DISCUSSIONS

From recorded data at ARDS Valu lui Traian during 2012-2016 was observed that year 2012 was the driest, when was recorded a total rainfall of 394.9 mm with 43.7 mm below the annual average in 75 years.
The crop of winter wheat belongs to the category of those crop plants which maximizes the increasing levels of fertilization so that the allocation of 80 kg/ha active substance nitrogen together with 70 kg/ha active substance of P_2O_5 (Table 1) brings a very significant production increase, statistically insured, 1628 kg/ha (143%), the average of the nine wheat varieties tested.
Maintaining a constant phosphorus agricultural fund (70 kg/ha) in conjunction with the allocation of two more levels of nitrogen higher by 40 kg/ha a.s. N leads to substantial production increases.
The fact that at the last level of fertilization of 160 kg/ha a.s. N and 70 kg/ha a.s. P_2O_5 under non-irrigation conditions, production has no capping tendencies, leads to conclusion that the nine varieties of winter wheat could reap even higher levels of fertilization.
At the $N_{120}P_{70}$ fertilization dose, a very significant production increase is obtained of 2772 kg / ha (173%), statistically assured.
At the agricultural fund $N_{160}P_{70}$ is obtained the highest production increase of 3224 kg/ha (184%) very significant production increase.
Of note, is that from the unfertilized agricultural fund N_0P_0 (mt) to $N_{80}P_{70}$ there is an increase of 1628 kg/ha. It is reduced to 1144 kg/ha between $N_{80}P_{70}$ and $N_{120}P_{70}$ agricultural fund and at 452 kg/ha between $N_{120}P_{70}$ and $N_{160}P_{70}$ agricultural fund.
Concerning the specific application to fertilizer application of different levels of fertility (Table 2), we find that there are obvious genetic differences between the nine tested genotypes on the use of nitrogen and phosphorus fertilizers.

Table 1. Influence of different fertilization levels on average production of winter wheat grains (average of 9 varieties) at ARDS Valu lui Traian

No crt.	Agricultural fund / Varieties	Grains yield (kg/ha)									Average yield / agrof. (kg/ha)	Difference		Significance
		Pitar	Litera	Voevod	Pajura	Otilia	Miranda	Izvor	Glosa	Boema		(kg/ha)	%	
1.	N_0P_0	3749	3686	3150	3623	4431	3896	3980	4106	3759	3822	mt	100	
2.	$N_{80}P_{70}$	5334	5187	4473	5103	6353	5534	5702	5912	5418	5450	1628	143	xxx
3.	$N_{120}P_{70}$	6489	6363	5397	6185	7560	6731	6878	7172	6542	6594	2772	173	xxx
4.	$N_{160}P_{70}$	6689	6899	5828	6699	8190	7193	7350	7581	6941	7046	3224	184	xxx

DL 5 % = 30 kg/ha
DL 1 % = 50 kg/ha
DL 0,1% = 70 kg/ha

Table 2. Production results obtained at nine varieties of winter wheat on four levels of fertilization, at ARDS Valu lui Traian

No crt.	Agricultural fund Variety	Yield kg/ha				Average yield (kg/ha)	Difference (kg/ha)	Significance
		N_0P_0	$N_{80}P_{70}$	$N_{120}P_{70}$	$N_{160}P_{70}$			
1	Pitar	3749	5334	6489	6689	5565	mt	
2	Litera	3686	5187	6363	6899	5534	-32	
3	Voevod	3150	4473	5397	5828	4712	-853	000
4	Pajura	3623	5103	6185	6699	5403	-163	00
5	Otilia	4431	6353	7560	8190	6634	1068	Xxx
6	Miranda	3896	5534	6731	7193	5839	273	Xxx
7	Izvor	3980	5702	6878	7350	5978	412	Xxx
8	Glosa	4106	5912	7172	7581	6193	628	Xxx
9	Boema	3759	5418	6542	6941	5665	100	

DL 5 % = 100 kg/ha
DL 1 % = 130 kg/ha
DL 0,1 % = 160 kg/ha

From this point of view, Otilia variety best capitalizes on increasing nitrogen doses, making a increase (average of the three agricultural fund) of 1068 kg/ha against the Pitar control variety, very significant production increase. Along with Otilia variety, three other varieties- Miranda, Izvor, and Glosa makes very significant increases for the probability of 0,1% (Glosa-628 kg/ha; Izvor-412 kg/ha; Miranda-273 kg/ha). Boema variety achieves an increase of 100 kg/ha, an increase that falls within the limits of experimental error. Smaller productions than the Pitar control variety are obtained from varieties: Litera, Pajura and Voevod. Litera variety is overtaken by 32 kg/ha of the Pitar control variety, differences that fall within the limits of experimental errors. Pajura variety is exceeded by 163 kg/ha of the Pitar variety, significant distinct production difference. Voevod variety, compared to the Pitar variety, produces less with 853 kg/ha, very significant production difference from a statistical point of view. This interaction is specific to each genotype. In the absence of chemical fertilizers against the Pitar variety, taken as control (Table 3) the highest yields are obtained by Otilia varieties with 4431 kg/ha and Glosa with 4106 kg/ha (682 kg/ha and 357 kg/ha of very significant yields). Izvor variety produces a yield of 3980 kg/ha, with an increase of 231 kg/ha (significant increase in yield).

