Scientific Papers. Series A. Agronomy, Vol. LXIV, No. 2, 2021
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESEARCH ON THE INFLUENCE OF TECHNOLOGICAL LINKS ON OIL RAPESEED PRODUCTION

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Abstract

Research carried out in the Western Plain of Romania, on a soil of carbonate chernozem type, wet, weakly salinized, in sodium depth, aimed to make contributions to the oil rapeseed cultivation technology, a culture particularly important for the area, on optimizing nitrogen fertilization and determining the type of fertilizer - ammonium nitrate or ammonium sulphate - for the above mentioned soil conditions, under the conditions of fattening a constant phosphorus and potassium background ($P_{80}K_{80}$), as well as the influence on production according to the date of operation and depth of the basic ploughing. The results showed that the application of nitrogen fertilizers in the form of ammonium sulphate was superior to the one of ammonium nitrate by 8%. Also, the results according to the period of execution of the basic ploughing emphasize the importance of carrying out this important work as early as possible, so that by the date of sowing to sit down and accumulate as much water in the soil.

Key words*: nitrogen fertilization, Timis Plain, Romania.*

INTRODUCTION

Due to the widespread use of rapeseed and for the purpose of producers of biodiesel and bioethanol, it is observed or continuous growth of cultivated areas (Fridrihsone et al., 2020; Zhang et al., 2013).

Oil rapeseed is a crop that reacts very well to mineral fertilization, but it is very important in addition to determining the time of application, also the correlation of the type of fertilizer, according to the type of soil and especially the soil reaction (Haneklaus et al., 1999; Wang et al., 2010; Matei et al., 2017; Louvieaux et al., 2020; Men et al., 2020).

Climate change in recent times also has a detrimental influence on rapeseed production, especially in very dry autumns when the percentage of plants rising is very low (Bătrâna, et al., 2020; Eyni Nargeseh et al., 2020).

In the current context, characterized by long periods of drought, the establishment of autumn rapeseed crops can raise many problems related to the performance of the ploughing, the establishment of the depth and the period of execution, in order to combat weeds on one hand, and on the other one, to favour the accumulation of as much water in the soil as possible, as well as to preserve the existing moisture in the soil favouring a good growth of the culture (Grosz et al., 2011; Șmuleac et al., 2020; Bečka et al., 2021).

MATERIALS AND METHODS

The research carried out in the salinized soils area had the following goals: to determine the efficiency of the doses and of the types of nitrogen fertilizer used in the salinized soil area on oil rapeseed cultures; to do research regarding the influence of the execution period, of the ploughing depth and of the salinized soil area on the oil rapeseed yield.

In order to find an answer to these questions the cultures have been organized in the Timiş Plain, on a wet phreatic carbonate chernozem, poorly salinized in its depth. The experiments have been bifactorial and there have been done three repetitions. The experiments done based on the nitrogen fertilization were:

A Factor – the type of nitrogen fertilizer used: a_1 - ammonium nitrate; a_2 - ammonium sulphate.

B Factor - the doses of nitrogen applied on a constant base of $P_{80}K_{80}$: b_1 - N_0; b_2 - N_{50}; b_3 -

N_{100}; b_4 - N_{150}; b_5 - N_{200}. There have been done research regarding the settlement of the date on which the ploughing should be done and of the ploughing depth for the crops and there have been organized bifactorial experiments with three repetitions.
The factor graduations were the following: A Factor - the ploughing date: a_1 - 10-15 July; a_2 - 10-15 August; a_3 - 10-15 September.
B Factor - the ploughing depth: b_1 - 18-20 cm; b_2 - 23-25 cm; b_3 - 28-30 cm.

