RESEARCH ON THE INFLUENCE OF COMPLEX CHEMICAL FERTILIZERS ON WINTER WHEAT CROP

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Keywords: winter wheat, complex chemical fertilizers, nitrogen, phosphorus, potassium

ABSTRACT

Winter wheat cultivation is very important for the national economy. Obtaining large and very good quality crops is a mandatory condition for feeding the population and the economic activity of farmers. The application of complex chemical fertilizers leads to maintaining high yields for wheat. This paper presents the results of a research carried out at a private farm in Bailesti, Dolj County, where the effect of different doses of complex chemical fertilizers applied in autumn and spring to wheat cultivation was investigated. The best results were given by a rate that included 120 kg of nitrogen, 80 kg of phosphorus and 40 kg of potassium per hectare. This rate gave a production of over 6000 kg per hectare.

INTRODUCTION

Wheat is one of the most important food plants grown in over 45 countries, feeding 35-40% of the world's population. The main utility is the baking of bread and various products made from flour. Bread is the staple food for most of the world's population. No food satisfies the requirements of the human body as completely and economically as wheat bread. The most complete and perfect food is bread, which is obtained from wheat flour.

Ensuring food products in conditions appropriate to food safety and security depends on two essential factors: the cultivation of plant species with high nutritional value and the use of chemical fertilizers. Among plant species, cereals, and within them, wheat is the most important food for man. Thus, wheat, rice and corn provide 50% of the necessary protein, 70% of the necessary carbohydrates and 15% of lipids, i.e. 50-55% of the calories consumed worldwide (Nicolescu M., 2005). The use of fertilizers is a major factor in increasing production of autumn cereals and especially wheat.

Wheat grain is rich in starch, protein, mineral salts and vitamins all elements with an important bioenergetical role for the human body. The favorable ratio between carbohydrates and proteins is suitable for the food ration, giving the possibility of consuming large quantities of bakery and pastry products.

Wheat bread is tasty nutritious and easily digestible, being superior to rye, barley or triticale and is the staple food for over 40% of the world's population. Thus, 1 kg of white bread contains: 93 g of protein and 522 g of carbohydrates, exceeding the carbohydrate requirements of the ration.

From wheat flour are also obtained: pasta and pastries, and in industry wheat is used for starch, dextrin, glucose and alcohol. In many countries, wheat is also used in animal feed, with the following advantages over corn:

- is richer in protein substances with a higher nutritional value than corn due to the balance between amino acids and due to the absence of zein;
- higher vitamin content;
- wheat production is comparable to that of maize;
- the cost of wheat cultivation is lower than that of corn cultivation, being a completely mechanizable crop;
- under irrigation conditions, the second crop can be obtained after wheat;
- due to the resistance to less favorable environmental factors, the cultivation area of wheat is larger than that of corn;
- harvesting early is a good precursor for other crops allowing timely

work and application of organic fertilizers and amendments where the accumulation of water and nitrates is necessary;

- the fasciculate root system ensures a good protection against soil erosion.

The problem of using nitrogen and phosphorus fertilizers in wheat cultivation is imposed on all soils in our country, taking into account the state of soil supply with nutrients. The level of production obtained without the application of fertilizers is, as a rule, low and does not cover, in many cases, the expenses incurred with the location and maintenance of this crop. It is believed that in the last 5 decades, the increase in the use of fertilizers has been the engine that has led to record increases in the world's food production. The generation of farmers who worked in 1950 was the first in history to double food production. Since 1984, population growth has taken place before the increase in per capita grain production, with an unprecedented value of 40%. But when fertilizer use began to decline, in the late 1980s, food growth also declined (Dumitru, 2010).

Chemical fertilizers can help double or even triple the production of straw cereals. In many cases, for more or less objective reasons, no fertilizer is applied, which leads to low yields and unsatisfactory economic results. The increases obtained from the application of one kg of active fertilizer are, on average, 10-15 kg of grains, which can exceed 25 kg of grains, under certain conditions. Given that one kg of fertilizer (including application) costs about 4 kg of grain, it is clear the high economic efficiency of applying fertilizers to winter wheat crops.

Therefore, today, more than ever, the fertilization of winter wheat, but also of other crops, must be done rationally, scientifically, with the lowest possible costs, so as to obtain high yields and a considerable profit.

