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THE INFLUENCE FERTILIZATION ON THE QUALITY PRODUCTION OF RYE IN THE CONDITIONS OF SANDY SOILS FROM SOUTHERN OLTENIA

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ABSTRACT

Cultivation of rye has a special importance for agriculture in România, this culture is the second panification cereal to after wheat. Rye is important in the culture first for fact that maybe capitalize on less favorable the soils cultivation of wheat, such as ones sand, ones acid or positioned in climate cool and moist. Regarding the uses rye, they are multiple from bakers to animal feed.

Quality characteristics values are strongly influenced by the applied technology. Productivity and production quality are influenced by dose and epoch of application of fertilizers during the experimentation. On sandy soils from southern Oltenia the culture of rye gives good results if are applied all links of the technological.

The best production results were obtained in variant fertilized with N150P80K80, in which nitrogen was applied 1/3 at sowing + 2/3 in vegetation (3336 kg / ha). Fertilization influenced the rate of protein, gluten, sedimentation index and mass of 1000 grains. Protein quantity of rye grains was comprised between from 10% the control variant and 12.2% in variant fertilized with N150P80K80 (N-100%, in the vegetation). Protein quantity calculated per hectare increase with growth grains production and between the two variables have established a correlation represented by a simple linear regression.

Increasing doses of nitrogen influences quality of the grains of rye and the best results were obtained at fertilization with N150.

Also, the epoch of application of fertilizers influences production quality and the best results were obtained when nitrogen dose was administered 1/3 at sowing + 2/3 in the vegetation or 100% in the vegetation, variants in which and production presented yield increases statistically assured.

INTRODUCTION

Currently, rye is grown primarily for human food, being Second cereal "bakeries", after wheat. Rye is a valuable food plant which makes the wheat crop under harsh conditions, drawing, acid soils or sandy soils and succeeding in the areas, climate cold and humid or dry areas.

The literature shows that rye grains contain on average 82.0% carbohydrate, 13.5% protein, 1.9% fat, 1.8% mineral substance and vitamins (B1, B2, PP). Many researches from the country and abroad highlights the importance of the chemical composition of rye grain depending on the applied technology and the area of culture (Gheorghe D., 1998, L. Füle, și colab., 2005, Kubicka H.,Carrillo J.M.,Benito C., 2005,P. R. Shewry, 2006,Timoshchenko, A.S., and all., 2008, Gheorghe D., and all., 2009, Iuliana Banu, Ina Vasilean, 2009, Slađana Žilić and all., 2011, Arkadiusz Stępień and all., 2016, A. A. Goncharenko and all., 2013,Iulian Drăghici and all., 2016).

In conditions similar of vegetation, rye has a lower protein content than wheat and with a lower digestibility. Rye dough, although it contains glutenin and gliadin, do not form

a gluten quantity and quality of wheat. It is, however, a second grain for bakery (after wheat) around the globe, higher barley and oats (Dragomir N., 2009).

Although the capacity of absorbing nutrients is high, by the fact that the rye is cultivated on poor soils (sands, podzols) respond well to fertilizer. Regime the feeding sandy soils, is deficient front of plant requirements and therefore ensure the necessary nutrients their growth and development can be achieved through rational use of fertilizers.

Researches by M. Nicolescu, 2008, on the sandy soils in southern Oltenia during 2006-2008 at rye highlight a protein content ranged from 10.50% in at monoculture at unfertilized and 19.12% in 3 years crop rotation (sorg- peanut- rye) at fertilization with N160P80K80. The protein content increases with increasing doses of nitrogen fertilizer and regardless of fertilization presented higher values in rotations compared to monoculture. Protein content presented higher values in rotations of three years, when rye is cultivated after legumes (mazăre- 14.70% peanuts - 15.16%, beans - 14.45%).

In the conditions practicing sustainable agriculture on sandy soils, researches has been directed to another type of fertilizing system, with lower doses of fertilizer, but the choosing the moment of application according to plant needs.

