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OPTIMIZATION OF PLANT NUTRITION OF CARROT BY MICROFERTILIZERS IN LEFT BENK FOREST-STEEPE OF UKRAINE

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The effect of microelements application on background of based application of mineral fertilizers on growing of carrot was researched. The carrot had been grown on dark-grey podzolic soil.

Microfertilizers such as EPSO Combitop and Epsotop, carrot, mineral fertilizers, dry matter.

Right micronutrient fertilizers application is important part of growing technologies in plantgrowing and gives high crop yield and good quality of carrot.

Plants need microelements in yearly stages of it growth (germination). In this stage seeds absorb more water caused microelements. Carbohydrates and proteins and lipids are hydrolyzed and form basic of future plants. Therefore, starter micronutrient fertilizers application gives positive effect on plant growth [2].

Further, microelements improve synthesis of chlorophyll and photosynthesis activity of carrot. It absence damages biosynthesis chlorophyll and blocks of photosynthesis.

Scientists researched effect of microelements. They determined that microelements increased plant resistant to drought. It is caused water regrouping from free water to fixed water and increasing water hold capacity of plant leave and activation of nitrogen and carbohydrate exchange.

The foliar fertilizers application is better method for microelements application for science and for practice. It regulates nutritive processes of plants during plant vegetation. Microelements ratio is very important. Every element of plant nutrition forms whole cycle of biochemical processes. And every of them

have the role. Therefore, microelements have to apply with macroelements according to plant needs [3].

The factors effect on elements absorbs by plants are:

1. Retlonslocation (same elements from old tissue to yang tissue) for Ca, K, B, S, Cu, Mn, Zn is absent.
2. Plants have critical stages during its vegetation. Elements deficiency in these stages decreases carrot yield.
3. It is proved that foliar fertilizers application optimized elements absorb by plants and made its more available for plants.

These factors caused wide using of foliar fertilizers application in agriculture.

All vegetative parts of plants absorb elements. There are leave and stem and fruit, etc. In this event microelements pervade to sells of plants in which physiological processes go more intensively. And in its part of plant body the microelements deficiency is more often. Liquid sate of micronutrient fertilizers and helat form of complex micronutrient fertilizers cause quickly its absorption into leave sells. Microelements get to leave surface and filter quickly through walls of the epidermis and walls of the cell membrane. They move into upper epidermis and penetrate into palisade layer and into porous layer and are assimilated by plant cells [1].

Also, these physical properties of these fertilizers such as stick capacity and equability of the covering are very important. They cause quickly they penetration through cuticula and 95-98 % its assimilation by plant cells. It causes positive effect on plant growth, on period of flowering and ripening of crops specially.

This technological method of fertilizers application decreases negative effect of chemicals on plants growth. It is known higher temperature or low temperature and high dose of herbicides cause stress for yang plants. Foliar fertilizers application allows these plants to decrease its biological losses.

This method has one of the advantages too. Foliar fertilizers application is made compatibly with application of the plant protection pills. And it save half of machine costs.

Complex foliar fertilizers application increases effective action of fungicides to 30 % and more. And, only foliar fertilizers application corrects nutrient deficiency in plant nutrition more effectively.

The methods of investigation. The field trials were located in vegetable experiment of department of agrochemistry and quality of plant products. The experiment was arranged in tree replication. The area of seed plot (variant) was 300 m^2.

The soil of research plot was dark-grey opodsolic soil. The soil solution has weakly acid reaction. The content of humus was low. The easy-hydrolysis nitrogen content was middle. The content of available phosphate was middle. The content of exchangeable potassium was higher.

The Elegans hybrid of carrot was sowing. This hybrid has carrot from 20 to 22 sm. It vegetation continue 140-150 days. It has resistance to diseases. When vegetation is prolong the carrots will accumulate more dry matter and more provitamin A and more vitamin C and period of carrot saving.

In field trials the next fertilizers ware applied: ammonium nitrate (34 %) (ГОСТ 2 – 85); OSP (19,5 %) (ГОСТ 5956 – 78); K-Mag(29 %) (ГОСТ 844-79)ESPO combitop, ESPO top та ESPO microtop (they include Mg, S, Mn, Zn, Cu, B). The foliar fertilizers application was made in stage of 3-4 leave formation and stageof 6-7 leave formation.

Results of the investigations. The foliar fertilizers application increasedintensity of assimilative processes into plant body and improved using of nutrients and speed of them absorption to plant roots. Microelements from foliar application from ESPO combitop andESPO top andESPO microtop on background of basic fertilizers application increased nitrogen content and phosphate content and potassium content in plants of carrot (table 1).