MATERIAL AND METHOD

The research was carried out at a private farm in Bailesti, Dolj County, on a chernozem soil type, where a bifactorial experiment with wheat after corn was placed, with the following factors and their gradations:

- factor A - NP doses: a1 = N0P0; a2 = N80P0; a3 = N80P80; a4 = N160P80;

- factor B - doses of potassium: b1 = K0; b2 = K40; b3 = K80; b4 = K120;

The placement method was the randomized block method, with 4 repetitions. The cultivated variety was Gruia, which is a variety with a semi-straight straw. The grain is red, MMB = 40-43 g, MH = 77-78 kg/hl. It is a semi-late variety, with a medium resistance to winter conditions and a good resistance to fall, drought and heat. It is semi-sensitive to powdery mildew, medium resistant to leaf blight. It is superior to many varieties in terms of resistance to powdery mildew, brown rust and leaf septoria. The baking quality of the Gruia variety is close to that of the Dropia variety, compared to which it tends to have more tenacious gluten. It has a high productivity, on average, 9-12% higher than the control varieties, the increase in production being higher in drought conditions, obtaining yields of 5,205 kg/ha in Transylvania and 5845 kg/ha in Moldova .

Despite its short size (66-86 cm), the variety behaves very well in conditions of water deficit, the drought rating being 3.3. The growth rate is 1.4-2.0 and as of the date of ear formation, it is 2-4 days earlier than that of Dropia. Phosphorus and potassium fertilizers were applied in autumn, in the form of complex fertilizers and the resulting nitrogen difference of nitrogen was applied in spring.

For the statistical processing, the method of analysis of variance in bifactorial experiments was used.

RESULTS AND DISCUSSIONS

The results obtained in 2019 highlighted the fact that the application of chemical fertilizers is a very important measure in increasing wheat production. However, too high doses do not increase production as expenses are incurred.

Table 1.

The influence of factor A (NP levels) on wheat production (q/ha), after maize, in 2019

Factors	Treatments	Yield (q/ha)	Difference	Significance
a2-a1	N80P0-N0P0	48.0-19.9	28.1	***
a3-a1	N80P80-N0P0	54.9-19.9	35.0	***
a4-a1	N160P80-N0P0	60.3-19.9	40.4	***
a3-a2	N80P80-N80P0	54.9-48.0	6.9	***
a4-a2	N160P80-N80P0	60.3-48.0	12.3	***
a4-a3	N160P80-N80P80	60.3-54.9	5.4	**

DL 5%=2.2 q/ha; DL 1%=3.2 q/ha; DL 0.1%=4.6 q/ha

It can be seen that the doses of fertilizers applied have contributed to the increase of wheat production to a large extent, amid the impoverishment of the soil in nutrients due to their consumption by the preceding plant (corn), which is emphasized in other works (Munson RD, 1985; Borlan Z. 2003).

Thus, the production increases 2.5 times when N80 is applied, reaching from 17.4 q / ha to 43.5 q / ha. The dose of N80 on a background of 40-120 kg of potassium per hectare contributes to the increase of production by 4.4 - 7.6 q / ha, respectively, 26.3-44.6%.

The application of nitrogen fertilizers on a P80 background contributes to the increase of production (compared to N80) by 8.8 q / ha and the application of N80P80 on different doses of potassium (40, 80, 120 kg / ha) brings a yield increase of 1.6-4.9 q / ha, therefore, lower production increases of 5.1-28.1%.

The high dose of nitrogen, of N160, on the background of P80 increases the production by 41.5 q / ha compared to unfertilized (NO0K0), by 15.4 q / ha compared to N80P0K0 and by 6.6 q / ha compared to N80P80. At this dose, the high doses of potassium, of 80 and 120 kg / ha are not justified because at N160P80K40 the production obtained is 60.6 and at N160P80K120 it is 60.8 q / ha.

The highest level of production is obtained after fertilization with N160P80K80 (60.9 q / ha) but very close yields are also obtained with the dose of N80P80K80 (56.2 q / ha) and which, probably, as will be seen from economic efficiency, they are less expensive.

a) The influence of factor A (NP levels) is shown in table 1

The analysis of the data contained in this table reveals the following aspects:

- the production is influenced only by the nitrogen dose: at N80 a production of 28.1 q / ha is obtained, being very significant;
- the minimum dose of nitrogen and phosphorus, of N80P80 contributes to the increase of the production by 35.0 q / ha, also, very significant;
- high dose of nitrogen and moderate dose of phosphorus, N160P80 gave the highest increase in production, of 40.4 q / ha, very significant;
- the difference between the average factor a4 and a3, respectively, an increase of 80 kg N / ha gives a small increase of 5.4q / ha.

Table 2.

