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OIL FLAX CROP CAPACITY FORMATION DEPENDING ON MINERAL NUTRITION IN THE CONDITIONS OF THE WESTERN FOREST STEPPE

Presented below are the results of the research into the effect of leaf-feeding with carbamide, $MgSO_4$ and oil nutrivant plus followed by complete mineral fertilizing ($N_{60}P_{30}K_{60}$) on oil flax crop capacity in the conditions of the Western forest steppe.

Key words: *fertilizing, oil flax, elements of crop efficiency, crop capacity.*

One of the elements of the technology of oil flax growing is the system of application of fertilizers. To increase the efficiency of oil flax growing technology it is necessary to select optimal doses and provide optimal essential nutrition elements correlation [3, 5].

To form one ton of seeds oil flax needs 55-65 kg of nitrogen, 10 - 25 kg of phosphorous and 40 – 50 kg of potassium. Fixation of nutrients in all phases of the development is uneven. A small amount is assimilated within the period from coming-up to budding; the assimilation of nutrients is in its maximum at the stage of blossoming. The increase in crop capacity and quality of produce is achieved by leaf-feeding of oil flax which provides a good development of plants and the richest yield. [7, 8].

The best nitrogen fertilizer for leaf-feeding is carbamide. The fertilizer contains the most assimilated form of nitrogen – amide nitrogen which is fast to penetrate through the surface of leaves. It is reasonable to apply carbamide along with $MgSO_4$ and microelements [2, 5, 6].

The traditional system of fertilizing being applied, oil flax is not able to provide high crop capacity and the quality of produce. The efficient solution to the above problem is leaf-feeding which helps the intensive growth of the plant, enables active and effective interference with the crop capacity formation and the quality of produce. That is why determination of the optimal norm of fertilizers for oil flax in the specific soil and climate conditions is essential to obtain rich crops of the plant.

Taking into consideration all above mentioned the aim of the research was to determine the influence of leaf-feeding against mineral fertilizing ($N_{60}P_{30}K_{60}$) on the crop capacity and the quality of oil flax seed in the conditions of the Western forest steppe.

The research into the influence of fertilizing on the crop capacity of oil flax was carried out in 2012-2013 on the experimental grounds of the Institute of Agriculture of the Carpathian region of National Academy of Agricultural Sciences on grey forest surface gley soil with the following agrochemical characteristics (reference to the experiment) layer – 0-20 cm: humus content (according to Tiurin) – 1,85%, a sum of imbided bases 23,2 mg-equiv per 100 g of soil, alkali hydrolyzed nitrogen (according to Cornfield) – 91,6 mg/kg, moving forms of phosphorous and exchange potassium (according to Kirsanov) – 69,0 and 68,0 mg/kg correspondingly. According to the modern scale such soil has a very poor rate of nitrogen and potassium, and the average rate of phosphorous. The reaction of the soil solution (pH sal. – 5,75) is subacid close to neutral.

For years of the research the preceding crop of oil flax has been winter wheat. The cultivation of the soil included the following steps: shallow ploughing of stubble, under-winter ploughing 20-22 cm deep, two cultivations in spring – the first is 8-10 cm deep, the second one is the depth of the seed burying along with harrowing and rolling by star-wheeled rollers. Along with pre-sowing cultivation there were applied mineral fertilizers according to the experiment scheme. The statistic data processing was carried out according to the method of B.A.Dospekhov (1982) [4].

The territory of the Western forest steppe belongs to the warm temperate and sufficiently humid climatic zone with 670-680 mm precipitation out of which 72% is recorded in the warm period, the sum of temperatures over $10\ ^0$ C above zero is 2300-2600 ^{0} C, hydrothermal coefficient is 1,5- 1, 8. Such weather conditions are favourable for good growth and development of oil flax.

The results of the research reveal the fact that oil flax is rather sensitive to mineral fertilizing.

