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Specific Features Of Dynamic Patterns Of Microelement In Spring Wheat Plants When Applying Growth Regulators In The Technology Of Cultivation.

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ABSTRACT

In the article the authors present the results of studying the effect of various growth regulators on the dynamic pattern of microelements in spring wheat plants. It has been found that the preparations used made it possible to optimize the mineral nutrition of plants. The degree of accumulation of trace elements in spring wheat plants varies according to the phenophases of growth and development. According to the content in the leaves and stems from the tillering stage to milky ripeness, the trace elements were: Fe> Mn> Zn> Cu> Co, in the reproductive organs of this crop the row of elements takes the following form: Fe> Zn> Cu> Mn> Co.

Keywords: spring wheat, growth regulators, pre-sowing seed treatment, dynamic patterns of microelements, mineral nutrition, yielding capacity.

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INTRODUCTION

Mineral nutrition of plants is the main factor that can be regulated for the purposeful management of plant growth and development in order to grow a high yield of good quality. Along with the main elements (nitrogen, phosphorus, potassium, sulfur, magnesium), microelements play a major role in plant nutrition. The intake of microelements by plants and their accumulation can vary widely, which is explained by the influence of specific soil and climatic conditions. In addition, the plants themselves are selective in absorbing trace elements. The process of trace element intake depends on the biological characteristics of plants, the biochemical composition and the strength of the bond of ions with cell membranes. It is also necessary to take into account the mutual influence of some trace elements on the change in the content of others (antagonism and synergism of ions) [7].

The diverse and significant role of trace elements for plants is due to their participation in complex biological and physiological processes. They intensify the activity of enzymes, vitamins, hormones, they are linked with the processes of synthesis of organic substances, help to increase the productivity of crops and improve product quality [2].

The deficiency of trace elements in plants is primarily due to the low availability of arable soil to the mobile forms of these elements. The balance of trace elements in soils can be improved by increasing the amount of organic fertilizer application and the use of complex mineral fertilizers containing trace elements [6].

At present, biosafe technologies of plant nutrition are being actively introduced with the use of environmentally friendly biological fertilizers, microbial biopreparations, micronutrients and various growth regulators [1,3,4,5,6]. The study of the dynamic pattern of the intake of trace elements by plants with the use of various growth regulators for pre-sowing seed treatment in view of the regional conditions of the Volga region forest-steppe is of considerable interest.

OBJECTIVES AND RESEARCH METHODS

The studies were conducted in laboratory and field settings of P.A. Stolypin Ulyanovsk State Agrarian University. The experimental crop is spring wheat of the variety Zemlyachka, the method of establishing the field experiment is generally accepted for small plot areas, replication is 4 times, the layout of variants in the experiment is randomized, the area of plots is 20 m^2. Before sowing, seeds were treated with growth regulators - Crezacin, Energia, Albit, Gumi, Zircon, Extrasol, in the concentrations recommended by the manufacturer. The soil of the experimental field is leached chernozem of medium thickness, medium clay loam with the following agrochemical characteristic: humus content - 4.3% (medium humus soil), Rn - 5.8 - 6.8 (slightly acid), the content of mobile phosphorus and potassium, respectively 107 - 142 and 103 - 135 mg / kg soil (elevated). The degree of saturation with bases is 96.4 - 97.9%. The amount of absorbed bases is 25.5 - 27.8 mg - eq. / per 100g of soil. During the years of study, the meteorological conditions were different in temperature and moisture conditions, which allowed a comprehensive study of the effect of the factors used. The content of microelements was determined by the atomic adsorption method in the plant samples selected during the growing season.

RESULTS AND THEIR DISCUSSION

The results of the study show that the degree of accumulation of trace elements in spring wheat plants varies according to phenophases of growth and development. According to the content in the leaves and stems from the tillering stage to milky ripeness, the trace elements comprised the following row: Fe> Mn> Zn> Cu> Co (Table 1,2,3).

In reproductive organs, the row of elements takes the following form: Fe> Zn> Cu> Mn> Co. The analysis of the dynamic pattern of individual microelements shows that pre-sowing treatment of spring wheat seeds with various growth regulators has a positive effect on the accumulation of these elements in plant organs.

