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THE INFLUENCE OF WHEAT AND MAIZE CROPS IN ROTATION AND MONOCULTURE ON SOIL PHYSIOLOGICAL COMPONENTS

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***Abstract**: As a living organism, zonally integrated into the environment and having specific features, the soil is in a permanent evolutionary process, both naturally and under the influence of human activity. The rotation of the crops influences the physiological components of the soil such as: the respiration potential, the cellulosolytic potential, and also the ability to lodge the atmospheric dinitrogen into the soil. The soil samples taken into study were harvested from soybean crops of a three-year rotation, corn coming from a 4-year field temporarely outside the crop rotation, and from monocultures of wheat and corn, the fertilized with N_0P_{70} variety, from the Am horizon (0-20 centimeters).*
According to the data collected from the present study, the rotation of the crops influences the physiological elements of the soil. The highest cellulosolytic activity was registered by the soil which was cultivated with corn after wheat and the lowest one was registered to the soil cultivated with wheat after soybean. The respiration activity of the soil which was under the wheat monoculture was considerably more positive. The result of the analysis situated in the value group a. The highest quantity of atmospheric dinitrogen was lodged (fixed) in the soil under the monoculture of wheat, and the lowest one was fixed in the soil under the corn culture with rotation after the wheat.

***Key words**: soil, dinitrogen, cellulosolytic activity, fertilization.*

INTRODUCTION

According to G. H. IONESCU ŞIŞEŞTI (1947), fertilization is a synthesis of favorable characteristics of the soil which are shown by its durable productivity.

Medical science gives an example of integralist conception, of evaluating human health, by variable tests, which describe at some point a lot of anatomic characteristics and his physiological manifestations. The soil, as a living organism, zonal integrated in the environment, having specific features, is always evolving, both naturally and under the influence of human activity, especially agricultural one (ŞTEFANIC & AL, 2014).

The rotation of the crops influences the physiological components of the soil as: respiration potential, the cellulosolytic potential and also the capacity of fixing of the atmospheric nitrogen from the soil.

The cellulose represents the deposit of bioenergetic carbon and it contributes to soil formation and also to the reserve and synthesis of the humus. Also, the cellulose results from the carbon dioxide in the atmosphere through the photosynthetic activity of the vegetal coating (ŞTEFANIC & AL, 2014).

The soil respiration activity represents a global biotic indicator of evaluation of the level of life from the soil.(GHEORGHIŢĂ N., 2008). Through the respiration process, biochimic reactions of oxidoreduction by the sources of energy who came from the environment are realized, releasing inside the cell, the energy needed for life (ŞTEFANIC & AL, 2006, 2011).

After MÜLLER (1968) the atmospheric fixation of the nitrogen through microorganisms is an important element to the biological circuit of the nitrogen. Each additional nitrogen source is of great importance for the growth of plant production. The researches on the free-range microflora of dinitrogen has been approached in the next years by many microbiologists and biochemists. Thereby, D.FEHER (1954) mentions that there have been detected 38 different types of atmospheric dinitrogen fixators.

ȘTEFANIC G & GEORGETA OPREA (2010,2011) surprised the mismatch between assessing the importance of assimilation CO_2 from the atmosphere and the evaluation of free dinitrogen in atmosphere, which can not explain the formation of terrestrial and aquatic biomass. The studying of the scientific writings has allowed them to determine that the amount of N_2 freely fixed, in the experiences with the soil did not include the nitrification of the ammoniacal nitrogen, process that can be performed simultaneously with dinitrogen fixation in the soil sample during incubation.

ȘTEFANIC G. & GEORGETA OPREA (2010) have corrected this method (Kjendal-clasic) by summing N (the clasic Kjendal method) with N-nitric, after and before the incubation of the soil stamps, for 30 days and the determining of the difference between these sums, giving the real measure of the aerobic process of free fixation of the N_2 in the soil and of correcting th technological conceptions of the administration of mineral fertilizers with nitrogen.