The application of fertilizers in the fields of flax influenced the formation of density of plants (table 1). Thus, after coming-up and before harvesting the density was high in all variants by 0,41 – 0,49 pcs/m^2 and by 0,54 – 0,72 pcs/m^2 correspondingly; as for control of fertilizers (without fertilizers) the above index was 6,0 mln pcs/ha and 5,08 mln pcs/ha. On the basis of the data analysis the highest rate of survival of plants within two years (89,4 %) was recorded in the experiment variants where there was used leaf-feeding by ceramide, $MgSO_4$ 5%, by complex action fertilizer oil nutrivant plus 2 kg/ha (at the stage "fir" and budding) against the mineral fertilizing ($N_{60}P_{30}K_{60}$). On the control ground (without fertilizers) the above rate was lower by 4,7 %.

Besides, the years of research enabled to define the following: fertilizing ($N_{60}P_{30}K_{60}$) along with leaf-feeding provides significant increase (by 10,6-18,4 cm), the height of a plant before control (without fertilizers) - 58,4 cm. The highest plants (76,8 cm) were recorded in the variants were leaf-feeding was applied twice (at the stage "fir" and budding) with carbamide, M_gSO_4 5%, complex fertilizer oil nutrivant plus 2 kg/ha against the complete mineral fertilizing (table 1).

1. The plant density, survival and height of oil flax plants depend on the mineral fertilizing (2012-2013).

Variants	Plant density, mln./ha		Plant survival, %	Plant height, cm
	After coming-up	Before harvesting		
Without fertilizers (control)	6,00	5,08	84,7	58,4
$N_{60}P_{30}K_{60}$-background	6,41	5,62	87,7	66,9
background+carbamide-5%(at the stage "fir-tree")	6,43	5,69	88,5	69,0
background+$MgSO_4$-5%(at the stage "fir-tree")	6,44	5,68	88,2	67,4
background+carbamide 5%+$MgSO_4$5%(at the stage "fir-tree")	6,50	5,76	88,6	70,3
background+oil nitrivan plus-2kg/ha (at the stage "fir-tree")	6,46	5,74	88,6	68,4
background+carbamide5%+$MgSO_4$5% +oil nutrivant plus 2 kg/ha-twice(the first- at the stage "fir-tree", the second- budding)	6,49	5,80	89,4	76,8
HIP_{05}	0,09	0,17	1,46	9,03

Leaf-feeding against the background of mineral fertilizing ($N_{60}P_{30}K_{60}$) contributed to the increase in the quantity of bolls on the plants, in the variants the above characteristic feature changed from 13,9 psc. to 15 pcs. per plant. The biggest quantity of bolls (15 pcs.) was recorded in the variant with leaf-feeding with carbamide, $MgSO_4$ 5%, complex fertilizer oil nutrivant plus 2 kg/ha – twice (the first – at the "fir-tree" stage, the second – at the stage of budding) against the background of fertilizing ($N_{60}P_{30}K_{60}$), whereas in the control variant (without fertilizers) and against the background ($N_{60}P_{30}K_{60}$), the above index was lower - 5,7 - 1,2 шт. (table 2)

Application of leaf-feeding with carbamide against fertilizing ($N_{60}P_{30}K_{60}$), $MgSO_4$5%y at the "fir-tree" stage, as well as its parallel application with micro fertilizer with the lead-feeding being applied twice at the "fir-tree" and budding stage increased the number of seeds on a plant by 2,0 – 7,9 pcs, while their number against the background was 70,4 pcs.

Combination of the main and leaf-feeding increased the mass of 1000 g of seeds by 0,5-0,61. The highest index 6,87 g was recorded in the variant with additional fertilizing (against the background $N_{60}P_{30}K_{60}$), carbamide, $MgSO_4$ 5%, and complex fertilizer twice (at the "fir-tree" and budding stages) when compared to the control variant (without fertilizers) where it constituted 6,26 g.

Determination of the mass of seeds from one plant showed the considerable increase of the above index in all the variants of fertilizing against the control (without fertilizers). The increase before control constituted 0,194 - 0,255 g. The biggest mass of seeds 0,537 g was recorded in case of leaf-feeding with carbamide, $MgSO_4$, complex action fertilizer oil nutrivan plus 2 kg/ha fertilizer twice (at the "fir-tree" and budding stages) against the background ($N_{60}P_{30}K_{60}$), the background ($N_{60}P_{30}K_{60}$) - 0,476 g and before the control (without fertilizers) - 0,282 (table 2).