MATERIAL AND METHOD

In order, determining the influence of fertilization with different doses of chemical fertilizers on grain quality rye on, sandy soils in southern Oltenia was initiated, an experience with the following factors:

Experimental variants:

V1. N0P0K0
V2. N0P80K0
V3. N0P0K80
V4. N0P80K80
V5. N50P80K80(N 100% sowing)
V6. N50P80K80 (N1/3 sowing + 2/3 vegetation)
V7. N50P80K80 (N- 100% vegetation)
V8. N100P80K80 (N100% sowing)
V9. N100P80K80(N1/3 sowing + 2/3 vegetation)
V10. N100P80K80 (N- 100% vegetation)
V11. N150P80K80(N100% sowing)
V12. N150P80K80(N1/3 sowing + 2/3 vegetation)
V13. N150P80K80(N- 100% vegetation)

At harvest from grains of rye were made the following observations and determinations:

- protein - spectrophotometric method with the analyzer NIR model INFRAMATIC 9200;
- moisture - spectrophotometric method with the analyzer NIR model INFRAMATIC 9200;
- gluten - spectrophotometric method with the analyzer NIR model INFRAMATIC 9200;
- sedimentation Zeleny index-spectrophotometric method with the analyzer NIR model INFRAMATIC 9200;
- index of fall (seconds) - the system for determining the activity of alpha - amylase, Perten model FALLING NUMBER 1310-
- weight of 1000 grains (g); - by weighing out 1,000 grains in digital electronic balance type KERN
- hectoliter weight (kg / hl); - with device for determining the weight hectoliter-Swantech model;

- production (kg/ha).

RESULTS AND DISCUSSIONS

Experience has been placed on a soil with low fertility, the soil is poorly stocked in nitrogen (0.05 to 0.10%), well stocked in extractable phosphorus (80-98 ppm) and low to medium stocked in exchangeable potassium (55-76 ppm). The organic carbon presented low values in the range of 0.19 to 0.40%, and the pH of the soil fluctuated between 5.62 and 6.66, values which show a moderate acidic to neutral reaction (Table 1).

Table 1

The chemical composition of the soil in the experimental field

Depth (cm)	Total nitrogen %	Extractable phosphorus (P-AL) ppm	Exchangeable potassium (K-AL) ppm	Organic carbon %	pH in water
0 - 40	0,05 - 0,10	80 - 98	55 - 76	0,19 - 0,40	5,62 - 6,66

From point of view of quality grain rye, results obtained on sandy soils shows the influence of mineral fertilization and of the epoch of application on the nutritional quality of the production of rye. The results are shown in Table 2.

Humidity of the grains was very low, below 11%, the limit being 13-14%. The differences between the variants studied are very low. Protein quantity of rye grains was between 10.0% in variant unfertilized and 12.2% in variant fertilized with N150P80K80 (N-100% vegetation). Protein quantity calculated per hectare increases with increasing grain yield, and between two variables was determined a correlation represented by a simple linear regression (Figure 1).

Iuliana Banu, 2003, show that, the protein content of rye grains can be a good indicator of its quality cooking. Protein content fluctuated between 9.45% average in the South Plain and Dobrogea and 10.53% in Oltenia Plain; in general, the weight, of the protein in grain rye has not exceeded 12% regardless of the area of culture.

The gluten content from beans is reduced as compared to wheat rye and its content was between 20% for the control variant and 28.8% in variant fertilized with N150P80K80 (N- 100% vegetation) or 26.2% in variant fertilized with N150P80K80 (N1/3 sowing + 2/3 vegetation). Gluten from grains of rye is less elastically than wheat, making the rye bread is denser and more compact. Values for optimal gluten content must be greater than 24%.

The results obtained show that the content of gluten rye grains increase the percentage in the variants in which the fertilized with all three macroelements and the best results were obtained for fertilizing crops the dose of N150P80K80. Zelleny index was less influenced by fertilization system, and the highest values were determined in variants fertilized with all three macroelements.