1 - The effect to ffertilization on microelenets content in plant soft able carrot on dark-grey opodsolic soil, % per dry matter

Variant of fertilization	Stages of plant growth and plant development								
	Beginning of carrot formation			Intensive carrot growth			Technic ripeness		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
1. control – without fertilizers	1,98	0,26	3,19	1,87	0,22	3,01	1,12	0,14	2,47
2. $N_{120}P_{100}K_{180}$ (background)	2,44	0,33	3,38	2,30	0,28	3,22	1,55	0,20	2,65
3. Background + ESPO combitop (5 kg per ha)in 3-4 leave formation stage	2,57	0,39	3,47	2,42	0,33	3,31	1,72	0,25	2,77
4.Background + ESPO top (5 kg per ha)in 3-4 leave formation stage	2,61	0,44	3,50	2,46	0,35	3,35	1,73	0,28	2,80
5. Background + ESPO combitop (5 kg per ha) in 3-4 leave formation stage + (5 kg per ha)in stage of 6-7 leave formation	2,64	0,47	3,52	2,48	0,37	3,38	1,76	0,31	2,84
6.Background + ESPO top (5 kg per ha) фаза 3-4 листки + (5 kg per ha)in stage of 6-7 leave formation	2,67	0,50	3,55	2,51	0,41	3,41	1,78	0,34	2,87
7. Background + ESPO microtop (5 kg per ha)in 3-4 leave formation stage	2,74	0,56	3,61	2,56	0,48	3,44	1,84	0,40	2,93
8. Background + ESPO microtop (5 kg per ha)in 3-4 leave formation	2,78	0,61	3,64	2,60	0,53	3,49	1.87	0,44	2,97

stage + (5 kg per ha)in stage of 6-7 leave formation									

The foliar application in 3-4 leave formation stage by EPSO combitop increased nitrogen content in plant to 2.57 % and phosphate content to 0.39 % and potassium content to 3.47 % in period of carrot formation. The foliar fertilizers application by EPSO top in this stage increased N content to 2.61 % and P content to 0.44 % and K content to 3.50 %. The foliar fertilizers application twice was more effective and increased macroelements content in plants of carrot (table 1).

The macroelements content in plants body was decreased in stage of carrot formation because elements ware re-distributed (retranslocation) between parts of plant body. But tendency of fertilizers effect was same.

Effect of activation of assimilative processes in plants was not only increased macroelements content in plant body and in change of morphological and biometric indexes of plants. Foliar spraying influenced on growth and development of vegetative part of plants. Plant height was the greatest in the variants with one and two spraying of plants (table 2).

The plant height was 45 sm in variant where basic application in rate $N_{120}P_{100}K_{180}$ had been applied and plants had been sprayed by ESPO microtop in stage of 3-4 leave formation. This index was 47 sm when plants had been sprayed this fertilizer twice. The plant height was less when EPSO combitop had been used.

The relation between vegetative part of plant and plant roots is very important index. In the stage of 3-4 leave carrots were least when EPSO combitop had been used in stage of 3-4 leave formation and in stage of 6-7 leave formation on background of basic fertilizers application. The relation between vegetative part of plant and plant roots was 1:4.11. The carrots formed more actively in condition of basic application in rate $N_{120}P_{100}K_{180}$. The relation between vegetative part of plant and plant roots was 1:3.75. in stage of 6-7 leave formation this index was changed in side roots growing.

In the variant with basic fertilizers application in rate $N_{120}P_{100}K_{180}$ and plant spraying by EPSO combitop in stage of 3-4 leave formation and stage of 6-7 leave formation this index was 1:1.12. It affirmed that plant roots grown actively under action of foliar fertilizers application by ESPO combitop.

2 – The relation between vegetative part of plant and plant roots and plant height

Variant of fertilization	Stages of plant growth and plant development							
	Stage of 3-4 leave formation				Beginning of carrot formation			
	Vegetative part of plant, g	Plant roots, g	Relation	Plant height, sm	Vegetative part of plant, g	Plant roots, g	Relation	Plant height, sm
1. Control – without fertilizers	4,6	1,2	1:3,81	35,3	17,87	11.6	1:1,52	42
2. $N_{120}P_{100}K_{180}$ (background)	5,1	1,36	1:3,75	36,6	15,53	11,5	1:1,36	44
3. Background + ESPO combitop (5 kg per ha) in 3-4 leave formation stage	4,7	1,32	1:3,56	33,3	17,03	13,6	1:1,25	41
4. Background + ESPO top (5 kg per ha) in 3-4 leave formation stage	4,9	1,15	1:4,31	38,3	17,43	13,3	1:1,31	43
5. Background + ESPO combitop (5 kg per ha) in 3-4 leave formation stage + (5 kg per ha) in stage of 6-7 leave formation	5,8	1,45	1:4,11	41,7	17,73	13,8	1:1,12	39
6. Background + ESPO top (5 kg per ha) фаза 3-4 листки + (5 kg per ha) in stage of 6-7 leave formation	5,4	1,32	1:4,09	36,1	16,36	13,7	1:1,18	40
7. Background + ESPO microtop (5 kg per ha) in 3-4 leave formation stage	4,5	1,19	1:3,78	31,7	15,92	12.5	1:1,29	45
8. Background + ESPO microtop (5 kg per ha) in 3-4 leave formation stage + (5 kg per ha) in stage of 6-7 leave formation	4,9	1,22	1:4,02	34,3	16,26	12,8	1:1,24	47

