PRELIMINARY RESEARCH ON THE IMPACT OF FERTILISATION SYSTEM ON WINTER WHEAT IN THE CONDITIONS OF THE DIDACTIC STATION IN TIMISOARA

CERCETARI PRELIMINARE PRIVIND INFLUENȚA SISTEMULUI DE FERTILIZARE LA CULTURA DE GRÂU DE TOAMNĂ ÎN CONDIȚIILE DE LA STAȚIUNEA DIDACTICĂ TIMIŞOARA

F. SALA, ISIDORA RADULOV, F. CRISTA, A. ŐKRŐS, ADINA BERBECEA

Agricultural and Veterinary University of the Banat, Timişoara, Romania

Abstract: *The purpose of this research was to test the apport of mineral fertilizer on sustaining the quality and quantity of wheat yield. In conditions when are realized new wheat types with differentent production capacities, new fertilizer sortiments, new technologies, on a economical and pedo-climatic changing environment it impose to test and found new fertilization solutions. For reaching of objectives the research we organized experiences in field, in whose from are tested the influence of some classical mineral fertilizer and foliage fertilizer upon yield quality at wheat. The result of research was favorable and offers multiple solutions for comparable results.*

Rezumat: *Scopul studiilor şi cercetărilor a fost de a testa aportul îngrăşămintelor minerale la susţinerea cantitativă şi calitatică a producţiei la cultura de grâu. În condiţiile în care sunt realizate noi soiuri cu potenţial diferit de producţie, noi sortimente de îngrăşăminte, noi tehnologii agricole, pe fondul condiţiilor economice şi pedo-climaterice în schimbare, se impune testarea şi găsirea de noi soluţii de fertilizare. Pentru realizarea obiectivelor de cercetare, am organizat experienţe de câmp în cadrul cărora s-a testat influenţa unor îngrăşăminte minerale clasice şi foliare asupra producţiei şi calităţii acesteia la cultura de grâu de toamnă. Rezultatele cercetărilor sunt favorabile şi oferă multiple soluţii pentru rezultate comparabile.*

Key words*: soil fertility, mineral fertilisers, fertilizer systems, wheat crop*
Cuvinte cheie*: fertilitatea solului, ingrăşăminte minerale, sisteme de fertilizare, cultura de grâu*

INTRODUCTION

The belief of numerous scientists is that reasonably applying fertilisers plays an essential and determining role in the quantitative increase of vegetal production, i.e. of food, but their efficient use is only possible if we know well soil features – as a nutrition medium for plants, crop nutritious requirements, and the interaction of fertilisers with soils and plants (HERA, 2002) (6,7). At present, they are studying methods of applying fertilisers for the efficient increase of the coefficient of valorising nutrients, as well as new assortments of chemical fertilisers applied on the soil and on the leaves that ensure plant requirements in conditions of food quality improvement, food source supply, and environmental protection (1,3,4,5).

In this paper, we present partial results concerning the impact of different fertiliser assortments on production and quality in winter wheat in order to improve the fertilisation system.

MATERIAL AND METHOD

The research we carried out consisted of the testing of the impact of different assortments of simple (urea), complex (NPK 15:15:15), and foliar (Bionat plus, Fertitel, and Cropmax) mineral fertilisers in different doses and combinations.

Fertilisers were applied according to the setting scheme of the field, on pre-established trial variants. Applying granulated mineral fertilisers was done manually by evenly spreading over the trial variants, and application of foliar fertilisers was done by treating the plants with portable pumps.

The biological material was represented by the Alex wheat cultivar, a cultivar adapted to the Western part of the country, and having a high yielding potential.

Research was carried out within the Didactic Station in Timişoara, on the plot A 363, whose topographic coordinates are: N 45° 28 □ 30.9 □, E 21° 7 □ 9.8 □. The land in the respective plot is plane, the soil is a cambic phaeosiom, representative for the area and favourable to wheat cultivation.

RESULTS AND DISCUSSION

The agricultural year 2006-2007 was characterised by a slightly deficitary precipitation regime, i.e. 554.4 mm compared to the multiannual mean for the region 600.4 mm, according to the data from the Meteorological Station in Timişoara (Table 1). The deficit is relatively evenly distributed on the two decades, the first decade with a minus of 20.2 mm, and the second decade with a deficit of 25.8 mm.