RESULTS AND DISCUSSIONS

Synthesis data on the harvests obtained according to the doses of fertilizers used, the yield obtained were between 992 kg/ha (N_0) and 4537 kg/ha (N_{200}), when fertilization was done with ammonium nitrate and between 992 kg/ha (N_0) and 4716 kg/ha (N_{200}) when fertilization was done with ammonium sulphate (Table 1).
On an average, on the applied nitrogen doses, by using the ammonium sulphate, conducted to a harvest increase of 5%, resulting in a significant difference of 179 kg/ha.
The harvest differences according to the nitrogen fertilizer dose applied, on an average on the two types of fertilizer, were of 1300 kg/ha in the variant fertilized with N_{50}, 2362 kg/ha in the fertilized variant with N_{100}, 2898 kg/ha in the fertilized variant with N_{150} and 3635 kg/ha, in the fertilized variant with N_{200}.
One may notice that all crop differences, depending on the nitrogen dose, are ensured as very significant.
The results lead to the conclusion that rapeseed for oil under the conditions of carbonate chernozem, poorly salinized, capitalize very good the nitrogen fertilizers.
Synthesis data on the evolution of the oil content highlight the negative influence of nitrogen fertilizers that caused the content's decrease, together with the increase in doses (Figure 1).
In the researched field, with the use of ammonium nitrate the decreased oil content was from 42.3 (N_0) to 38.8% (N_{200}), and in the fertilized variants with ammonium sulphate the decrease was 42.3% (N_0) to 39.5% (N_{200}). It results that in the use of ammonium nitrate the decrease of the oil content was 0.7% higher (at the N_{200} dose level) compared to the use of the same dose but under the form of ammonium sulphate.
Oil production points out that in the researched area N_0 - N_{200} oil production ranged from 420 kg/ha to 1760 kg/ha when the application was made under the form of ammonium nitrate and between 420 kg/ha and 1863 kg/ha, when the application was made in the form of ammonium sulphate (Table 2). On an average, on the applied doses, oil production was 6% higher when the application was made under the form of ammonium sulphate, compared with the one under the form of ammonium nitrate application.
In conclusion, nitrogen fertilisers negatively influenced the seed oil content due to the favourable effect on the crop and have determined the increase of oil production with very significant differences towards the control (N_0) by 536 kg/ha (N_{50}), 942 kg/ha (N_{100}), 1121 kg/ha (N_{150}) and 1392 kg/ha (N_{200}).

Table 1. The syntheses of the yield results obtained for the oilseed rape according to the type of the used nitrogen fertilizer and to the used fertilizer doses

Factor A Type of fertilizer	Factor B - Nitrogen doses on the merits of $P_{80}K_{80}$					Average Factor A			
	No_0	No_{50}	No_{100}	No_{150}	N_{200}	Crop (kg/ha)	%	Difference (kg/ha)	Significance
Ammonium nitrate	992	2172	3240	3824	4537	2953	100		
Ammonium sulfate	992	2412	3467	3955	4716	3108	105	179	X

DL 5% = 168 kg/ha; DL 1% = 210 kg/ha; DL 0.1 % = 273 kg/ha

Average Factor B

Specification	No_0	No_{50}	No_{100}	No_{150}	N_{200}
Crop kg/ha	992	2292	3354	3890	4627
%	100	231	338	392	466
Difference		1300	2362	2898	3635
Significance		XXX	XXX	XXX	XXX

DL 5% = 191 kg/ha DL 1% = 252kg/ha DL 0.1% = 327 kg/ha

Table 2. The syntheses of the oil production results obtained for the oilseed according to the used type of nitrogen fertilizer and to the experimented fertilizer doses

Factor A Type of fertilizer	Factor B - Nitrogen doses on the merits of $P_{80}K_{80}$					Average Factor A			
	No_0	No_{50}	No_{100}	No_{150}	N_{200}	Crop (kg/ha)	%	Difference (kg/ha)	Significance
Ammonium nitrate	420	904	1312	1507	1760	1180			
Ammonium sulfate	420	1008	1411	1574	1863	1255	106	75	

