

THE INFLUENCE OF FERTILIZERS ON OILSEED RAPE IN KASTANIOZIOM SOIL CONDITIONS FROM CERNA – TULCEA

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Abstract: The latest increasing interest on oilseed rape (III rd oil producing crop in the world) crop impose the better knowing of its technology, especially the fertilizer use. Taking account the lack of research results on this issue in our country and worldwide on kastanioziom soil type from Dobrogea we have initiated experiments on the effect of several potassium fertilizer doses on this type of soil from Cerna commune, District Tulcea. The researches have been made on a stationary experiment with two factors: the A factor – the potassium dose as potassium chlorure and the B factor – the nitrogen dose, using ammonium nitrate with 34.5% N. The cropkind was Triangle, with 50-70 germinable seeds/s.m., at 25 cm between rows, using 2.8 kg seeds/ha. The surface of an experimental plot was 35 s.m. (3.5 m x 10 m). The novelty of these researches has been the using of several doses of potassium as potassium chlorure, both alone and along with nitrogen in the conditions of assuring phosphorus needs from soil reserves due to a good soil supplying degree in this element (51-67 ppm P). The researches have been focused on the following aspects:- the

determination of some productivity element as: nr of plants per s.m. after emerging, begining of winter, begining of spring, average number of branches and flowers per plant and average number of pods and seeds per plant, average yield per plant; - the average yield per hectare and its quality by determining: the hectolitric mass, the mass of 1000 seeds, the oil content in %; The researches have been carried out within 2008-2010 period and are the first for their kind in this area having a high importance for loco growers who crop the land without an agrochemical study of the soil and without applying potassium fertilizers whose content in soil is scarce and that is absolutely necessary in the metabolism of fats, respectively, in the increasing of the oil content used as biodiesel. From this point of view, the paper is original because there were not published such researching results so far. The importance of the paper is given by the fact that it responds to problems related to the rational use of fertilizers to oilseed rape, contributing to the improving of technology of this crop.

Key words: oilseed rape, kastanioziom, nitrogen fertilizer, potassium fertilizer, productivity elements, pods

INTRODUCTION

The oilseed rape is the fifth largest food oil crop in the world and the third as biodiesel production. The oilseed rape oil has wide uses in industry and as food: the cattle cakes that remain after oil extraction are a good fodder for animals, being rich in protein (38-42%), sugars (17-18%) and minerals, the oilseed rape straw are used in construction industry. This crop is harvested early allowing good conditions for winter wheat and barley; it is an excellent crop for bees (aprox. 50 kg honey/ha).

Due tu these facts and, especially, to biodiesel production, according to EU Directive 2003/30/CE related with green fuels, the surface cropped with oilseed rape has increased from 300 ha in 1995 to 80,000 ha with an average yield of 2,090 kg/ha.

The oilseed rape is a high consuming crop of nutrients, 30-55 kg N, 20-23 kg P₂O₅ and 38-65 kg K₂O per tone. In these conditions there appear the need of establishing the most appropriate doses of nitrogen and potassium in order to improve the cropping technology of this culture in our country.

MATERIAL AND METHODS

In order to establish the most efficient doses of nitrogen and potassium in the conditions of ensuring the phosphorus from soil reserve we have experimented within 2008-2010 period on the kastanioziom soil from Cerna commune, District Tulcea, several nitrogen and potassium doses in an area where oilseed rape is largely cropped.

The trial has comprises two factors as follows:

-the A factor – the potassium fertilizer with three graduations: a₁ K₂O – 0; a₂ K₂O – 50; a₃- K₂O-100 as potassium chlorure 40% imported from Italy; - the B factor – the nitrogen dose with five graduations: b₁- N=0; b₂- N=16; b₃- N=50; b₄- N=100; b₅- N=150, ammonium nitrate 34,5%.

The experiment has comprised 15 variants of these factors in three replications, one variant (plot) having 3.5 m x 10 m. The hybrid was Triangle from KWS Company that was seeded at 25 cm between rows, using 2.8 kg seeds/ha, with a density of 50-70 germinable seeds/s.m.

The soil where the experiment was carried out is a calcaric kastanoziom with the following horizons: Amp-Am-A/C-C_K-C_{Ca} and the following phisico-chemical features:

Table 1

The phisico-chemical features of the calcaric kastanoziom from Cerna – Tulcea

Horizon	Amp	Am	A/C	C _K	C _{Ca}
Depth	0-13	13-27	27-44	44-62	62-85
Thick sand (2-0.2mm)%	0.4	0.3	0.3	0.2	0.2
Fine sand(0.2-0.02mm)%	64.5	63.5	65.4	70.5	68.5
Silt(0.02-0.002mm)%	16.4	18.4	18.4	15.9	19.4
Clay(<0.002mm)%	18.9	17.4	15.9	13.4	11.9
pH<H ₂ O	8.1	8.1	8.3	8.2	8.3
CaCO ₃ %	2.5	3.3	6.4	6.7	12.4
Humus	1.9	1.8	1.2	1.1	
Nt%	0.092	0.086	0.058	0.053	
P mobile ppm	67	51	33	32	
K mobile ppm	217	103	81	78	

The climate where the trials took place has a pronounced aridity, with 400 mm rainfall, solar radiation of 400-500 kJ/cm², the average annual temperature of 11.3⁰C, with a minimal temperature of -26.8⁰C and a maximal one of 39.8⁰C.