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Table 1 – Dynamic pattern of trace elements in the leaves of the spring wheat variety Zemlyachka, mg / kg (average for the years of studies)

Variants	Cu	Co	Zn	Mn	Fe
	Tillering				
Control	26,76	0,096	41,98	44,46	161,39
Crezacin	28,26	0,105	43,60	47,10	163,44
Energia	29,06	0,113	43,69	46,57	164,20
Albit	27,78	0,102	42,65	45,24	162,29
Gumi	27,61	0,101	42,75	45,50	162,21
Zircon	27,53	0,103	42,65	46,44	162,48
Extrasol	28,36	0,101	43,09	46,17	162,54
Shooting					
Control	23,04	0,083	36,37	40,78	150,95
Crezacin	24,41	0,091	38,19	42,45	153,45
Energia	25,87	0,100	38,64	42,87	153,38
Albit	23,32	0,090	37,21	41,48	152,12
Gumi	24,74	0,089	37,63	42,26	151,10
Zircon	24,62	0,087	37,23	42,16	152,23
Extrasol	24,32	0,094	38,07	43,00	152,56
Ear formation					
Control	19,85	0,112	31,90	30,54	143,39
Crezacin	20,99	0,127	34,02	33,10	146,03
Energia	21,91	0,128	33,85	32,69	146,49
Albit	20,60	0,116	32,25	30,86	144,11
Gumi	21,26	0,119	33,86	31,56	144,22
Zircon	21,70	0,117	32,78	31,78	144,57
Extrasol	20,97	0,118	33,39	31,86	144,95
Milky ripeness					
Control	13,93	0,16	27,87	19,92	135,43
Crezacin	15,84	0,23	29,87	21,46	137,32
Energia	16,81	0,27	28,90	22,63	137,56
Albit	14,09	0,21	28,58	20,20	135,65
Gumi	15,13	0,19	29,11	21,06	137,05
Zircon	16,25	0,20	28,96	21,05	137,83
Extrasol	15,10	0,21	29,70	21,57	136,46

Table 2 – Dynamic pattern of trace elements in stems of spring wheat of the variety Zemlyachka, mg/kg (average for the years of studies)

Variants	Cu	Co	Zn	Mn	Fe
	Shooting				
Control	18,25	0,100	29,82	30,90	139,10
Crezacin	19,99	0,111	31,75	32,87	142,30
Energia	20,37	0,117	32,42	33,59	142,11
Albit	17,98	0,105	30,63	31,29	140,22

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Gumi	19,13	0,108	31,23	32,54	140,65
Zircon	19,95	0,104	31,42	32,57	140,67
Extrasol	19,35	0,108	31,68	33,30	141,15
Ear formation					
Control	15,23	0,107	25,43	18,43	109,99
Crezacin	16,63	0,115	27,38	20,35	112,62
Energia	17,47	0,121	28,53	20,49	113,32
Albit	15,67	0,114	26,79	19,60	110,47
Gumi	16,62	0,113	27,01	19,10	111,28
Zircon	16,24	0,113	27,46	20,60	111,18
Extrasol	17,01	0,116	27,63	20,21	111,83
Milky ripeness					
Control	10,12	0,111	19,11	12,32	74,07
Crezacin	11,13	0,119	21,26	14,05	76,27
Energia	11,93	0,124	19,96	14,25	76,19
Albit	10,51	0,114	20,16	12,75	74,91
Gumi	11,19	0,115	21,06	13,88	75,40
Zircon	11,61	0,118	20,87	13,74	75,40
Extrasol	11,09	0,117	20,18	14,36	76,12

Table 3 – Dynamic pattern of trace elements in ears of spring wheat of the variety Zemlyachka, мг/кг (average for the years of studies)