MATERIAL AND METHODS

For the soil characterization, stamps of soil under the soybean crop from the rotation of 3 years, under the corn of 4 years field temporarely outside the crop rotation, under the monocultures of wheat and corn from the variant N_0P_{70}, from the horizon Am (0-20 centimeters) have been harvested from The Didactic Farm Moara-Domnească, in April, when the soil was wet. The samples were cut, then passed through a 2-3 millimeter sieve, then kept in plastic bags in the refrigerator at +4° C (ȘTEFANIC & AL. 2014). For the characterization of the physiological state of the soil has been analyzed the potential of respiration, the cellulosylic potential and the fastening capacity of the dinitrogen in the soil.

The principle of the method for determining the soil's respiration potential is taken over of (ȘTEFANIC & AL 2014).after DOMMERGUE (1960, 1968). The quantitative determination of breathing is done to ascertain that the aerobic creatures are breathing by absorbing atmospheric oxygen with which it carries out the oxidation of organic compounds, from the environment and eliminates carbon dioxide (STOKLASA, 1929). For the quantitative determination of respiration is used the respirometer (ȘTEFANIC,1988).

The principle of the method for determining the cellulolytic potential of the soil was taken over VOSTROV & PETROVA (1961), with the technical modifications brought by ȘTEFANIC (1994) who replaced the patches of pure cotton with cloth of 25-50% polyester or with poplin cloth with elastane blend.

The patches are hemmed with an electric soldering bit, or by buckling in a spirtiera under a Bunzen gas bulb. After the seaming , the patches must be boiled in water, then rinsed to remove the dressing industrially applied on the cotton cloth. After drying at 105° C and cooling in a desiccator, the patches are weighed with the accuracy of 1 milligram and registered, as initial weight (Gi-mg).

The principle of the method used to determine the soil potential to free-fix the atmospheric dinitrogen in the soil is based on the method corrected by ȘTEFANIC G. & OPREA GEORGETA, (2010) which takes into account the idea of nitrogen determined by the classical method Kjeldahl, the nitrified dinitrogen, which is done during the incubation period of the soil sample, is also included.

RESULTS AND DISCUSSIONS

From the data presented in table 1, it can be seen that the maize from wheat rotation has positively influenced the cellulose degradation, the result being significantly different from the average, being in the value group a, while the wheat after soybean rotation has negatively influenced the cellulose degradation process, the result being very significant negative compared to the average, with a position in the value group c. At the soil samples under the monocultures of wheat and maize no significant differences were obtained from the average of the experience, these being positioned in the value group b.

Table 1

The influence of culture after precursors on the biodegradable cellulosolysis on chromic luvisol

The variant	**Biodegradable cellulose** (mg/100 mg cloth)	Difference (mg/100 mg cloth)	Segnificance
Wheat monoculture	**b** 1.60	-0.04	
Wheat after soybean	**c** 0.90	-0.74	000
Maize monoculture	**b** 1.62	0.22	
Maize after wheat	**a** 2.44	0.80	***
Average	1.64	Mt	

$DL_{5\%}$ = 0.262 mg/100 mg cloth; $DL_{1\%}$ = 0.396 mg/100 mg cloth; $DL_{0,1\%}$ = 0.638 mg/100 mg cloth

From the effected analysis, it results that the highest value of 2.44 milligrams of biodegradable cellulose/100 g soil was obtained from the soil cultivated with corn in rotation after wheat and the lowest value 0.9 mg of biodegradable cellulose/ 100 g soil was obtained from the soil cultivated with wheat in the rotation after soy.

