ECONOMIC CONSIDERATIONS ON WHEAT CROPS CULTIVATED FOLLOWING SOY CROPS ON AN ARGIC CHERNOSEM IN THE TRANSYLVANIAN PLAIN

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Abstract. 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. The goal of this research is to scientifically and economically substantiate the differentiated fertilization systems involved in obtaining big productions in the reference area. In this study it was tried to track the effect of the nitrogen-phosphorous interaction in achieving wheat cultivated following soy productions, obtained in 2011 and 2013. The obtained results present the production levels obtained for wheat crops (Dumbrava Variety), the prior crop being soy. The already existing and further research will enrich the study's utility in taking a rational fertilization decision based in the future also on the support of the suggested solutions.

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

INTRODUCTION

Economic approaches dedicated to ensure real management of fertilizing resources on agricultural crops (in this case, corn) 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. Obviously, these approaches involve first of all 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). Economic and fertilization optimization objectives, regarding this study were:

- Investigating by economic analysis, the efficiency indicators in experimental variants, which, based on net revenues (of the increase of production) and their unitary costs assess the rates of return of the technical effect;
- Research on economic efficiency research results supported the appropriateness of performing further studies regarding programming technologies of fertilizer application, that includes based on maximizing net income, detailing specific indicators for the optimization of calculating the NP doses, of their programming the establishment of fertilizer assortment and relevant recommendations related to the rational application of fertilizers;
- From the data collected and developed systematically it was suggested detailing the changes related to the development of agrochemical soil fertility and its productivity under long-term impact of the application of fertilizers through experimental technologies and programs (Poruţiu A., PhD Thesis, 2014).

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).

MATHERIALS AND METHODS

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:

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

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 years 2011 - 2012 - 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	Crop	Maximum production obtained (kg/ha)	NP Dose	Significance of factors influence x)
2011	Wheat grown following soy	5400,00	N120P160	NP - f. d. s.; N - f. d. s.; P - f. d. s.
2013	Wheat grown following soy	6564	N160P160	NP - f. d. s.; N - f. d. s.; P - s.
Mean	Wheat grown following soy	5906,60	N133P146	

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 soy	5400,00	N150P160	310	19	6,7
2013	Wheat after soy	6564,00	N160P160	320	21	10,6
Mean	Wheat after soy	5906,60	N133P146	279	21	8,9

Technical results obtained as the mean of the years 2011 and 2013 prove the possibility of obtaining maximum yields of wheat, Dumbrava variety, 5906,60 kg / ha with a fertilizer dose of N133P146 (crop after soy). 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 soy 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							
40	Vs		877	600	1566	1000	633	935
	Cs		570	744	1002	1089	1206	922
	Vs/1 leu		2.06	0.8	1.56	0.92	0.52	1.17
80	Vs		966	1700	1733	1466	933	1360
	Cs		746	1019	1230	1345	1451	1158
	Vs/1 leu		1.29	1.66	1.4	1.08	0.64	1.21
120	Vs		1300	1682	2266	1600	1433	1656
	Cs		949	1190	1438	1570	1706	1371
	Vs/1 leu		1.36	1.41	1.57	1.01	0.91	1.25
160	Vs		1000	1800	2500	1433	733	1491
	Cs		1094	1365	1623	1729	1864	1535
	Vs/1 leu		0.91	1.31	1.54	0.82	0.39	0.99
Media/ Mean	Vs		1036	1446	2016	1375	933	1361
	Cs		840	1080	1323	1433	1557	1247
	Vs/1 leu		1.41	1.3	1.52	0.96	0.61	1.16

Table 4

Economic efficiency indicators for wheat grown after soy 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							
40	Vs		669	695	648	770	938	744
	Cs		580	782	930	1106	1289	937
	Vs/1 leu		1.15	0.89	0.7	0.7	0.73	0.83
80	Vs		1235	1312	1391	1391	1589	1384
	Cs		819	1024	1231	1388	1569	1206
	Vs/1 leu		1.5	1.28	1,13	1	1.01	1.18
120	Vs		1751	1692	1929	1775	2036	1837
	Cs		1039	1229	1447	1638	1819	1434
	Vs/1 leu		1.69	1.38	1.33	1.08	1.12	1.32
160	Vs		1954	1933	2041	1984	2460	2074
	Cs		1224	1421	1626	1824	2061	1631
	Vs/1 leu		1.6	1.36	1.26	1.09	1.19	1.3
Mean	Vs		1402	1408	1502	1480	1756	1510
	Cs		916	1114	1309	1489	1685	1302
	Vs/1 leu		1.49	1.23	1.11	0.97	1.01	1.16

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 soy crops responded to the application and even overdosage of nitrogen – which can sustain high and economical productions per surface unit.

CONCLUSIONS

Capping trends of the fertilizing effect occurs, for wheat grown after soy, when exceeding the following doses: N-120 kg/ha, P2O5-40-80 kg/ha. It turns out that the effect of phosphorus contributes to a better use of high and very high doses of N. Therefore, the NP interaction remains the primarily effect, followed by the effect of nitrogen, as essential and then the effect of phosphorus. 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 certain

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;

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