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INFLUENCE OF MINERAL NITROGEN FERTILIZATION ON THE PRODUCTION OF RAPESEED AND ITS EFFECTS ON THE FERTILITY OF REDDISH PRELUVOSOIL FROM MOARA DOMNEASCĂ - ILFOV

Liviu DINCĂ, Dumitru-Ilie SĂNDOIU, Aurelian PENESCU, Viorel Cătălin OLTENACU, Constantin DÎRLOMAN, Wilson Pedro ANTONIO

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, 011460, Bucharest, Romania

Corresponding author email: dinca_liviu84@yahoo.com

Abstract

The experiment was carried out at the Moara Domneasca - ILFOV research station in 2011-2012 cropping year. It is a kind of bi-factorial experience, type 3x4 subjected to split plots method in four repetitions and studied the following factors: A - factor - rapeseed hybrid (a1- Exagone, a2 – Extend, a3 - DK Expower) and B - factor (b1 -N0, b2 -N60, b3 -N120, b4 -N180). In the experiment we applied a general content of P60. The most productive rapeseed hybrid in the Moara Domneasca - ILFOV was Exagone which attained an average fertilizing of 41.89 q/ha production. The Nitrogen dose which achieved the highest production was N180 with 51.28 q/ha. The Correlations show the dependence of the soil-enzymes on the applied doses of nitrogen. The total nitrogen (Nt%) and the soil pH also prove to depend on the nitrogen mineral application. The catalase activity is depending on the soil pH, it has a higher value at higher pH.

Key words: *rapeseed, soil fertility, chemical fertilization, soil enzymes.*

INTRODUCTION

The recommended spacing adopted in our country in the recent years is 25 cm (Picu and Tianu, 1983, Pop, 1985; D.I. Sandoiu and al., 2003). The recommended densities in Romania are 70-110 plants/sqm (Bîlteanu, 2001, Muntean et al., 2008, Gus et al., 2003).

According to the literature review of Hera et al. (1980, 1986), Boguslawski (1965), Stefanic et al. (1965, 2006, 2011), Dinca et al. (2011, 2012), Dick (1994), Sandoiu et al. (2012), Gil-Sotres et al. (2004), Bo Liu et al. (2007), the effect of mineral fertilizers over the soil biological activity can be assessed in a variety of ways. Some researchers found stimulating influences, some inhibitory and some without any influence.

The differentiated approaches of mineral fertilizers doses arise from the theories of Liebig (mineral nutrition law) and become more consistent after the works of: Barlog et al. (2004), Bell (1970), Bilsborrow et al. (1993), Borlan and Hera (1973, 1984, 1996) Hera and Davidescu (1964), Hera et al. (1994) demonstrated that applying nitrogen to the rapeseed culture brought an increase compared to the production provided by chemically unfertilized variants.

The purpose of this paper is to highlight the best performing rapeseed hybrid in Moara Domneasca-Ilfov, to highlight the most effective nitrogen fertilization dose for a maximum yield of rapeseed and to evaluate the mineral fertilizer application effects over the fertility of reddish preluvosoil in the agricultural year 2011-2012.

MATERIALS AND METHODS

The experiment was carried out at Moara Domnească-Ilfov in the 2011-2012 cropping year, it is a bi-factorial type experience subjected to the split plots method in four repetitions and had studied the following factors: A factor-rapeseed hybrid (a_1-Exagone, a_2 – Extend, a_3-DK. Ex-power) and B factor – the nitrogen dose (b_1-N_0, b_2-N_{60}, b_3-N_{120}, b_4-N_{180}). In the experiment it was applied a general content of P_{60}. The previous crop was winter wheat. A general content of $N_{60}P_{60}$ was applied. Rapeseed is sown on 13/09/2011 and ensured a density of 70 seeds germination/m^2, harvesting was done manually in each variant experience on 13/7/2012. Soil samples were

collected on 13/09/2012 at the depth of 0-20 cm and were conditioned by the method of Peterbugski (1954) and Ştefanic (2006) and were subjected to biological analysis by Ştefanic (2006, 1994) and chemical by Elena Stoica et al. (1986), Conklin (2005), Rowell (1994).