Carrotyieldandqualityofcarrotdependfromcomplexofagrotechnicoperationsandfrom climaticconditionsandfromsoilconditionsandfromtimeofpantsowingandfromselectionofche micalsandseeds, etc. The fertilizers application is more effective operation from its. Fertilizers influence on crop yield and quality of crop products, multinutrient fertilizers especially.

The foliar fertilizers application on background of basic fertilizers application increased carrot yield and quality of products (table 3) .

3. - The effect of fertilization on carrot yield

Variant of fertilization	Carrot yield, t per ha	Product yield, %	Additional carrot yield to control		Additional carrot yield to background	
			t per ha	%	t per ha	%
1. Control – without fertilizers	39,5	78,5	-	-	-	-
2. $N_{120}P_{100}K_{180}$ (background)	56,3	82,0	16,8	42,5	-	-
3. Background + ESPO combitop (5 kg per ha) in 3-4 leave formation stage	63,3	83,5	23,8	60,2	7,0	12,4
4. Background + ESPO top (5 kg per ha) in 3-4 leave formation stage	60,7	81,3	21,2	53,6	4,4	7,8
5. Background + ESPO combitop (5 kg per ha) in 3-4 leave formation stage + (5 kg per ha) in stage of 6-7 leave formation	73,8	86,0	34,3	77,1	17,0	30,1
6. Background + ESPO top (5 kg per ha) фаза 3-4 листки + (5 kg per ha) in stage of 6-7 leave formation	68,6	84,1	29,1	73,0	12,3	21,8
7. Background + ESPO microtop (5 kg per ha) in 3-4 leave formation stage	59,8	87,1	20,3	51,3	3,5	6,2
8. Background + ESPO microtop (5 kg per ha) in 3-4 leave formation stage + (5 kg per ha) in stage of 6-7 leave formation	64,2	88,4	24,7	62,5	6,1	10,8
$LSD_{0.95}$t per ha			3,4			

Carrot yield was biggest in variant with fertilizers application in rate $N_{120}P_{100}K_{180}$ and plant spraying by EPSO combitop in stage of 3-4 leave formation

and in stage of 6-7 leave formation. It was 73.8 t per ha. The additional carrot yield to control was 34.3 t per ha (table 3) and additional carrot yield to background was 17 t per ha. Carrot yield was high enough in variant with basic fertilizers application in rate $N_{120}P_{100}K_{180}$ and plant spraying by EPSO top in dose 5 kg per ha twice. Carrot yield was 68.6 t per. The additional carrot yield to control was 29.1 t per ha or 73 % and the additional carrot yield to background application was 12.3 t per ha.

The basic fertilizers application in rate $N_{120}P_{100}K_{180}$increased carrot yield to 56.3 t per ha. The additional carrot yield to control was 16.8 t per ha or 42.5 %. The foliar fertilizers application increased carrot yield on 7.8 t per ha or 12.4 %. Twice foliar application increased carrot yield on 21.8 t per ha or on 30.1 %.

The product yield is very important index for quality of carrots. The fertilizers application influenced on product yield essentially

The product yield of carrots was in variant where basic fertilizers application in rate $N_{120}P_{100}K_{180}$ had been applied and plant had been sprayed by EPSO microtop in stage of 3-4 leave formation and in stage of -7 leave formation. It was 88.7 %. Twice foliar fertilizers application increased product carrot yield in variant with using of all three micronutrient fertilizers. The only once foliar fertilizers application was less effective. They increased product carrot yield to 81.3 5 and to 83.5 %. The product carrot yield was the least in the control variant. It was 78.5 5.

Conclusions. Therefore, the foliar applications by EPSO combitop and EPSO top and EPSO microtop in stage of 3-4 leave formation and in stage of 6-7 leave formation (carrot roots formation) on background of basic fertilizers application in rate $N_{120}P_{100}K_{180}$activated assimilative processes in carrot plants and increased macroelements absorption by plant roots and improved biometric indexes of carrot plants. These conditions caused formation of high carrot yield with high product carrot yield.

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Вивчено вплив мікродобрив, що внесені позакоренево на фоні основного удобрення на продуктивність моркви столової за вирощування на темно-сірому опідзоленому ґрунті.

Мікродобрива, EPSOcombitop, EPSOtop, морква столова, продуктивність, мінеральні добрива