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ECONOMIC EFFICIENCY IN THE USE OF ORGANIC AND MINERAL FERTILIZERS ON WHEAT GROWN ON REDDISH PRELUVOSOIL

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Abstract

This paper will present the results obtained on the reddish preluvosoil, in the period of 2014-2016, situated on the experimental field of the Department of Soil Sciences, at Moara Domneasca. The wheat crop is part of a crop rotation wheat-barley-sugar beet. The experience is a two-factor concept, organised in three repetitions, with the next factors: a - organic fertilization and b - mineral fertilization. The research aims to find the perfect balance between the used resources and the best results, in an economic point of view. As natural fertilizers were used plant residues and manure, nutrient needs are supplemented with mineral fertilizer based mostly on nitrogen. The research has shown, that nitrogen fertilization with organic and mineral nitrogen increases wheat production along with profits. In terms of production, the best is a3 – b4 (40 t/ha leaves an pices of sugar beet and a dose of N_{150}), but, economically, the variant a1-b4 (unfertilized organically with a dose of N_{150}) gives the best outcome for the farm.

Key words*: costs, fertilizer, profit magin, wheat.*

INTRODUCTION

In agriculture, as in any activity with an economic purpose, the goal is to maximizd production and thus profits.

The volume of production is closely connected with tillage, seeding quality, labor and the treatments applied to the crop. All these components are assigned an economic value which takes the form of production cost.

Economic performance has a wide scope of coverage, essentially reflects the relation between effects and efforts (Zahiu et al., 1997).

Independent investment strategy is a strategy that must be inclusive, or rather to integrate other strategies aimed at achieving the overall strategy of the agricultural firm (Bogdan, 2004).

According to the National Statistics Institute, in Romania, most of the farms are in private households. Also, the wheat acreage is maintained at a high level, one of this country's favorite crops, along with corn.

Wheat is a whole grain, with multi-purposes, rich in nutrients necessary for human consumption (proteins, lipids, carbohydrates), but given also use in food for animals. To obtain a high yield of wheat is recommended to include it in a rational rotation. Wheat monoculture should not be practiced, as it leads to the expansion of diseases, pests and weed appearance, specific to wheat, leading to the gradual reduction in the yields obtained. Nitrogen, as a basic element in plant nutrition is the main ingredient of proteins from wheat, addition application helps increase its protein content. In their nutrition, plants accumulate soil nitrogen in ammonia and nitric form, and convert it through amination and transamination reactions in protein substances (Borlan and Hera, 1994).

To optimize the application of mineral nitrogen, wheat requirements must be taken into consideration, together with the conditions provided by the soil (Dincă et al., 2010; Gîdea et al., 2015).

MATERIALS AND METHODS

The research on organic and mineral fertilization for growing autumn wheat on red preluvosoil began in 1991, in the experimental field of the Department of Soil Sciences at Moara Domneasca farm.

The paper presents data obtained between the years of 2014-2016. The wheat crop is part of a rotation wheat-barley-sugar beet.
The two factors experience is organized by the subdivided parcels method, in three repetitions factors: a - organic fertilization and b - mineral fertilizer.
Factor a - organic fertilization - included 3 experimental versions: a_1- unfertilized, a_2- residual from 30 t/ha manure and a_3- leaves and pieces of sugar beet + N_{50}.
Factor b - mineral fertilization - included 5 different experimental versions: b_1 – unfertilized, b_2 - N_{60}, b_3 - N_{100}, b_4 - N_{150} and b_5 - N_{200}.
For all the scenarios it was provided a mineral fund of P_{70} and it was used Glosa wheat.
Determinations carried out on variations and repetitions consisted in determining production, number of ears, hectolitre mass and weight of a thousand grains (MMB). The results were calculated and statisticaly interpreted by variant analysis method.
In designing these expenses came: cost of mechanized work (machinery depreciation, fuel, labor, maintenance and repair of machinery), the cost of mineral fertilizers and organic, cost of seed and pesticide costs. Economic efficiency was assessed by calculating gross profit margin for each experimental variant.
To calculate revenue was used for wheat average price of 0.6 RON/kg of February 2016 in Muntenia Region (www.madr.ro).
In calculating the expenditure was considered a price of 1.2 RON/kg for ammonium nitrate (33.5%) and 2 RON/kg superphosphate (46%).
For manure was used an average price of 30 RON / t. The total value of organic fertilization with manure was divided as follows: 50% for sugar beet, 30% for wheat and 20% for barley.

RESULTS AND DISCUSSIONS

Analyzing the data presented in Table 1, we have the next observations: organic fertilization increases wheat production for all variants of mineral fertilizer.
Mineral fertilization effect is higher for unfertilized organically, or control variant. The highest production is obtained for variant a_3 - b_4 (40 t/ha of leaves and epicotyls of sugar beet + N_{50} with a dose of mineral nitrogen - N_{150}). Variant a_3 - b_5 (40 t/ha of leaves and epicotyls of sugar beet + N_{50} with a dose of mineral nitrogen - N_{200}) causes a decrease in production compared to variant a_3 - b_4.

Table 1. Influence of mineral and organic nitrogen fertilization on wheat production

Fertilizer: Organic / Mineral	a_1 – unfertilized organically			a_2 - 30 t/ha of manure applied to the preceding crop			a_3 - 40 t/ha of leaves and epicotyls of sugar beet + N50		
	Prod. (q/ha)	Dif. (q/ha)	Semn.	Prod. (q/ha)	Dif. (q/ha)	Semn.	Prod. (q/ha)	Dif. (q/ha)	Semn.
b_1 – N_0	43.47	Mt		47.04	Mt		69.39	Mt	
b_2 – N_{60}	58.7	15.23	***	62.45	15.41	***	76.17	6.68	***
b_3 – N_{100}	74.63	31.15	***	71.98	24.94	***	90.42	21.03	***
b_4 – N_{150}	84.12	40.65	***	85.42	38.38	***	101.40	32.01	***
b_5 – N_{200}	90.52	47.05	***	90.49	43.45	***	98.42	29.03	***

For each variant was conducted a set of agricultural tasks, together with the application of treatments. The cost of each activity or input, is presented in Table 2. The activities and input mentioned in the table above, were the starting point of our analysis, and were used for variant a_1 - b_1(unfertilized organically with a dose of N_{100}).