DL 5% = 83 kg/ha; DL 1% = 127 kg/ha; DL 0,1 % = 164 kg/ha

Average Factor B

Specification	No_0	No_{50}	No_{100}	No_{150}	N_{200}
Crop kg/ha	420	956	1362	1540	1811
%	100	228	324	367	324
Difference		536	942	1121	1392
Significance		XXX	XXX	XXX	XXX

DL 5% = 87 kg/ha; DL 1% = 123kg/ha; DL 0,1 % = 176 kg/ha

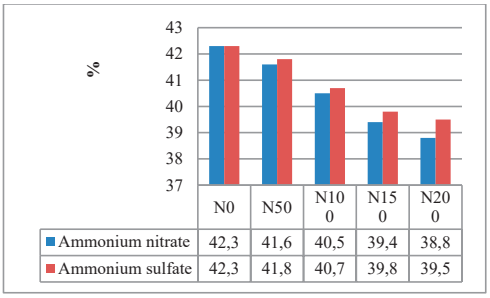

Figure 1. The rapeseed oil content variation according to the type of nitrogen fertilizer and to the applied fertilizer doses

The results obtained according to the depth of the ploughing and the date of its completion underline the importance of carrying out this important work as early as possible, so that by the date of sowing the land settles and accumulates as much water in the soil (Table 3). Compared to the ploughing carried out in mid-July, by delay of one month, the harvest decreased by 12% namely by 348 kg/ha. The delay in the completion date until the end of August increased crop losses by 28%, resulting in a decrease of 794 kg/ha.

The increase in the depth of ploughing execution from 18-20 cm to 23-25 cm increased the harvest by 11%, returning a difference of 238 kg/ha. Increasing the depth of the work to 28 to 30 cm contributed to the increase of the harvest by 21%, respectively by 477 kg/ha.

The results obtained show that the date of execution of the ploughing and the depth of its performance to the limit where there is no danger of bringing to the surface the layer with higher concentration of salts, represents for rapeseed an important link in the chain of cultivation technology.

Table 3. The syntheses of the results obtained for the oilseed rape in according to the date and to the depth of the basic ploughing

Factor A Date	Factor B - Depth (cm)			Average Factor A			
	18 - 20	23 - 25	28 - 30	Crop (kg/ha)	%	Difference (kg/ha)	Significance
10.07 – 15.07	4593	4872	5049	4838	100		
10.08- 15.08	4295	4468	4706	4490	88	- 348	0
15.08 – 30.08	3770	4030	4333	4044	72	- 794	000

DL5% = 214 kg/ha DL 1% = 354 kg/ha DL 0.1% = 649 kg/ha

Average Factor B

Crop (kg/ha)	4219	4457	4696
%		111	121
Difference (kg/ha)		238	477
Significance		XXX	XXX

DL 5% = 58 kg/ha DL 1% = 82 kg/ha DL 0.1% = 115 kg/ha

CONCLUSIONS

The application of nitrogen fertilisers in the form of ammonium nitrate and ammonium sulphate with doses of N_{50}-N_{200} on the background of $P_{80}K_{80}$ provided harvest increases between 70% (N_{50}) and 466% (N_{200}).

The application of nitrogen fertilisers in the form of ammonium sulphate was superior to the application in the form of ammonium nitrate by 5% and with a significant difference of 179 kg/ha.

The rapeseed oil content ranged from 42.3% (N_0) to 38.8% (N200) when the ammonium nitrate was used also between 42.3% (N_0) and 39.5% (N_{200}) when ammonium sulphate was used.

Although nitrogen fertilizers negatively influenced the rapeseed oil content, intended for the favourable effect on the seed harvest, they increased oil production with very significant differences towards the control, by 536 kg/ha for the N_{50}, by 942 kg/ha for the N_{100}, by 1121 kg/ha for the N_{150} and by 1392 kg/ha for the N_{200} fertilised variants.

The date of the autumn rapeseed ploughing is of a particular importance given the early sowing of this crop. The delay of the ploughing effect until the end of August results in harvest losses of 794 kg/ha.