As regard the climatical conditions, the two years of trials where average; this thing is shown in the following table:

Table 2

The clime data as compared with the average of the zone, rainfall (a)

Year month	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	Total
2008-2009	41.1	31.9	38.0	34.2	35.6	32.4	27.6	27.2	33.4	38.7	52.2	46.7	439
2009-2010	47.6	36.0	33.1	24.0	33.7	39.5	24.0	32.7	32.0	46.9	63.0	53.5	466
Average	31.0	42.0	25.2	36.5	39.9	33.8	35.7	30.6	34.5	41.9	51.9	42.8	445

Table 2

The climate data as compared with the average of the zone, temperatures (b)

Year month	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	Total
2008-2009	22.1	17.6	11.8	6.0	1.5	1.6	0.2	4.4	10.4	16.5	20.2	21.9	11.18
2009-2010	21.8	18.2	11.9	5.4	1.2	1.2	0,1	4.8	9.8	16.7	19.9	21.5	11.04
Average	21.6	17.3	11.6	6.1	1.6	1.4	0.1	4.3	9.6	15.8	19.9	22.4	10.97

RESULTS AND DISCUSSIONS

The average yield

The A factor, potassium doses has decisively influenced the oilseed rape, the variants fertilized with the highest dose of K₂O have given 2.763 kg/ha that is significant, 670 kg/ha higher than the unfertilized control variant (table 3).

Table 3

The influence of the A factor (K₂O dose) on the oilseed rape yield (2008-2010)

Factor A	Yield			Sign.
	Kg/ha	%	Dif.	
a ₁ - K 0(Ctrl.)	2,092.9	100	Ctrl.	-
a ₂ -K 50	2,355.4	112.6	262.4	-
a ₃ - K 150	2,763.5	132.0	670.5	**
DL5%=339.11; DL1%=459.63; DL0.1%=769.15 kg/ha				

The B factor, nitrogen dose has, also, influenced the oilseed rape yield yet not in the same measure as potassium. Thus, with the unfertilized control variant there are obtained 2,076 kg/ha and with N 150 there were obtained 2,541.7 kg/ha (table 4).

Table 4

The influence of B factor (nitrogen dose) on the oilseed rape (2008-2010)

Factor B	Yield			Sign.
	Kg/ha	%	Dif.	
b ₁ - N ₀ (Ctrl.)	2,076.11	100		-
b ₁ - N ₁₆	2,316.60	111.56	240.44	-
b ₁ - N ₅₀	2,440.72	117.53	364.69	-
b ₁ - N ₁₀₀	2,401.94	115.65	325.89	-
b ₁ - N ₁₅₀	2,541.77	122.40	465.67	*
DL5%=370.18; DL1%=489.11; DL0.1%=785.16 kg/ha				

The interaction between nitrogen and potassium emphasizes the fact that in K 0 N 0 to N 150 conditions the yields are between 1,868.33-2,171.66 kg/ha and with K 50 N 0- to N 150 the yields ranged from 1,850 – 2,383 kg/ha and with the k 100 and N 0 to N 150 there are obtained the highest yields, of 2,510 to 3,070 kg/ha that demonstrates that the interaction between nitrogen and potassium is linked, see (JENMA, 1972, BESSON, 1985) (table 5).

The hectolitic mass

The hectolitic mass with the 15 variants taken in study has varied in close limits, between 64.36 with the not fertilized variant and 61.33 kg/ha with k 100 N 50. All other variants have given higher yields than the not fertilized control variant (table 6).

Table 5

The interaction between A and B factors (potassium and nitrogen) with the oilseed rape crop in 2008-2010 period

Researched factors		Average yield, kg/ha	Diff.	%	Sign.
A-K ₂ O dose	B-N dose				
a1K ₂ O = 0	N0	1,868.33	-	-	-
	N16	2,216.66	348.33	111.5	-
	N50	2,187.83	319.50	117.5	-
	N100	2,020.50	152.17	115.6	-
	N150	2,171.66	303.33	122.4	-
a1K ₂ O = 50	N0	1,850.00	-	-	-
	N16	2,184.83	334.83	118.0	-
	N50	2,290.50	440.50	123.8	*
	N100	2,340.00	490.00	126.4	*
	N150	2,383.33	533.33	128.8	**
a1K ₂ O = 100	N0	2,510.00	-	-	-
	N16	2,548.33	38.33	101.5	-
	N50	2,843.83	333.83	113.3	-
	N100	2,845.33	335.33	113.3	-
	N150	3,070.33	560.33	122.3	*
DL5%=338.18; DL1%=474.11; DL0.1%=669.15 kg/ha					

Table 6

The variation of the hectolitic mass and the oil content in function of the fertilizers doses

	Fertilizer doses														
	K0					K50					K100				
	N0	N16	N50	N100	N150	N0	N16	N50	N100	N150	N0	N16	N50	N100	N150
Oil,%	40.0	40.6	41.1	41.2	41.2	41.3	41.2	41.4	41.4	41.4	41.3	41.6	41.6	42.0	42.3
H. mass	64.3	65.2	64.9	64.9	65.0	64.9	65.0	65.2	65.3	65.3	64.9	65.2	65.3	65.3	65.2

The oil content has been directly influenced by the fertilizer doses. The highest difference between the not fertilized variant and the fertilized ones has been of 2.21%, between KON0 and K100N150 where the oil content reaches 42.26%.

CONCLUSIONS

The applied fertilizers and especially the potassium ones have contributed to the increasing of the oilseed rape yield. Thus, the applying of K100 has determined the obtaining of 2,763 kg/ha, 670 kg/ha higher than with K0 which is a significant difference.

The applying of nitrogen fertilizers as N150 dose has determined the obtaining of 2,541 kg/ha yield, 465 kg/ha more than the not fertilized variant.

The interaction between potassium and nitrogen can determine the highest outputs. Thus, with K50N100 the yield outputs are 26% and with K100N150 of 22%, the yields being the highest, of 2,340 and 3,070 kg/ha.

The oil content from oilseed rape has increased along with the applying several fertilizer doses to K100N150, reaching 42.26%, 2.2% higher than KON0.

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