Table 3. Behaviour of the nine varieties of winter wheat on different agricultural funds, at ARDS Valu lui Traian

Agricultural fund	Varieties	Yield		Diff. by control	Significance
		absolute (kg/ha)	relative (%)		
N_0P_0	Pitar	3749	100	mt	
	Litera	3686	98	-63	
	Voevod	3150	84	-599	000
	Pajura	3623	97	-126	
	Otilia	4431	118	682	***
	Miranda	3896	104	147	
	Izvor	3980	106	231	*
	Glosa	4106	110	357	***
	Boema	3759	100	10	
$N_{80}P_{70}$	Pitar	5334	100	mt	
	Litera	5187	97	-147	
	Voevod	4473	84	-861	000
	Pajura	5103	96	-231	0
	Otilia	6353	119	1019	***
	Miranda	5534	104	200	*
	Izvor	5702	107	368	***
	Glosa	5912	111	578	***
	Boema	5418	102	84	
$N_{120}P_{70}$	Pitar	6489	100	mt	
	Litera	6363	98	-126	
	Voevod	5397	83	-1092	000
	Pajura	6185	95	-304	00
	Otilia	7560	117	1071	***
	Miranda	6731	104	242	*
	Izvor	6878	106	389	***
	Glosa	7172	111	683	***
	Boema	6542	101	53	
$N_{160}P_{70}$	Pitar	6689	100	mt	
	Litera	6899	103	210	*
	Voevod	5828	87	-861	000
	Pajura	6699	100	10	
	Otilia	8190	122	1501	***
	Miranda	7193	108	504	***
	Izvor	7350	110	661	***
	Glosa	7581	113	892	***
	Boema	6941	104	252	*

DL 5% = 190 kg/ha
DL 1% = 250 kg/ha
DL 0,1% = 330 kg/ha

Larger yield than control Pitar and Boema varieties, with 3759 kg/ha and Miranda, with 3896 kg/ha, but yield increases fall within the limits of experimental errors. Pitar variety, performs higher yield to Litera variety (3686 kg/ha) and Pajura (3623 kg/ha), but yield differences do not exceed the probability of 5%. A single variety, Voevod, achieves a yield decrease of 599 kg/ha compared to the control variety Pitar, very significant difference. On the $N_{80}P_{70}$, agricultural fund we find that Otilia and Glosa varieties make very significant yied increases compared to the Pitar control variety. Izvor variety, achieves an increase that this time increases in significance, significant (N_0P_0) to very significant ($N_{80}P_{70}$). Along with these, there significant increase in the yield of the Miranda variety (200 kg/ha). Voevod variety is also outdated in this agricultural fund, Pitar variety, with a very significant yied difference, variety that exceeds Pajura variety also, with 231 kg/ha, significant yield gap. The other varieties - Litera and Boema - produces negative and positive yield differences, but not statistically assumed. Constantly maintaining the phosphorus dose to 70 kg/ha and increasing the nitrogen dose by 40 kg/ha, does not bring significant changes in hierarchy of reaction of varieties to reaction of control variety. Except for Pajura variety, which is exceeded by 304 kg/ha (significant production difference), the other varieties make similar statistical differences, with those on the $N_{80}P_{70}$ agricultural fund. Supplementing the nitrogen dose by another 40 kg/ha (N_{160}) and maintaining the phosphorus dose to 70 kg/ha, contributes to the slight modification of the varieties reaction hierarchy compared to the control variety.

At this level of fertilization, four varieties achieve very significant yield increases, compared to the Pitar variety, namely: Miranda, with an increase of 504 kg/ha; Izvor with an increase of 661 kg/ha; Glosa with an increase of 892 kg/ha and Otilia with an increase of 1430 kg/ha.