Falling Number show use value of grain sprouted and is measured in seconds. The correct values for alpha-amylase are 200-250 seconds. Over 280 seconds, shows a deficit of alpha-amylase activity and can be corrected and below 180 seconds is not for bread and beans can be sprouted. Values Falling Number to rye were between 276 seconds in variant unfertilized and 372 seconds in variant fertilized with N100P80K80 (N1/3 sowing + 2/3 vegetation. The values show a deficiency in alpha - amylase may be correct.

Since its introduction in the early 1960s, the test Falling Number has become a world standard in the cereals and grist, the industries for measuring the activity of alpha - amylase in wheat, durum wheat, triticale, rye and barleyas, well as and products milled

from these grains. Weight of 1000 grains and hectoliter weight have presented higher values in the variants fertilized with N150P80K80 dose.

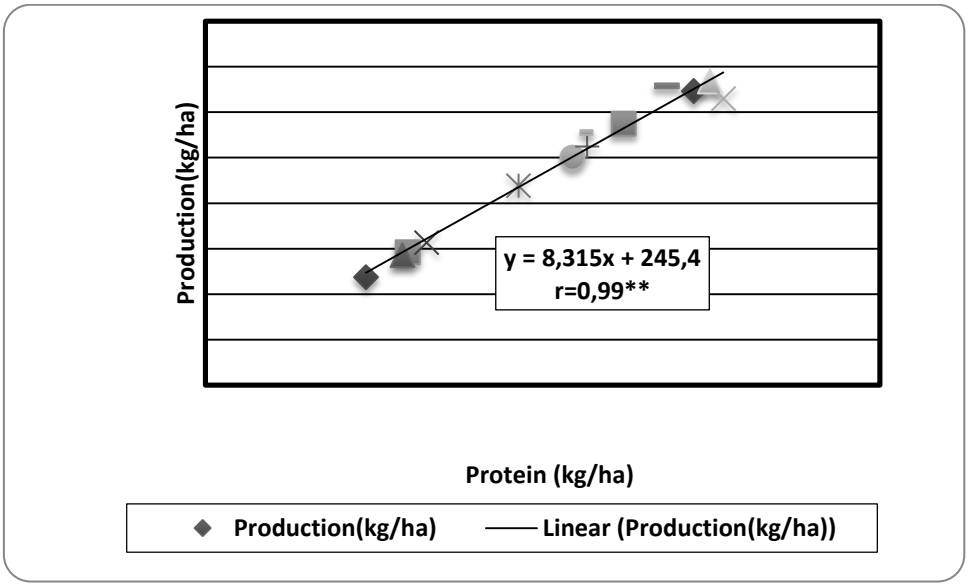

Figure 1- Correlation between the quantity of protein (kg / ha) and the grain yield (kg / ha) depending for fertilization system

The administering of increasing dosages of fertilizers increases progressively rye grain harvest per unit of area and the protein content of the grain, resulting at the end an increase of the amount of protein achieved per hectare. The gluten content in grain rye showed slight increases with increasing dose of fertilizer (table 3). Between the dose of nitrogen applied, the amount of protein and gluten content there is a direct correlation values of the protein and of gluten increased by increasing the production (Figure 2). Falling Number showed lower values at dose of N50. The values show a low amylase activity, which can be corrected in the process bakery, but it does not indicate sprouting grain in the spike.

Also, between the quantity of protein calculated per hectare and production of rye grains by increasing the dose of nitrogen was established a linear correlation with a correlation factor, highly significant (r = 0.997 **) (Figure 3).

If we analyze the influence of epoch of application of fertilizers on grain quality rye from the results shown in Table 4 is observed that the best results were obtained when the nitrogen dose is administered N1/3 sowing + 2/3 vegetation or 100% in the vegetation, variants in which and production, presented statistically assured increases. Protein quantity was 10.83% when nitrogen was applied 1/3 of the dose at sowing and 2/3 in the vegetation and 11.40% when nitrogen was applied 100% in the vegetation. Also, the amount of gluten in grains presented maximum values in these variants.