Table 1

Climate features of the agricultural year 2006-2007 (Meteorological Station in Timişoara)

	X	XI	XII	I	II	III	Decade I	IV	V	VI	VII	VIII	IX	Decade II	*Mean*/ Total
Multiannual mean temperature	12.8	6.0	1.0	-1.5	0.6	5.7	4.1	11.3	16.3	19.4	21.5	20.8	16.8	17.7	*10.9*
Temperature 2006/2007	22	6	2	4	6	9	8.16	13	18.3	22.5	24.1	23	14.9	19.3	*13.73*
Multiannual mean precipitations	47.8	52.9	49.0	40.0	38.8	36.0	264.5	47.2	64.9	73.5	58.4	50.3	41.5	335.8	600.3
Precipitations 2006/2007	17	31	21	26	92	57	244	4	68	65	46.4	65	62	310.4	554.4

Meteorological conditions were, in general, favourable to wheat cultivation, thermal values and precipitation volume ranging within the limits of multiannual means. A precipitation deficit was recorded in April – much below the multiannual mean level (total precipitations 4 mm) which, associated with high temperatures for the period and with the movement of the air masses led to a diminution of the soil moisture with impact on plant growth. Later precipitations ensured vegetation in good conditions.

Fig. 1. Soil profile in the trial field.

Soil in the trial field can be characterised as a medium texture soil, with low acid-neutral reaction (*p*H = 6.7-7.2), good humus supply (H = 3.2-4%), nitrogen index IN = 3.09, high base saturation degree (above 85-87%), low mobile phosphorus supply (P_{AL} = 23.1 ppm), and medium potassium supply (K = 142-145 ppm). Soil profile is presented in Figure 1.

In the presented trial conditions, fertilisers applied within trial variants were valorised by the wheat crop through crops differentiated both quantitatively and qualitatively as shown in Table 2 and in Figure 2.

Table 2
Level of winter wheat yield in the *Alex* cultivar under the impact of the fertilisation system (2007)

	Trial variants		Yield level (kg/ha)	Relative values (%)	Differences (kg)	Signifi-cance
P0 K0	N0	Mt	1982.00	100.00	-	
	N50	V1	2521.50	127.22	539.50	
	N100	V2	2881.25	145.37	899.25	*
	N150	V3	3161.25	159.50	1179.25	***
	N200	V4	3392.50	171.17	1410.50	***
P50 K50	N100	V5	3301.00	166.55	1319.00	***
	N150	V6	3708.75	187.12	1726.75	***
	N200	V7	4145.00	209.13	2163.00	***
P100 K100	N100	V8	4024.25	203.04	2042.25	***
	N150	V9	4410.00	222.50	2428.00	***
	N200	V10	4563.75	230.26	2581.75	***
P150 K150	N100	V11	4585.00	231.33	2603.00	***
	N150	V12	5150.00	259.84	3168.00	***
	N200	V13	5233.75	264.06	3251.75	***
Foliar fertilisers	Bionat 3l/ha	V14	4208.75	212.35	2226.75	***
	Bionat 2x2 l/ha	V15	4312.50	217.58	2330.50	***
	NPK 75 kg as/ha + Bionat 2x2	V16	4620.00	233.10	2638.00	***
	NPK 75 kg as/ha + Fertitel 2x	V17	4373.25	220.65	2391.25	***
	Cropmax 2 l/ha 2x2	V18	4645.00	234.36	2663.00	***

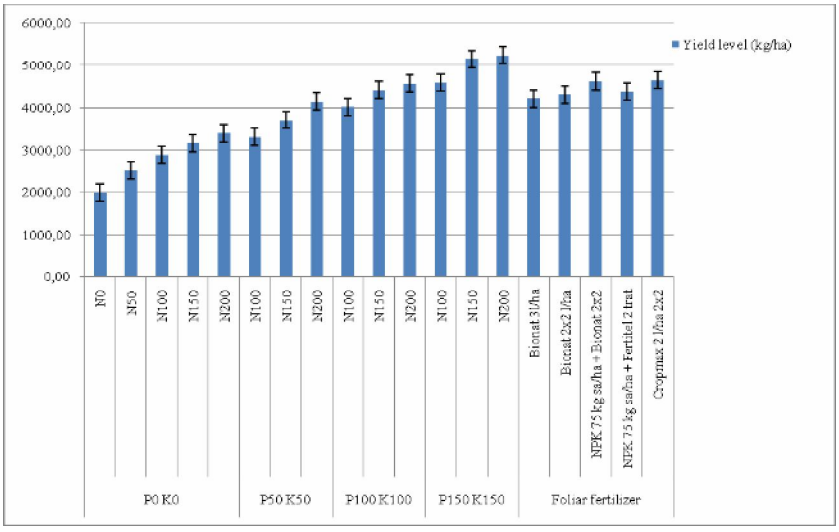

Fig. 2. Diagram of the level of winter wheat yield in the *Alex* cultivar under the impact of the fertilisation system (2007).