The climatic conditions during the analyzed period are shown in the figures *1* and *2*. It is shown in May of 2012 with a rainfall surplus (112.9 mm) and the annual temperatures average exceeding the normal values. Climatic conditions are a factor with high influence over the soil characteristics and the production of rapeseed.

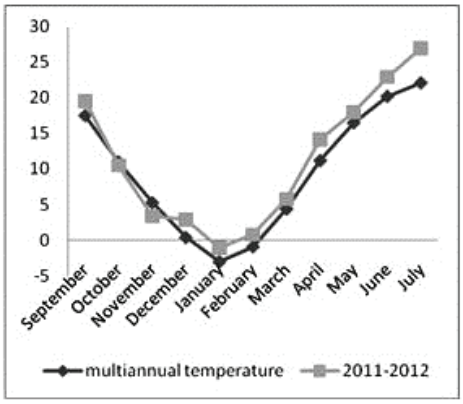

Figure 1. The monthly and multiannual average of temperatures in vegetation time of rapeseed cultures

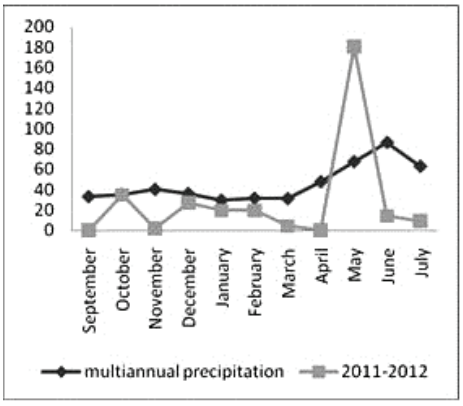

Figure 2. The monthly rainfalls and multiannual values from the vegetation time of rapeseed cultures

RESULTS AND DISCUSSIONS

1. The influence of mineral fertilization on rapeseeds hybrids.

Following the influence of the rapeseed hybrids on the average of the mineral fertilization with nitrogen (Table 1), it can be noticed that the hybrids Exagone and DK-Expower were classified in the first group with the production values of 41.89 q/ha and 40.86 q/ha, and at the lower level in the group *b* was ranged the Extend hybrid with a production value of 38.36 q/ha.

According to the fertilization influence on hybrids medium, it was observed that the application of nitrogen positively influenced the production of rapeseed, which at the application dose of N_{180} produced 51.28 q/ha, classified in the first group *a*, followed by the application of a N_{120} with production of 46.13 q/ha and was placed in values of group *b*. The unfertilized variants and the application of N_{60}-dose achieved a significantly lower production than the application of high doses of

nitrogen which were placed in the group *c* level of confidence.

According to the combined influence of the nitrogen fertilization and the rapeseed hybrid assortment on the reddish preluvosoil the Moara Domneasca differentiation observed statistical ensured results on chemical nitrogen. The best yield of unfertilized content was obtained at the hybrid Extend which was classified in the group of values *a*. At N_{60} dose application have no statistical differences on hybrids. Based on N_{120} dose application, hybrids that responded best were Exagone and DK. Expower, and with the application of N_{180} dose hybrid DK. Ex-power best performed with a production of 57.45 q/ha. The hybrids Exagone and Extend did not respond to fertilization with mineral nitrogen at N_{180} dose application DK. Ex-power hybrid responded at N_{180} dose application with the production of 57.45 q/ha which was the highest production in the experiment followed by Exagone hybrid at N_{180} with a production of 52.53 q/ha.

