CONSIDERATIONS REGARDING AN ECONOMIC APPROACH ON WHEAT CROPS CULTIVATED FOLLOWING CORN CROPS ON A REPRESENTATIVE SOIL IN ROMANIA

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Abstract. Promoting during the last decades of sustainable agriculture and sustainable concepts entails the application of the principles that lead to productive agricultural technologies, technically and economically efficient solutions with effective protection of the environment and consumers that ensure not only productivity but also real optimization of production, social and environmental components and causes a new quality of life. In this study was tracked the effect of the nitrogen-phosphorous interaction in achieving wheat productions. The research presents the stated results as annual (partial) values and it will continue with them as being reference values for further experimental years (as stages in long term experiments) and with approaches that will economically substantiate the suggested solutions.

Keywords: wheat crops, economic optimization, fertilization systems, nitrogen-phosphorous interaction, productions.

INTRODUCTION

In the context of the optimization of soil-plant system, an important scientific and practical role is played by the agrochemical optimization alternatives that harmonize the fertilizing components of the soil with the demands of the vegetal species that can exploit better the production capacity of the soil and genotypes cultivated in order to obtain high vegetal productions that are consumable in large quantities, having superior quality indices, in terms of maintaining an equilibrium in the environment and determining food safety and security (Rusu et al., 2005).

The production data are obtained from such experiments, framed in the "long term experiments system" from ASAS-ICDCPT Fundulea network, which hold objectives that target both the effect and efficiency of differentiated fertilizations on productions and also the impact of fertilizers on the soil fertility evolution, on the quality of the productions obtained (Poruţiu et al., 2013).

Optimizing agrochemical soil-plant system represents meeting the essential objective in a higher degree and the crops requirements to soil reaction and representation of elements and nutrients in specific concentrations and ratios between them (Borlan and Hera, 1984).

Economic approaches dedicated to ensure real management of fertilizing resources on agricultural crops (wheat) are considering going through stages of scientific evidence on the economic efficiency of fertilizer application and then developing a substantiation framework for the optimization of fertilization. These approaches involve defining the concepts and objectives of establishing relevant indicators expressing fertilization efficiency and optimization in order to disseminate the results obtained in the delimitation of differentiated fertilization systems (Otiman, 1979; Otiman, 1987; Toader et al., 2013).

MATERIALS AND METHODS

The experimental approaches were performed under SCDA Turda conditions, using the experimental protocol of long term experiences, first located in the agricultural year 1966/1967, for wheat-corn-soy rotation (Haş, 2006). Dumbrava wheat variety has the following biological, agronomical and productive characteristics: plants height - 85-95 cm, exhibit a white, 9-11 cm long ear. The grain is medium-sized, oval and red. One thousand grain weight (MMB) is quite high, within 45-50 g, the hectoliter mass (MH) of 75-80 kg/hl.

The field experience which underpins the achievement of objectives is a bi-factorial structure that tracks the effect of the NP interaction on wheat:

o A factor - phosphorus doses (kg P_2O_5/ha): 0; 40; 80; 120; 160, with annual application to wheat;

o B factor - nitrogen doses (kg N/ha): 0; 50; 100; 150; 200, with annual application to wheat after corn;

Soil from the nutrient experiences: according to soil mapping, pedological and agrochemical study and from the soil quality monitoring results, this soil fits the argic chernozem type, in the pedological class of cernisoils. Fertilizer used in the experiments: complex fertilizer 20-20-0 is a solid, granulated nitrophosphate, which holds when applied, the effect of the interaction of the two elements from its composition (N·P), here in balanced concentrations and reports (1:1:0) (Hera, 2008). When harvesting the wheat, production results were collected and for these the absolute increases due to phosphorus application as a fertilizer were calculated. The processing and interpretation of the data was conducted using the production curves according to polynomial models and they were graphically represented in this study. When harvesting the corn, production results were collected and for these the absolute increases due to phosphorus application as a fertilizer were calculated.

The processing and interpretation of the data was conducted using the production curves according to polynomial models and they were graphically represented in this study.

The economic indicators tracked and studied were economic efficiency indicators:

- Production increase per surface unit (ha) (ΔQ);
- Value of the production increase per surface unit (ha) (V_S);
- Additional costs per surface unit (ha) (Cs);
- The value of the production increase per 1 leu of additional costs (V_S/1 leu Cs);

RESULTS AND DISCUSSIONS

The complex application of the NP combinations exhibits multiple possibilities of obtaining productions of 5.5 - 7 t grains/ha for wheat grown after corn, at 100 – 200 kg N/ha and 40 – 160 kg P/ha insured at the same time and productions of 5 – 6,5 t grains/ha for wheat grown after soy, at 80 – 160 kg N/ha and 40 – 160 kg P/ha.

Wheat production results in the experimental year 2013 allow a synthesis of their analysis regarding some production effective approaches through differential fertilizing systems based on the NP complex effect, a high priority and often used technology (Table 1, 2).