The influence of factor B (K levels) on wheat production (q/ha), after maize, in 2019

FACTORS	TREATMENTS	YIELD (Q/HA)	DIFFERENCE	SIGNIFICANCE
b2-b1	K40-K0	45.2-43.0	2.2	*
b3-b1	K80-K0	46.9-43.0	3.9	***
b4-b1	K120-K0	47.9-43.0	4.9	***
b3-b2	K80-K40	46.9-45.2	1.7	-
b4-b2	K120-K40	47.9-45.2	2.7	*
b4-b3	K120-K80	47.9-46.9	1.0	-

b) The influence of factor B (potassium levels)

The doses of K40, K80 and K120 lead to lower harvest increases, respectively, of 2.2 - 4.9 q / ha and the differences between them are also reduced, of 1.0-2.7 q / ha. ha (k120-K40), which indicates that the application of potassium fertilizers does not lead to significant crop increases in wheat cultivation (Table 2).

Table 3.

Wheat production after corn in 2019, depending on the interaction of the researched factors

A Factor	B Factor	Treatment	Yield q/ha	Relative yield %	Diff. q/ha	Significance
a1 (N0P0)	b1(K0)	N0P0K0	17.4	100.0	Mt.	
	b2(K40)	N0P0K40	18.5	106.3	1.1	-
	b3(K80)	N0P0K80	21.1	121.3	3.7	*
	b4(K120)	N0P0K120	22.6	129.9	5.2	**
a2 (N80P0)	b1(K0)	N80P0 K0	43.5	249.0	26.1	***
	b2(K40)	N80P0 K40	47.9	275.3	30.5	***
	b3(K80)	N80P0 K80	49.6	285.0	32.2	***
	b4(K120)	N80P0 K120	51.1	293.6	33.7	***
a3 (N80P80)	b1(K0)	N80P80 K0	52.3	300.6	34.9	***
	b2(K40)	N80P80 K40	53.9	305.7	36.5	***
	b3(K80)	N80P80 K80	56.2	323.0	38.8	***
	b4(K120)	N80P80 K120	57.2	328.7	39.8	***
a4 (N160P80)	b1(K0)	N160P80 K0	58.9	338.5	41.5	***
	b2(K40)	N160P80 K40	60.6	348.3	43.2	***
	b3(K80)	N160P80 K80	60.9	350.0	43.5	***
	b4(K120)	N160P80 K120	60.8	349.9	43.4	***

DL 5%=3.4 q/ha; DL 1%=4.6 q/ha; DL 0.1%=6.1 q/ha

c) Influence of AxB factor interaction (NP levels x K levels)

The nitrogen-phosphorus interaction proves to be beneficial at the dose of N160P80, when it gives an increase in production of 41.5 q / ha, compared to unfertilized (NO0O0).

The nitrogen-phosphorus interaction (N160P80), compared to the single application of nitrogen, n80, gives a production increase of 15.4 q / ha, while compared to the NP interaction at the dose of N80P80, it gives a production increase of only 6 , 6 q / ha. The nitrogen - potassium interaction (N80K40) gives a production increase of 29.4 q / ha, compared to N0P0K40, as well as the nitrogen - phosphorus - potassium interaction (N80P80K40 compared to N0P0K0), which also gives a production increase of 35, 4 q / ha. The best interaction between the two factors, A and B, is found to be at the dose of N160P80K40, which gives a production increase of 42.1 q / ha. The same result is obtained with N160P80K120 but the

dose is higher and probably uneconomical. It can therefore be found that the interactions that give the highest production increases are N160P80K0 (41.5 q / ha), N80P80K40 (35.4 q / ha) and N160P80K120 (38.2 q / ha).

CONCLUSIONS

The wheat yields obtained directly reflect the effect that the doses of fertilizers used had. Thus, when not fertilized, the production is 19 q / ha. The use of nitrogen alone, N40 or N160 has the effect of obtaining yields of 33.6 q / ha and 46.6 q / ha, respectively, yields increasing 2.42 times. The use of different doses of nitrogen on the background of P40 has the effect of obtaining yields of 43.7 - 59.6 q / ha, yields that are 1.4 - 3.3 times higher than unfertilized and on the background of P80 the yields reach values of 49.5 - 66.2 q / ha, between P80N120 and P80N160 there are no differences in production. The use of different nitrogen levels on the background of P120 results in yields of 56.1-69.3 q / ha higher even than when using P120N160, but very close to P120N120. At the maximum dose of phosphorus experienced, P160, different nitrogen levels increased production to 70.7 q / ha. Therefore, those obtained by using the following fertilizer doses can be considered as high and efficient yields: P80N120 (66.2 q / ha), P120N120 (66.6 q / ha) and P120N160 (69.3 q / ha).

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