Table 1. The influence of mineral fertilization on hybrids variety (q/ha)

Factor A \ Factor B	b_1-N_0	b_2-N_{60}	b_3-N_{120}	b_3-N_{180}	Average A
a_1-EXAGONE	a 30.71 b	a 32.41 b	a 51.92 a	b 52.53 a	a 41.89
a_2-EXTEND	a 35.75 b	a 34.50 b	b 39.34 a	c 43.87 a	b 38.36
a_3-DK. EXPOWER	b 28.32 c	a 30.50 c	a 47.16 b	a 57.45 a	a 40.86
Average B	31.60 c	32.47 c	46.13 b	51.28 a	
DL P	A	B	B*A	A*B	
5%	1.967	4.206	6.494	7.284	

2. The influence of mineral fertilization on chemical changes in the reddish preluvosoil of Moara Domneasca-ILFOV after the first year of experimentation.

Following the influence of mineral fertilization under rapeseeds in reddish preluvosoil chemical changes at Moara Domneasca-Ilfov we witnessed statistical differences (Table 2). The nitrogen doses application has negatively influenced the pH of soil, 3 level of fertilization were placed in the group *b* values ranging from 5.31 to a N_0 variant of 4.94 at the N_{180} dose. This was observed by Sandoiu et al. (2012), Stefanic and Sandoiu (2011) at other cultures and time periods. Following the influence of mineral fertilization over the soil organic matter content showed no difference because the observation time was short. The total N content has a significant increase up to N_{120} and decrease to N_{180}. The rapport C/N showed an opposite trend, the most favorable situation was at N_{120}.

Table 2. Influence of mineral fertilization on chemical changes in the reddish preluvosoil (Moara Domneasca-Ilfov)

Experimental Variants	pH of soil	O.M (%)	Ah (m.e./100g soil)	Sb (m.e./100g soil)	T (m.e./100g soil)	V (%)	Nt (%)	C/N
N_0	a 5.31	2.37	6.85	14.09	28.96	67.26	c 0.13	a 10.70
N_{60}	b 5.04	2.34	6.42	14.76	28.68	69.70	b 0.14	b 9.93
N_{120}	b 4.95	2.37	6.71	12.58	27.13	64.60	a 0.15	b 9.18
N_{180}	b 4.94	2.31	6.56	17.78	32.02	71.69	d 0.12	a 10.77
DL P								
5%	0.077	-	-	-	-	-	0.006	0.440
1%	0.117*	-	-	-	-	-	0.008*	0.660*
0.1%	0.189	-	-	-	-	-	0.014	1.060

3. The influence of mineral fertilization over some pedo-biological changes of reddish preluvosoil in the Moara Domneasca area-ILFOV after the first year of experimentation.

The Table 3 shows the influence of mineral nitrogen fertilization over the cellulolytic activity of the reddish preluvosoil. The best response was obtained with N_{120} application. The breathing potential activity of the reddish preluvosoil responded to doses of nitrogen application, which can lead to an eventual mineralization of organic matter. Soil-enzymatic activities were negative answer to nitrogen application doses as confirmed by Boguslawski (1965) which states that the enzymes are long responsible before chemical analysis.

Table 3. The Influence of mineral fertilization on some biological changes of reddish preluvosoil in Moara Domneasca-Ilfov County

Experimental Variants	Cellulose (mg cell)	Breathing (mg CO_2/100g soil)	Catalase (cm^3 O_2/100 g soil)	Phosphatase (mg P/100g soil)	Amidase (NH_4 mg/100g soil)
N_0	b 5.16	b 39.73	a 112.02	a 2.32	b 0.28
N_{60}	b 4.80	b 40.85	b 44.48	b 0.71	a 1.16
N_{120}	a 6.48	a 49.96	b 32.88	b 0.55	a 1.01
N_{180}	c 3.30	a 53.13	c 13.12	b 0.54	b 0.22
DL P					
5%	0.786	4.160*	30.486*	0.310	0.254
1%	1.192*	6.310	46.192	0.470*	0.386
0.1%	1.916	10.140	74.243	0.750	0.620