Table 2

Influence the fertilization system on the quality of the grain rye

Varianta		Moisture (%)	Protein		Gluten (%)	Index Zeleny (ml)	Falling Number (s)	Weight of 1000 grains (g))	Hectoliter weight (Kg/hl)	Production (kg/ha)
			(%)	(kg/ha)						
N0	P0K0	10,8	10	119	20,0	22	276	26	65	1185
	P80K0	10,7	10,3	150	21,3	30	289	28	66	1460
	P0K80	10,7	10,2	146	21,2	29	332	28	66	1428
	P80K80	10,7	10,5	164	20,8	27	307	27	66	1566
N50P80K80	(N 100% sem.)	10,2	10,6	232	22,2	21	316	29	67	2191
	(N1/3 sem. + 2/3 veg.)	10,1	10,9	272	22,6	22	332	29	67	2499
	N- 100% veg.)	10,5	10,8	283	23,5	30	318	30	66	2621
N100P80K80	(N100% sem.)	10,7	10	278	24,2	26	340	29	68	2775
	(N1/3 sem. + 2/3 veg.)	10,4	10,4	342	25,7	28	372	28	67	3287
	(N- 100% veg.)	10	11,2	362	24,0	29	341	30	68	3230
N150P80K80	(N100% sem.)	9,8	10,8	310	23,3	27	323	31	66	2872
	(N1/3 sem. + 2/3 veg.)	10,5	11,2	374	26,2	33	358	30	70	3336
	(N- 100% veg.)	10,4	12,2	384	28,8	44	303	30	69	3148

DL5% -399kg/ha DL1% - 535kg/ha DL0,1%- 702kg/ha

Table 3

The influence dose of nitrogen on grain quality rye

The dose of nitrogen (kg/ha)	Protein		Falling Number (s)	Gluten (%)	Production (kg/ha)
	%	kg/ha			
N0	10,25	144	301	20,85	1410
N50	10,56	257	322	22,76	2437
N100	10,53	330	351	24,63	3130
N150	11,4	356	328	26,1	3119

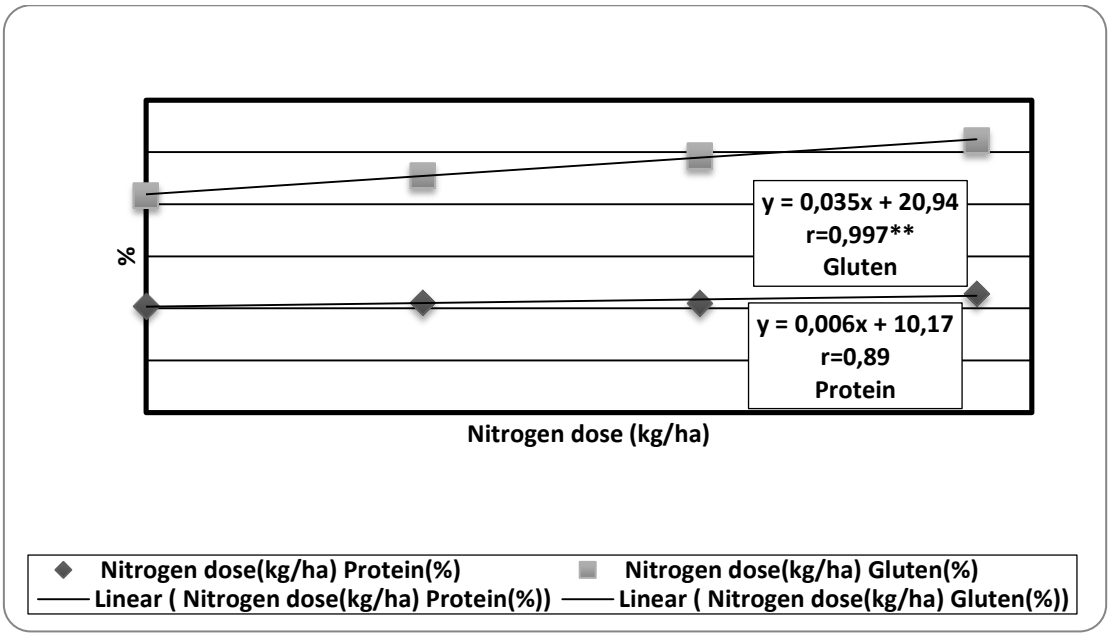

Figure 2 - Correlation between the dose of nitrogen and the content of protein and gluten from the grain rye