Table 1

Summary indicators of fertilizer applied to wheat crop (Variety Dumbrava)

Year	Cultura/Crop	Maximum production obtained (kg/ha)	NP Dose	Significance of factors influence x)
2011	Wheat grown following corn	5533,33	N150P80	NP - f. d. s.; N - f. d. s.; P - n. s.
2013	Wheat grown following corn	6945,33	N150P120	NP - f. d. s.; N - f. d. s.; P - d. s.
Mean	Wheat grown following corn	6391,60	N150P106	

x) f. d. s. - very distinctly significant; d. s. - distinctly significant; s. - significant; n. s. – insignificant

Table 2

Report on production and maximum increases to the content of active substance/hectare (N+P)

Year	Crop	Maximum production	NP Dose	Dose sum N+P	/ Production/NP dose	Prod. Dif. (M)/NP dose
2011	Wheat after corn	5533,33	N150P80	230	24	9,6
2013	Wheat after corn	6945,33	N150P120	270	26	16,8
Mean	Wheat after corn	6391,60	N150P106	256	25	10,1

For wheat crops efficiency indicators calculated for 2011 and 2013 show levels that prove a higher efficiency of the NP doses (Table 3, 4).

Table 3

Economic efficiency indicators for wheat grown after corn in 2011(Vs; Cs; Vs/1 leu Cs) (lei)

N	Economic efficiency indicators	P →	0	40	80	120	160	Mean
0	Vs	–	–	–	–	–	–	–
	Cs							
	Vs/1 leu							
50	Vs		900	1766	1700	1300	1433	1420
	Cs		644	943	1100	1752	1390	1166
	Vs/1 leu		1.39	1.87	1.54	0.74	1.02	1.31
100	Vs		1500	3100	3000	2700	3033	2667
	Cs		920	1235	1424	1571	1759	1382
	Vs/1 leu		1.63	2.51	2.1	1.71	1.72	1.93
150	Vs		1800	2366	3233	2700	3133	2646
	Cs		1158	1414	1660	1801	2034	1613
	Vs/1 leu		1.65	1.67	1.94	1.49	1.54	1.66
200	Vs		2166	3000	2700	2166	2933	2593
	Cs		1402	1663	1844	1987	2252	1829
	Vs/1 leu		1.72	1.8	1.46	1.09	1.3	1.47
Media/ Mean	Vs		1592	2558	2658	2217	2633	2332
	Cs		1031	1314	1507	1778	1859	1498
	Vs/1 leu		1.6	1.96	1.76	1.26	1.39	1.59

Table 4

Economic efficiency indicators for wheat grown after corn in 2013 (Vs; Cs; Vs/1 leu Cs) (lei)

N	Economic efficiency indicators	P →	0	40	80	120	160	Mean
0	Vs	–	–	–	–	–	–	–
	Cs							
	Vs/1 leu							
50	Vs		1053	1373	1368	1231	1368	1279
	Cs		703	840	1111	1244	1416	1063
	Vs/1 leu		1.49	1.63	1.23	0.99	0,97	1.26
100	Vs		1794	2268	2587	2448	2408	2301
	Cs		967	1224	1444	1605	1762	1400
	Vs/1 leu		1.85	1.85	1.79	1.52	1.37	1.68
150	Vs		2337	2828	3121	3154	2867	2861
	Cs		1242	1468	1685	1875	2056	1665
	Vs/1 leu		1.88	1.92	1.85	1.68	1.39	1.74
200	Vs		2541	2795	3074	3026	2952	2878
	Cs		1469	1683	1900	2086	2287	1885
	Vs/1 leu		1.72	1.66	1.61	1.45	1.29	1.55
Media/ Mean	Vs		1931	2316	2538	2465	2399	2330
	Cs		1095	1304	1535	1703	1880	1503
	Vs/1 leu		1.74	1.77	1.62	1.41	1.26	1.56

The illustration of the way of manifestation of the dependencies of average productions per hectare on the two fertilizing factors applied (x_1 = dose of P a. s./ha și x_2 = dose of N a. s./ha) can be graphically expressed through response surfaces. This illustration exhibits the evolution of average productions in relation to P doses (x1) and N doses (x2), it highlights the areas of the positive x_1x_2 interactions and suggests the production levels, for wheat and corn, probable on the argic chernozem and that may extrapolate the obtained results. The research on the situation of economic optimum doses and the technical optimum doses show that on an argic chernozem type of soil, the essential and recommended element is nitrogen. Wheat crops cultivated following corn crops responded to the application and even overdosage of nitrogen – which can sustain high and economical productions per surface unit.

CONCLUSIONS

Statistically it was proven to be essential and very distinctly significant the effect of NP interaction for wheat crops grown after corn and after soy, followed by the individual action of nitrogen and less of the phosphorus.Wheat grown after corn has a higher apparent response and a more constant one to NP interaction, then to N, the previous plant here proves to induce a better harness of the fertilization applied. In the set of the mentioned alternatives of fertilization with the mentioned doses, grain yields can be obtained of 5-6-6,5 t/ha for wheat crops on argic chernozem at SCDA Turda, specific to the ecological conditions of the Transylvanian Plain. Economic analysis of the results of differentiated fertilization highlights high economic variability of the combinations of x_1 (P doses) and x_2 (doses of N).

This variability occurs from the level of production, the level and value of production increases obtained, equally important and essential, from the amount of additional costs due to fertilization. From here, it results the net income that is differentiated from the values of the mentioned indicators and differentiated from the values obtained per 1 leu extra costs with fertilization.

The economic analysis in which some calculations that show numerical and percentage indicators of this field (value of increase, additional costs, net revenue, net revenue/1 leu spent on fertilization, rate of return) were made, is capable of also differentiating the technologies that were or can be applied to prevent fertilization formulas, such as „widespread formulas" and can bind technological efforts, by costs and results, to the rational technical and economic feature.

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