4. The dependence of the soil fertility factors related to the application of mineral nitrogen doses.

Between the nitrogen applied doses and pH values we show a negative correlations (Figure 3). Between pH values and catalase (Figure 4) is a positive correlation and with breathing (Figure 5) a negative correlation statistical significance. Catalasic activity (Figure 6) and phosphatasic activity (Figure 7) decrease with the increasing of nitrogen doses. The amidase activity registered the maxim value at N_{60} dose and with nitrogen doses increase the amidase activity decrease with minim value at N_{180} (Table 3). The potential breathing activity is in dependence with the cellulolitic activity till its averages values (Figure 8). After due pH decreasing values the potential breathing activity increased with the increasing of fungus activity in acid soils.

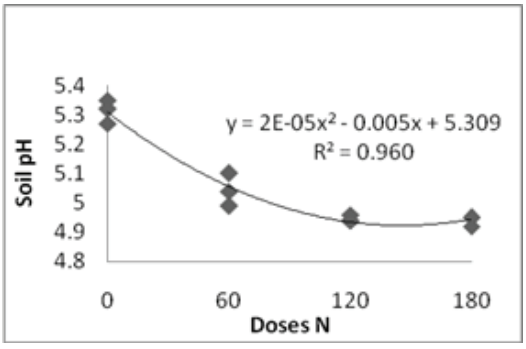

Figure 3. The influence of mineral nitrogen application on the soil pH

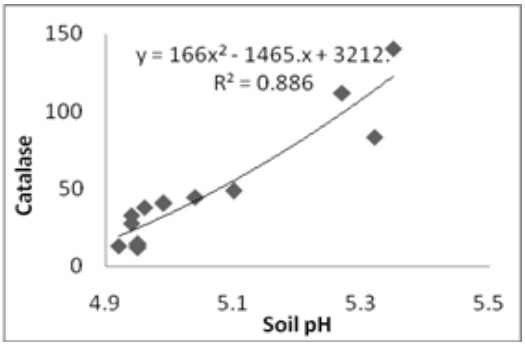

Figure 4. Dependence of catalase activities on chemical reaction of the soil

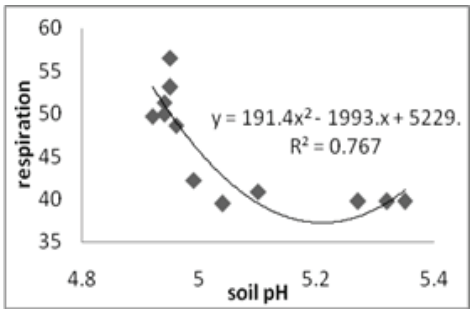

Figure 5. Dependence of breathing activities by chemical reaction of the soil

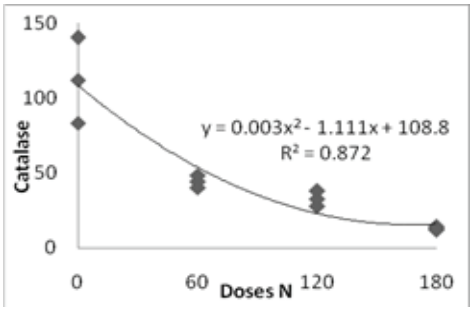

Figure 6. Dependence of catalase activities by nitrogen doses

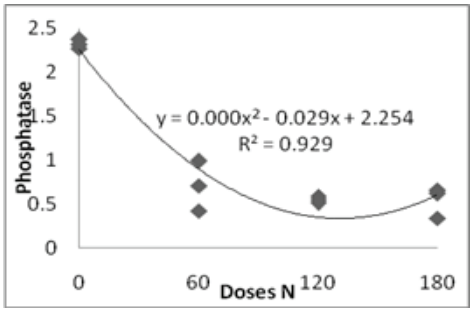

Figure 7. The influence of mineral nitrogen application on the phosphatase activity of the soil