From the data presented in table 2, it can be observed that, in terms of the average of experience, the potential of respiration activity of the soil which was under the monoculture of wheat was significant (27.52 mg CO_2/100g soil), the result of the analysis being situated in the value group a, while the potential of the respiration activity of the soil under the wheat from the rotation after soy, it was significantly more negative (20.35 mg CO_2/100 g soil), the result of the analysis being situated in the value group b. At the soil cultivated with maize in monoculture and in the rotation after wheat it can be seen that no significant differences were obtained, regarding the potential of respiration of the soil towards the average of experience. However, the potential of the respiration of the soil under the crop of maize from the rotation after wheat was bigger (25.83 mg CO_2/100g soil), the result of the analysis being situated in the value group a, comparative with the the potential of the respiration activity under the monoculture of maize (21.98 mg CO_2/100g soil), with the result of the analysis situated in the value group b.

Table. 2

The influence of the culture, after the precursors, on the respiration of chromic luvisol (Moara Domnească)

The variant	**Respiration (mg CO_2/100g soil)**	**Difference (mg CO_2/100 g soil)**	**Segnificance**
Wheat monoculture	**a** 27.52	3.60	*
Wheat after soybean	**b** 20.35	-3.57	00
Maize monoculture	**b** 21.98	-1.94	

Maize after wheat	**a 25.83**	1.91	
Average	23.91		

$DL_{5\%}$ = 2.161 mg CO_2/100 g soil; $DL_{1\%}$ = 3.272 mg CO_2/100 g soil; $DL_{0.1\%}$ = 5.256 mg CO_2/100 g soil

In table 3, it can be observed that the monoculture of wheat positively influenced the lodging process of the atmospheric dinitrogen , the result being significantly more distinct than that of the witness (the average of the experiment), being situated in the value group a. Also, in the value group a, it is also the soil under the monoculture of corn. The soil under the monoculture of maize and the wheat from the rotation after soy did not present amounts of atmospheric dinitrogen fixed with significant differences toward the average of experience. The soil under the crop of maize in rotation after wheat has influenced negatively the fixation of the atmospheric dinitrogen , the result of the analysis being significantly more negative than the average of the experiment, this being part of the value group b. In the fixation of the wheat after soy's case, the atmospheric dinitrogen did not differ from the average of the experiment, but in the multiple comparison the resulting quantities belong to the value group b.

Table 3

The influence of the culture, after the precursors, on the fixation of the atmospheric dinitrogen in the chromic luvisol

The variant	Dinitrogen (mg N/100 g soil)	Difference (mg N/100g soil)	Segnificance
Wheat monoculture	**a** 17.88	7.58	**
Wheat after soybean	**b** 6.71	-3.59	
Maize monoculture	**a** 11.82	1.52	
Maize after wheat	**b** 4.8	-5.50	0
Average	10.30	Mt	

$DL_{5\%}$ = 3.80 mg N/100g soil; $DL_{1\%}$ = 5.71 mg N/100g soil; $DL_{0.1\%}$ = 9.24 mg N/100g soil

According to the data presented in table 3, the highest amount of atmospheric dinitrogen of 17.88 mg N/100 g soil was fixed in the soil under the monoculture of wheat and the lowest amount 4.8 mg N/100 g soil, was fixed in the soil under the monoculture of maize in the rotation after wheat.

CONCLUSION

The researches on some physiological indicators of the red preluvosoil, carried out in the Farm Moara Domnească's crop field (Ilfov), allow the following conclusions to be highlighted :

1. The highest amount of biodegradable cellulose of 2.44 mg/100 g of canvas was registered in the soil cultivated with corn, and the lowest one of 0.90 mg /100 g canvas was obtained at the soil cultivated with wheat.
2. The highest values of respiration potential of the soil of 27.52 mg CO_2/100 g soil were registered at the monoculture of wheat with significant values toward the average which followed corn after wheat with 25.83 mg CO_2 /100 g soil, the results of the analysis being situated in the value group a.
3. The highest amounts of atmospheric dinitrogen of 17.88 mg N/100 g soil were registered under the monoculture of wheat, and the lowest one of 4.8 mg N/100 g soil was fixed in the soil under the crop of maize in rotation with wheat.

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