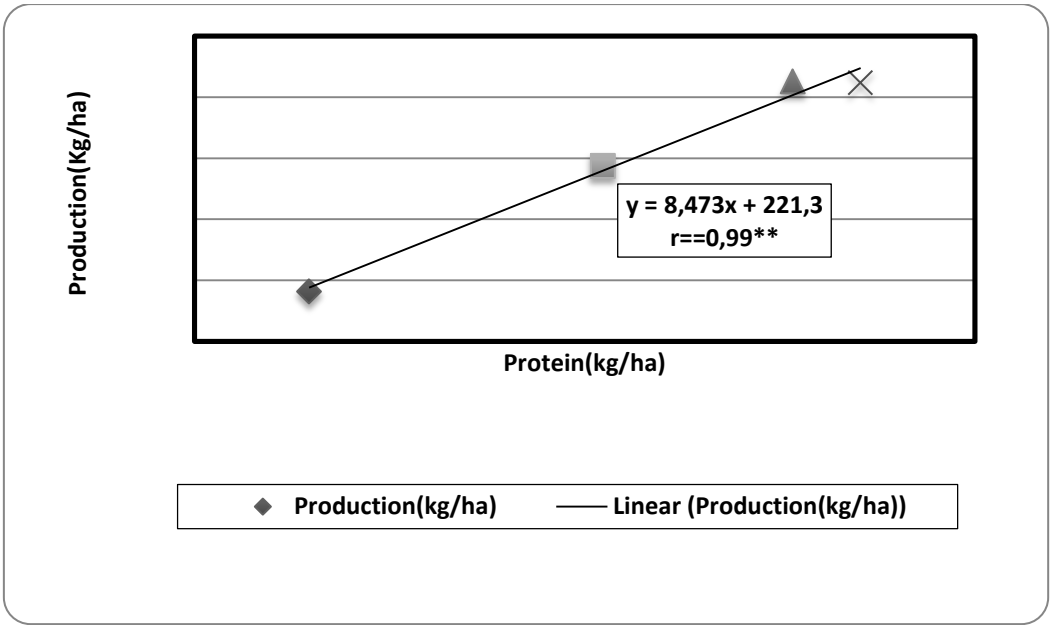

Figure 3 - Correlation between the quantity of protein in the kg / ha and the grain yield (kg / ha) depending of increasing the dose of nitrogen

Table 4

The influence epoch to apply fertilizers on grain quality rye

Variant	Protein		Falling Number (s)	Gluten (%)	Production (kg/ha)
	%	kg/ha			
N0	10,25	144	301	20,85	1410
N- 100% sowing	10,46	273	326	23,23	2613
N1/3 sowing + 2/3vegetation	10,83	329	354	24,83	3041
N- 100% vegetation	11,40	342	320	25,43	2999

CONCLUSION

Production of rye and grain quality are influenced by dose and age, the application of fertilizers during the period of experimentation.

The best production results were obtained in variant fertilized with N150P80K80 in which nitrogen was applied at sowing 1/3 + 2/3 vegetation (3336 kg / ha), with an increase of production assured as very significant statistically.

Fertilizers applied and the epoch of application influences the determining the percentage of protein, gluten, sedimentation index and weight of 1000 grains.

The application of increasing dosages of fertilizers has led to increased production of rye per unit of area of the grain and the content of protein, finally resulting in an increase in the amount of protein achieved per hectare. The gluten content in grain rye presented slight increases with increasing dose of fertilizer.

Also, epoch the application of fertilizers influence the quality of rye and the best results were obtained when nitrogen dose was administered 1/3 sowing + 2/3 vegetation or 100% in the vegetation, variants in which and presented production increases statistically assured (the amount of protein was 10.83% when nitrogen was applied 1/3 of the dose at sowing and 2/3 in the vegetation and 11.40% when nitrogen was applied 100% in the vegetation).

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