The depth of execution of the ploughing up to 28-30 cm, the depth to which there is no danger of bringing the layer with high concentration of salts, determined the growth by 21% of the harvest, compared to a ploughing of 18-20 cm.

REFERENCES

Bătrîna, Ş.L., Jurcoane, Ş., Popescu, I., Marin, F., Imbrea, I.M., Crista, F., Pop, G., Imbrea, F., (2020). *Camelina sativa*: A study on amino acid content. *Romanian Biotechnological Letters*, 25(1): 1136–1142.

Bečka, D., Bečková, L., Kuchtová, P., Cihlář, P., Pazderů, K., Mikšík, V., & Vašák, J. (2021). Growth and yield of winter oilseed rape under strip-tillage compared to conventional tillage. *Plant, Soil and Environment*, 67(2): 85–91.

Eyni Nargeseh, H., Aghaalikhani, M., Shirani Rad, A.H., Mokhtassi-Bidgoli, A, Modarres-Sanevi, A M. (2020). Comparison of 17 Rapeseed Cultivars under Terminal Water Deficit Conditions Using Drought Tolerance Indices. *JAST*, 22(2): 489–503.

Fridrihsone, A., Romagnoli, F., Cabulis, U., (2020). Environmental Life Cycle Assessment of Rapeseed and Rapeseed Oil Produced in Northern Europe: A Latvian Case Study. *Sustainability*, 12: 5699.

Grosz, D., Borcean, I., Tabara, V., Imbrea, F., & Marian, F. (2011). Researches regarding the interaction between cultivating variety-fertilized-planting distance between rows at the oilseed rape. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Agriculture*, 68(1): 144–148.

Haneklaus, S., Paulsen, H. M., Gupta, A. K., Bloem, E., & Schnug, E. (1999, September). Influence of sulfur fertilization on yield and quality of oilseed rape and mustard. In Proceedings of the 10th International Rapeseed Congress (pp. 26–29).

Louvieaux, J., Leclercq, A., Haelterman, L., Hermans, C. (2020). In-Field Observation of Root Growth and Nitrogen Uptake Efficiency of Winter Oilseed Rape. *Agronomy*, 10: 105.

Matei, G., Dodocioiu, AM., Imbrea, F., Dobre, C.Ş. (2017). The productivity of some rapeseed genotypes in the climatic conditions of ARDS Caracal. *Research Journal of Agricultural Science*, 49(1), p. 3.

Men, S., Chen, H., Chen, S., Zheng, S., Shen, X., Wang, C., Liu, D. (2020). Effects of supplemental nitrogen application on physiological characteristics, dry matter and nitrogen accumulation of winter rapeseed (*Brassica napus* L.) under waterlogging stress. *Scientific Reports*, 10(1): 1–10.

Şmuleac, L., Rujescu, C., Şmuleac, A., Imbrea, F., Radulov, I., Manea, D., Ienciu, A., Adamov, T., Paşcalău, R., (2020). Impact of Climate Change in the Banat Plain, Western Romania, on the Accessibility of Water for Crop Production in Agriculture. *Agriculture*, 10(10): 437.

Wang, Y., Lu, J., Li, X., Liu, W., Ma, C., & Gao, X. (2010). Effects of drought stress during overwintering on fertilizer use efficiency of rapeseed (*Brassica napus*). *Plant Nutrition and Fertilizer Science*, 16(5): 1203–1208.

Wick, K., Heumesser, C., Schmid, E., (2012). Groundwater nitrate contamination: Factors and indicators. *J. Environ. Manag.*, 111: 178–186.

Zhang, H., Berger, J.D., and Milroy, S.P. (2013). Genotype×Environment Interaction Studies Highlight the Role of Phenology in Specific Adaptation of Canola (*Brassica napus*) to Contrasting Mediterranean Climates. *Field Crops Res.*, 144: 77–88.