Table 4. Winter wheat varieties behaviour on different agricultural funds, at ARDS Valu lui Traian

No. Crt.	Variety	Agricultural fund	Yield (kg/ha)	Difference (kg/ha)	Significance
1	Pitar	N_0P_0	3749	mt	
		$N_{80}P_{70}$	5334	1585	xxx
		$N_{120}P_{70}$	6489	2740	xxx
		$N_{160}P_{70}$	6689	2940	xxx
2	Litera	N_0P_0	3686	mt	
		$N_{80}P_{70}$	5187	1501	xxx
		$N_{120}P_{70}$	6363	2677	xxx
		$N_{160}P_{70}$	6899	3213	xxx
3	Voevod	N_0P_0	3150	mt	
		$N_{80}P_{70}$	4473	1323	xxx
		$N_{120}P_{70}$	5397	2247	xxx
		$N_{160}P_{70}$	5828	2678	xxx
4	Pajura	N_0P_0	3623	mt	
		$N_{80}P_{70}$	5103	1480	xxx
		$N_{120}P_{70}$	6185	2562	xxx
		$N_{160}P_{70}$	6699	3076	xxx
5	Otilia	N_0P_0	4431	Mt	
		$N_{80}P_{70}$	6353	1922	xxx
		$N_{120}P_{70}$	7560	3129	xxx
		$N_{160}P_{70}$	8190	3759	xxx
6	Miranda	N_0P_0	3896	Mt	
		$N_{80}P_{70}$	5534	1638	xxx
		$N_{120}P_{70}$	6731	2835	xxx
		$N_{160}P_{70}$	7193	3297	xxx
7	Izvor	N_0P_0	3980	Mt	
		$N_{80}P_{70}$	5702	1722	xxx
		$N_{120}P_{70}$	6878	2898	xxx
		$N_{160}P_{70}$	7350	3370	xxx
8	Glosa	N_0P_0	4106	mt	
		$N_{80}P_{70}$	5912	1806	xxx
		$N_{120}P_{70}$	7172	3066	xxx
		$N_{160}P_{70}$	7581	3475	xxx
9	Boema	N_0P_0	3759	mt	
		$N_{80}P_{70}$	5418	1659	xxx
		$N_{120}P_{70}$	6542	2783	xxx
		$N_{160}P_{70}$	6941	3182	xxx

DL 5 % = 180 kg/ha
DL 1 % = 240 kg/ha
DL 0,1 % = 320 kg/ha

At this level of fertilization, Litera and Boema varieties obtain significant yield increases, Pajura variety exceeds the yield of Pitar variety, with an increase of 10 kg/ha, not statistically assured. Voevod variety, as well as the other levels of fertilization, is overtaken by the Pitar variety, with a very significant yield difference. As for behavior of varieties at

increasing doses of chemical fertilizers (Table 4) have been found that the nine analyzed varieties obtain very significant yield increases. Thus, $N_{80}P_{70}$ agricultural fund performs against the N_0P_0 (control), the lowest yield of 1323 kg/ha to Voevod variety and the highest yied of 1922 kg/ha to Otilia variety. The same agricultural fund makes the following increases: 1480 kg/ha for Pajura variety; 1501 kg/ha for Litera variety; 1585 kg/ha to Pitar variety; 1659 kg/ha, Boema variety; 1722 kg/ha to Izvor variety and 1806 kg/ha to Glosa variety. At the next level of fertilization, $N_{120}P_{70}$, yield increases made against control N_0P_0 are between 2247 kg/ha to Voevod variety and 3129 kg/ha to Otilia variety. The growing order of contributions on this agricultural fund is: 2562 kg/ha for Pajura variety; 2677 kg/ha, for Litera variety; 2740 kg/ha, Pitar variety, 2783 kg/ha, Boema variety; 2835 kg/ha to Miranda variety and 3066 kg/ha to Glosa variety. At last level of fertilization $N_{160}P_{70}$, compared to the non-fertilized control variety there is a yield difference of 3076 kg/ha, to Pajura variety and 3759 kg/ha to Otilia variety. The following differences are observed for the other varieties analyzed: 2940 kg/ha to Pitar variety; 3076 kg/ha, for the Pajura variety; 3182 kg/ha to Boema variety; 3213 kg/ha, for Litera variety; 3297 kg/ha to Miranda variety; 3370 kg/ha for Izvor variety and 3475 kg/ha for Glosa variety.

CONCLUSIONS

Application of chemical fertilizers, especially those with nitrogen, has been shown to be the nutrient element which determines the largest yield increases.

Wheat efficiently harnesses chemical fertilizers, all tested varieties respond favourably to fertilization, through yield increases, thus there are differences between varieties related to the fertilization reaction.

Fertilizers with nitrogen must be accompanied by phosphorus and potassium, depending on the soil, the pre-emergence plant and the climatic conditions.

Phosphorus fertilizers contribute to increasing the effectiveness of applying nitrogen fertilizers.

The fractional application of nitrogen fertilizers ensures the supply of plants with this element throughout the vegetation period, giving the possibility of growing grain yields.

Growing in the same yield unit of several genetically diversified varieties, with different precocity periods and multiple varieties resistance, contributes to the continuous improvement of the yield potential, as well as to improving harvest stability.

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