Compared to the control, where yield reached 1982.00 kg/ha, there were statistically ensured yield increases in all the other fertilized variants. In the case of the variant unilaterally fertilised with nitrogen, there were yield increases between 539.50 kg/ha for 50 kg a.s. N/ha and 1410.50 kg/ha for 200 kg a.s. N/ha.

Applying nitrogen, phosphorus, and potassium fertilisers in different doses and ratios, led to much more important yield increases as a result of the synergic effect of fertiliser valorisation. Thus, we obtained yields between 3301.00 kg/ha and 5233.75 kg/ha, with yield increases between 1319.00 kg/ha in the trial variant $N_{100}P_{50}K_{50}$ and 3251.75 kg/ha in the variant $N_{200}P_{150}K_{150}$, compared to the control variant.

Analysing the independent participation to the yield increase of nitrogen fertilisers applied in three doses (N_{100}, N_{150} and N_{200}) on the three phosphorus and potassium agri-funds (Figure 3), we can notice ensured yield increases.

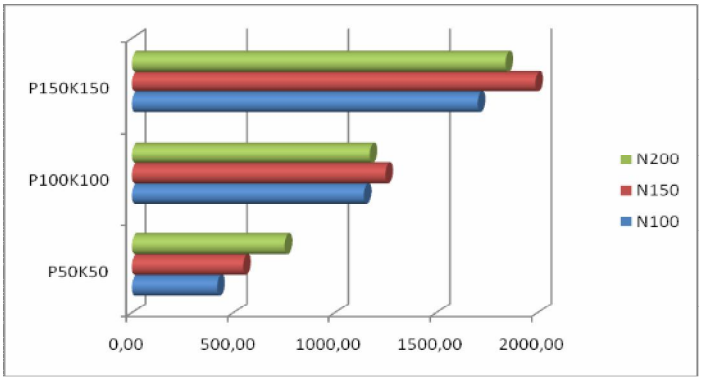

Fig. 3. Ensured yield increase with nitrogen fertilisers on phosphorus and potassium agri-funds in the *Alex* winter wheat cultivar (2007).

Phosphorus and potassium fertilisers lead to variable yield increases in relation to nitrogen doses (Figure 4).

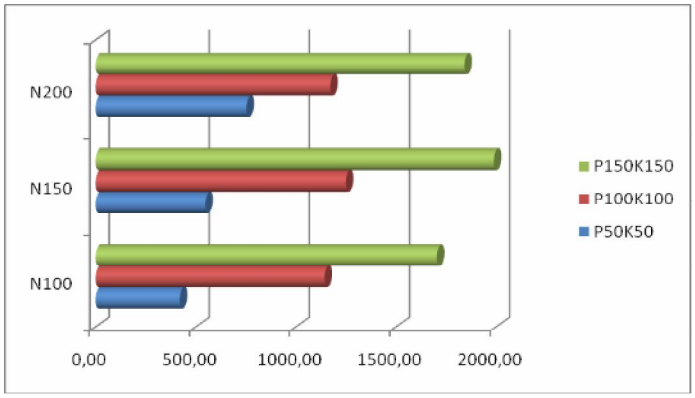

Fig. 4. Ensured yield increase with phosphorus and potassium fertilisers in relation to nitrogen in the *Alex* winter wheat cultivar (2007).

The use of foliar fertilisers (Bionat plus, Fertitel, and Cropmax) alone or associated with complex fertilisers ensure yields between 4208.75 kg/ha (Bionat plus 3 l/ha) and 4645.00 kg/ha (Cropmax). Yield increases compared to the control are between 2226.75 kg/ha and 2663.00 kg/ha.

The fertilisation variants that ensured in the trial conditions of the year 2007 some of the highest yields can be considered as follows: $N_{200}P_{150}K_{150}$, $N_{200}P_{150}K_{150}$, followed by Bionat plus 2 l/ha on an agri-fund of NPK 75 k a.s./ha, Cropmax 2 l/ha (Figure 5).