Table 2. Technological data for the wheat crop

Activity	Price for mechanized task (RON/ha)	Input quantity (Kg/ha)	Price for inputs (RON/ ha)
Plowing - 22 cm	300		
Soil preparation - disc harrow (2 passes)	250		
Fertilizing with superphosphate	60	152	305
Sowing	150	300	360
Herbicides	60	3.6	295
Harvested and chopped straw	300		

For the other experimental variants was added the extra cost of inputs, such as increased doses of nitrogen, manure and preparing the leaves and epicotyls of sugar beet.

Table 3. Total expenditure (RON/ha)

Fertilizer	a_1 – unfertilized organically	a2 - 30 t/ha of manure applied to the preceding crop	a3 - 40 t/ha of leaves and epicotyls of sugar beet + N50
$b_1 – N_0$	2080	3076	3740
$b_2 – N_{60}$	2418	3414	4016
$b_3 – N_{100}$	2582	3576	4242
$b_4 – N_{150}$	2802	3798	4462
$b_5 – N_{200}$	3040	4038	4702

By analyzing total costs presented in Table 3, we can draw the following observations: the amount of expenditures on organic fertilization increases in direct proportion to the amount of mineral nitrogen and administered.

The highest value is achieved for total expenditures variant a3-b5 (40 t/ha of leaves and epicotyls of sugar beet + N_{50} with an extra dose of mineral nitrogen – N_{200}), where nitrogen is the maximum dose.

Our goal is to see if what we spend in inputs is found in the revenue.

Table 4. Revenue (RON/ha)

Fertilizer	a_1 – unfertilized organically	a2 - 30 t/ha of manure applied to the preceding crop	a3 - 40 t/ha of leaves and epicotyls of sugar beet + N50
$b_1 – N_0$	2608	2822	4163
$b_2 – N_{60}$	3522	3747	4568
$b_3 – N_{100}$	4477	4319	5425
$b_4 – N_{150}$	5047	5125	6084
$b_5 – N_{200}$	5429	5429	5905

The amount of revenue is directly influenced by the production obtained. Revenue increases at the same time as the dose of mineral nitrogen, except for variant a3-b5 (40 t/ha of leaves and epicotyls of sugar beet + N_{50} with a dose of mineral nitrogen – N_{200}). Organic fertilization also triggers increased production, leading to increased revenue. The maximum income recorded was for a3-b4 solution, the variant with the highest production.

Table 5. Profit for all experimental variants (RON/ha)

Fertilizer	a_1 – unfertilized organically	a2 - 30 t/ha of manure applied to the preceding crop	a3 - 40 t/ha of leaves and epicotyls of sugar beet + N50
$b_1 – N_0$	528	-254	423
$b_2 – N_{60}$	1104	108	552
$b_3 – N_{100}$	1895	743	1181
$b_4 – N_{150}$	2245	1327	1622
$b_5 – N_{200}$	2387	1391	1203

The analysis recorded profits, it is found that the highest values of profit are obtained for organic unfertilized variant (a_1). The amount of profit increases with the dose of mineral nitrogen. Variant a_2-b_1 is the only variant with loss.

Table 6. Profit margin (%)

Fertilizer	a_1 – unfertilized organically	a2 - 30 t/ha of manure applied to the preceding crop	a3 - 40 t/ha of leaves and epicotyls of sugar beet + N50
$b_1 – N_0$	20.25%	-9.00%	10.16%
$b_2 – N_{60}$	31.35%	2.88%	12.08%
$b_3 – N_{100}$	42.33%	17.20%	21.77%
$b_4 – N_{150}$	44.48%	25.89%	26.66%
$b_5 – N_{200}$	43.97%	25.62%	20.37%

Analyzing the data presented Table 6, there was an increase in profit margin at the same rate with mineral nitrogen dose increase, up to version b_4 (N_{150}). After the dose of N_{150}, the profit margin registers a downtrend for b_5 variant, for all variants of organic fertilization. The biggest profit margin is obtained for variant a_1-b_4.

CONCLUSIONS

Nitrogen fertilization organic and mineral nitrogen triggers increased production of winter wheat.

The optimum solution in terms of output obtained for organic nitrogen fertilization is a_3-40 variant t/ha of leaves and epicotyls of sugar beet + N_{50}.

Expenses increase proportionally with dose of mineral nitrogen. The highest cost recorded is for variant a3-b5, which also has a downtrend in production. This is not a viable option economically.

The largest revenue is for the variant a_3-b_4 (40 variant t/ha of leaves and epicotyls of sugar beet + N_{50} with an extra dose of N_{150}), and it records the highest production/ha.

The profit obtained increases with the dose of mineral nitrogen and obtains the highest value variant for a_1-b_5.

The profit margin, the most important indicator in the economic analysis, marks the highest value for variant a_1-b_4 (44.48%). The variant with the largest production per hectare recorded a profit margin of only 26.66%, due to high costs.

As for organic fertilizers, the lowest profit margins are for variant a_2 - 30 t/ha of manure applied to the preceding crop, with any mineral suppliment.

For mineral fertilizer, is not recommended to use o dose of nitrogen above $N_{150,}$ because the the cost are to high and so profit margins start to decrease.

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