Variants	Cu	Co	Zn	Mn	Fe
	Ear formation				
Control	6,41	0,16	18,18	2,83	16,23
Crezacin	7,63	0,26	18,94	3,32	18,07
Energia	7,77	0,23	18,41	3,38	18,32
Albit	7,01	0,22	18,82	3,21	16,66
Gumi	7,14	0,19	18,78	3,27	17,38
Zircon	6,85	0,21	19,85	3,10	17,36
Extrasol	7,84	0,21	20,78	3,08	17,44
Milky ripeness					
Control	7,05	0,23	23,56	5,12	23,44
Crezacin	7,70	0,27	23,44	5,49	25,38
Energia	7,67	0,28	23,89	5,63	26,38
Albit	7,53	0,27	24,61	5,90	25,51
Gumi	7,23	0,30	25,01	6,00	25,52
Zircon	7,84	0,31	25,97	6,15	26,22
Extrasol	8,04	0,28	24,20	5,96	24,37
Milky ripeness					
Control	7,13	0,25	23,95	6,09	25,11
Crezacin	8,09	0,34	25,44	6,70	30,24
Energia	7,82	0,35	26,48	7,44	32,10
Albit	7,64	0,29	25,07	6,51	27,48

Gumi	7,25	0,31	25,66	6,51	28,38
Zircon	8,10	0,30	26,81	7,37	28,83
Extrasol	8,27	0,29	24,94	6,70	26,76

The content of microelements in the leaves of the experimental crop due to the use of growth regulators as compared to the control group increased: Cu- by 0.16-2.88 mg / kg, Co- by 0.05-0.32 mg / kg, Zn- by 0.67 -2.27 mg / kg, Mn- by 0.28-2.71 mg / kg, Fe- by 0.15-2.81 mg / kg, depending on the type of experiment and the phase of development of spring wheat plants, the content of trace elements in stems also increased: Cu-by 0.39-2.24 mg / kg, Co- by 0.03-0.15 mg / kg, Zn- by 0.81-3.10 mg / kg, Mn- by 0.39-2.69 mg / kg, Fe- by 0.48-3.33 mg / kg. Growth regulators had a similar effect on the content of trace elements in the reproductive organs of spring wheat, the increase was: Cu- 0.12-0.96 mg / kg, Co- 0.03-0.10 mg / kg, Zn- 0.23-2 , 86 mg / kg, Mn- 0.25-1.36 mg / kg, Fe- 0.43-6.99 mg / kg. This tendency was observed in all the years of studies, both unfavorable and favorable under weather and climatic conditions, which proves a positive manifestation of the action of growth regulators under stressful situations that occur very often in the Volga forest-steppe (lack of moisture, high or low temperatures). The best results on the accumulation of trace elements in spring wheat plants are observed when treating seeds with Crezacin, Energia and Zircon.

Studying the mechanism of intake of mineral nutrition elements and taking account of the constantly changing needs of plants for nutrients, one can create optimal conditions for their nutrition, therefore, having an effect on productivity. The growth regulators used in the experiment contribute to an increase in the yielding capacity of spring wheat (table 4).

Table 4 - The influence of growth regulators on the yielding capacity of spring wheat of the variety Zemlyachka, t / ha

Variant	2010	2011	2012	Average	Increment
Control	0,65	3,61	1,28	1,85	-
Crezacin	0,70	4,19	1,65	2,18	0,33
Energia	0,65	4,21	1,70	2,19	0,34
Albit	0,70	3,64	1,51	1,95	0,10
Gumi	0,65	3,73	1,56	1,98	0,13
Zircon	0,75	3,71	1,60	2,02	0,17
Extrasol	0,70	3,80	1,49	2,00	0,15
LSD_{05}	0,05	0,48	0,2	–	–

On average, for the years of studies, the increase in the yielding capacity of spring wheat amounted to 0.10-0.34 t / ha, depending on the variant. The most effective treatment was by preparations Crezacin and Energia.

CONCLUSIONS

Thus, the use of growth regulators in the cultivation technology of agricultural crops permits one to optimize the mineral nutrition of plants, including trace elements, which ultimately ensures the realization of their biological potential of productivity, their capacity to form high-quality products, and resistance to unfavorable growing conditions. In addition, growth regulators can reduce the sensitivity of plants to the lack of trace elements in the soil, thereby avoiding a decrease in yield.

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