2. Influence of fertilizing on structure indices of oil flax (data for the period of 2012-2013)

Fertilizing	Quantity of bolls on a plant, pcs.	Quantity of seeds from one plant, pcs.	Mass 1000 seed, g	Mass of seeds from one plant, g
Without fertilizers (control)	9,3	45,2	6,26	0,282
$N_{60}P_{30}K_{60}$-background	13,8	70,4	6,76	0,476
background+carbamide-5%(at the stage "fir-tree")	14,1	72,4	6,79	0,491
background+$MgSO_4$-5%(at the stage "fir-tree")	13,9	70,9	6,80	0,481
background+carbamide 5%+$MgSO_4$5%(at the stage "fir-tree")	14,3	74,1	6,82	0,504
background+oil nitrivan plus-2kg/ha (at the stage "fir-tree")	14,1	72,4	6,79	0,491
background+carbamide5%+Mg $SO_4$5% +oil nutrivant plus 2 kg/ha-twice(the first- at the stage "fir-tree", the second-budding)	15,0	78,3	6,87	0,537
HIP_{05}	1,02	2,1	0,10	0,02

Crop capacity formation is a complex productive process which is determined both by genetic potential of plants and external conditions. To provide rich crop it is necessary to have complete information about versatility of impact of certain factors which take part in the growth and development of plants, and their interaction [5].

3.Oil flax crop capacity depending on mineral fertilizing (data for the period of 2012 - 2013 pp.)

Fertilizing	Crop capacity, t/ha	Increase, t/ha	
		до контролю	до фону
Without fertilizers (control)	1,43	-	-
$N_{60}P_{30}K_{60}$-background	2,67	1,24	-
background+carbamide-5%(at the stage “fir-tree”)	2,79	1,36	0,12
background+$MgSO_4$-5%(at the stage “fir-tree”)	2,73	1,30	0,06
background+carbamide 5%+$MgSO_4$5%(at the stage “fir-tree”)	2,90	1,17	0,23
background+oil nitrivan plus-2kg/ha (at the stage “fir-tree”)	2,81	1,38	0,14
background+carbamide5%+$MgSO_4$5% +oil nutrivant plus 2 kg/ha-twice(the first- at the stage “fir-tree”, the second- budding)	3,11	1,68	0,44
$НІР_{05,}$т/га	0,12		

The analysis of the research carried out within 2 years reveals the regularity of oil flax plant crop capacity formation depending on mineral fertilizing. There has been found out that the lowest level of crop capacity 1,43 t/ha was recorded in the variant without fertilizers (control). Fertilizers ($N_{60}P_{30}K_{60}$ - background) being applied, oil flax crop capacity increased up to 2,67 t/ha, crop capacity increase before control - 1,24 t/ha. Leaf-feeding against the background ($N_{60}P_{30}K_{60}$) in all the variants provides the

increase in crop capacity from 2,79 up to 3,11 t/ha, the increase before control 1,36 – 1,68 t/ha correspondingly, before the background 0,12-0,44 t/ha. (table 3)

The richest crop capacity of oil flax seeds - 3,11 t/ha in average for the period of 2012-2013 – was obtained provided the application of complete mineral fertilizer $N_{60}P_{30}K_{60}$ combined with leaf-feeding with carbamide, $MgSO_4$ 5 % content and the fertilizer of complex action oil nutrivant plus 2 kg/ha-twice (the first time – at the "fir-tree" stage, the second one – at the beginning of budding stage). The increase before control (without fertilizers) was 1,68 t/ha, before the background - 0,44 t/ha.

CONCLUSIONS. Based on the results of the research the following was ascertained: the formation of oil crop capacity formation is considerably influenced by leaf-feeding with carbamide, $MgSO_4$ 5% combined with complex action fertilizer oil nutrivant plus 2 kg/ha twice (at the "fir-tree" and budding stages) against the background of fertilizing ($N_{60}P_{30}K_{60}$), which provides rich crop capacity 3,11 t/ha in the soil and climate conditions of the Western forest-steppe. Following the above scheme of fertilizing it was possible to obtain the biggest height and density of plants, the best survival during the vegetation period and maximal structural characteristics of the plant crop capacity.

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