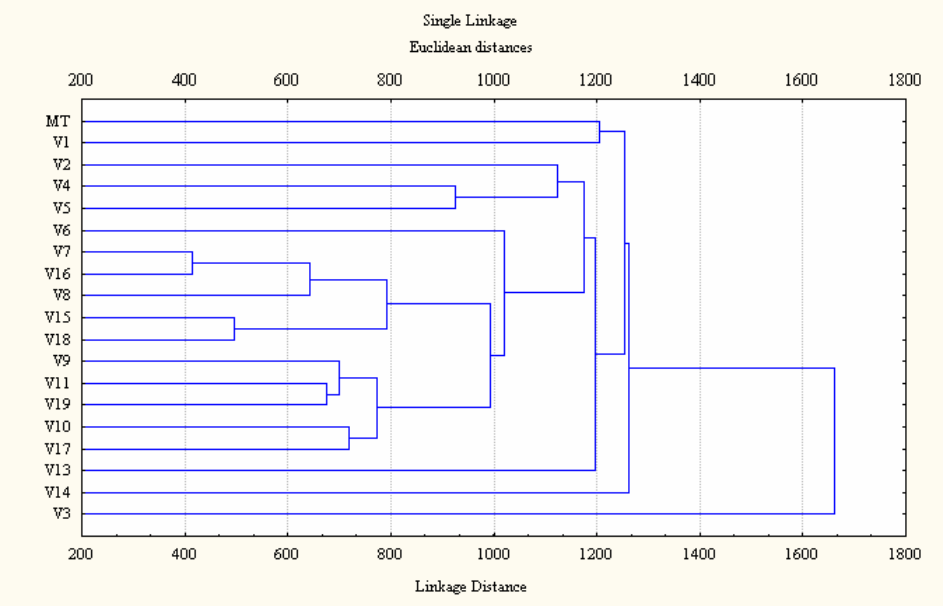

Fig. 5. The graphical representation of cases.

Analysing yield quality through the prism of moist and dry gluten content, we can see the favourable impact of fertilisation on this quality index compared to the control variant. Moist gluten content oscillated between 16.58 in the control variant, and 28.74 in the variant fertilised with Bionat plus while dry gluten content was between 7.55 in the control variant, and 14.90 in the variant $N_{100}P_{100}K_{100}$ (Figure 6).

CONCLUSIONS

In our research, we tested several types of fertilisers in different doses and combinations to catch the way they impacted winter wheat yields.

Yields oscillated between 1982.00 kg/ha in the control variant, and 5233.75 kg/ha in the $N_{200}P_{150}K_{150}$ kg a.s./ha variant. The yield increase oscillated between 539.50 kg/ha in the $N_{50}P_0K_0$ variant, and 3251.75 kg/ha in the $N_{200}P_{150}K_{150}$ variant.

Yield quality from the point of view of gluten content was also favourably impacted by the fertilisation applied, the highest dry gluten content being between 7.55 in the control variant, and 14.90 in the $N_{100}P_{100}K_{100}$ variant.

Results show the different fertiliser supplies, close yields being obtained through different fertilisation variants. Thus, there were comparable results in the following variants:

$N_{200}P_{150}K_{150}$ and $N_{150}P_{150}K_{150}$ with the best yields; Cropmax 2x2 l/ha with Bionat 2x2 l/ha + NPK 75 kg/ha; $N_{200}P_{100}K_{100}$ with $N_{100}P_{150}K_{150}$.

Trial data we obtained offer multiple solutions for comparable results, quantitatively and qualitatively, which represents different possibilities for practical application.

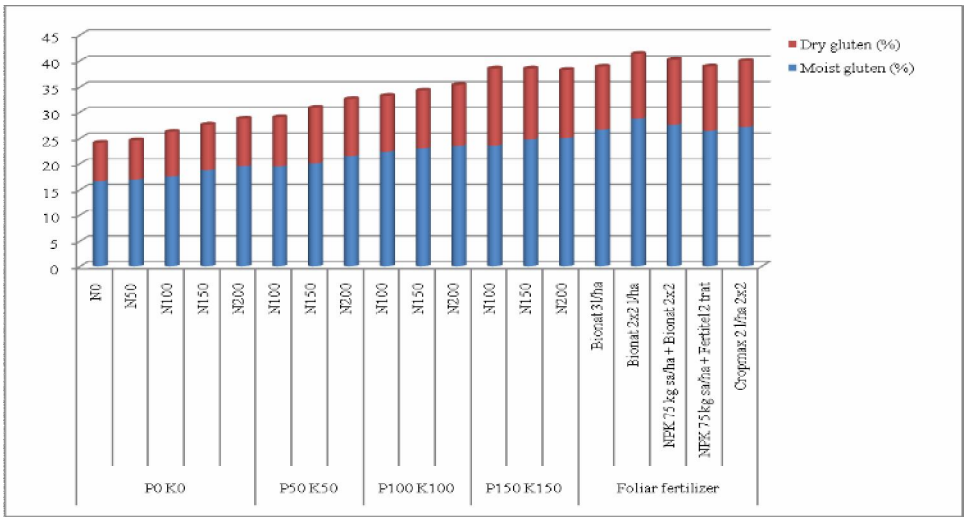

Fig. 6. Wheat yield quality under the impact of fertiliser doses from the point of view of gluten content (2007).

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