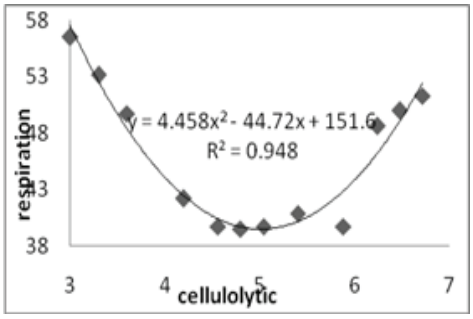

Figure 8. Dependence activities of breathing by cellulolytic activities

CONCLUSIONS

The Hybrid rapeseedseed was most productive in Moara Domneasca-ILFOV in 2011-2012 cropping year was Exagone which obtained a production average of 41.89 fertilization q/ha.

At rapeseeds hybrids the average nitrogen dose which attained the highest production was N_{180} with 51.28 q/ha.

The maximum production in experiment was 57.45 q/ha at the hybrid DK Expower and at N_{180} doses.

After the first year of experimentation the nitrogen application has negatively affected the soil pH, which decreased from 5.31 to 5.04 with N_{60} dose application to unfertilized.

The catalase activity and the phosphatase activity were sensitive to nitrogen dose application.

The Catalase activity is dependent on the soil pH, it has a higher value at higher pH.

The potential breathing activity is strictly dependent on the soil cellulolytic activity.

REFERENCES

Barlóg P., Grzebisz W., 2004. Effect of timing and nitrogen fertilizer application over the winter oilseed rape (*Brassica napus L.*). I. Growth dynamics and seed yield. Journal of Agronomy and Crop Science, 190 (5), p. 305-313.

Bell N.J., 1970. Fertilizer experiments with special crops. In: 14th Annual Manitoba Soil Science Society Proceedings. Winnipeg, Man.

Bilsborrow P. E., Evans E.J., Zhao F.J., 1993. The influence of spring nitrogen over yield, yield components and glucosinolate content of autumn-sown oilseed rape (*Brassica napus*). Journal of Agricultural Science-Cambridge, 120, p. 219-219.

Bîlteanu G., 2001. Fitotehnie vol. 2. Ed. Ceres Bucuresti.

Borlan Z., Hera C., 1973. Metode de apreciere a starii de fertilitate a solului in vederea folosirii rationale a ingrasamintelor. Ed. Ceres Bucuresti.

Borlan Z., Hera C., 1984. Optimizarea agrochimica a sistemului sol-planta. Editura Academiei Republicii Socialiste România.

Borlan Z., Gavrilita I., Stefanescu D., Nebunelea D., 1996. Fertilization within Sustainable Crop Production System, I. Phosphorus; Soil Science; XXX, nr. 2, p. 27-44.

Ciontu C., 2005. Agricultura ecologica a rapitei si biocarburantii. Proiect 'Sprijinirea serviciilor în agricultura finantat de MAPDR si THE WORLD BANK'.

Conklin A., 2005. Introduction to Soil Chemistry: Analysis and Instrumentation, Wiley Interscience.

Davidescu D., Hera C., 1964. Eficienta diferitelor forme de îngrasaminte cu azot asupra principalelor plante de cultura. Lucrari stiintifice IANB, Vol. VII, Bucuresti.

Diaconu P., 2006. Rapita-sursa importanta pentru biodisel. Dezvoltarea Biocombustibilului în Europa, Seminar International.

Dick R.P., 1994. Soil enzyme activities as indicators of soil quality. SSSA special publication.

Dinca L., Sandoiu D.I., Stefanic G., 2011. Influence of organic and mineral fertilization on the level of soil fertility in a long duration experiment in Moara Domneasca-ILFOV, UASVM Bucharest, Series A, Vol. LIV, p. 211-216.

Dinca L., Sandoiu D.I., Stefanic G., Ciontu C., 2013. Modification of some chemical and physiological characteristics of reddish preluvosol, produced by the system of soil basic tillage and fertilization. http://www.incda-fundulea.ro.

Dinca L., Sandoiu D.I., Stefanic G., Obrisca M., Pârvan L., 2012. Influence of organic and mineral fertilization on biotic potential in a long-term experiment from Moara Domneasca-ILFOV, Analele Universitatii din Craiova, seria Agricultura-Montanologie-Cadastru Vol. XLII-2012/1, 174-178.

Gil-Sotres F., Trasar-Cepeda C., Leirós M.C., Seoane S., 2005. Different approaches to evaluating soil quality using biochemical properties. Soil Biology and Biochemistry, 37 (5), p. 877-887.

Gus P., Cordos N., Mihaiu I., Rusu T., Ivan I., 2003. Rapita-tehnologie de cultivare. Aliment si combustibil. Ed. Risoprint, Cluj-Napoca.

Hera C., Chirita V., Ghinea, L., 1986. Optimizarea regimului azotului din sol prin folosirea inhibitorilor enzimatici. 1. Influenta inhibitorilor enzimatici asupra dinamicii nitratilor din sol si productiei agricole, Prob. Agrofitotehn. Teor. Apl. (Fundulea), 8, p. 135-152.

Hera C., Eliade G., Ghinea L., Popescu A., 1994. Asigurarea azotului necesar culturilor agricole, Ed. Ceres, Bucuresti.

Hera C., Kiss S., Calancea L., Dragan-Bulandra M., Radulescu D., Bologa M., Firu V., Ghinea L., Heidel H., Popescu A., 1980. Inhibitor al hidrolizei ureei în sol, Brev. inv. România, No. 68,084.

Liu B., Gumpertz M.L., Hu S., Ristaino J.B., 2007. Long-term effects of organic and synthetic soil fertility amendments on soil microbial communities and the development of southern blight.Soil Biology and Biochemistry, 39 (9), 2302-2316.

Munteanu L.S., Cernea S., Morar G., Duda M., Vârban D., Muntean S., 2008. Fitotehnie, Ed. Academic Pres, Cluj-Napoca.

Peterbugski D.A.V., 1954. Manual de lucrari practice la Chimia Agricola, Ed. Agro-silvica de stat, Bucuresti.

Picu I., Tianu A., 1983. Aspecte privind cultura rapitei de toamna pentru ulei, Rev. Cereale si plante tehnice nr. 8.

Pop I., 1985. Influenta unor elemente tehnologice asupra productiei de rapita de toamna, An. INCDA Fundulea Vol. LII.

Rowell D.L., 1994. Soil Science Method & Applications, Ed. Longman Group UK.

Sandoiu D.I, Dinca L., Stefanic G., Ciontu C., Penescu A., 2012. Effect of organic and mineral manuring on microbial processes of reddish preluvosoilin Romanian field after 19 years of experimentation, Proc. Rom. Acad., Series B, 2012, 14 (3), p. 245-249.

Stefanic G., 1994. Biological definition, quantifying method and agricultural interpretation of soil fertility. Romanian Agriculture Research 2; 107-116.

Stefanic G., 2006. Metode de Analiza a solului (Biologica, Enzimatica si chimica), Prob. Teor. si Aplic. Agrofitotehnice Fundulea.

Stefanic G., Jarnea S., Tomescu E., 1965. Total soil phosphatasic capacity., Symp. on method in soil biology., Bucharest, p. 145-149.

Stefanic G., Sandoiu D.I., 2011. Biologia Solurilor Agricole, Ed. Elisavaros Bucuresti.

Stefanic G., Sandoiu D.I., Gheorghita N., 2006. Biologia Solurilor Agricole, Ed. Elisavaros Bucuresti.

Stoica E., Rauta C., Florea N., 1986. Metode de analiza chimica a solului, Bucuresti.

Von Boguslawski E., 1965. Zur Entwicklung des Begriffes Bodenfruchtbarkeit. Zeitschrift für Pflanzenernährung, Düngung, Bodenkunde, 108 (2), p. 97-115.