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The Yield and Quality of Hulless Barley Under Foliar Fertilization with Microelement Fertilizer in Conditions of Forest-Steppe of The Middle Volga Region.

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ABSTRACT

In field experiments with hulless barley, carried out on leached black soil, it was established that in the course of foliar treatment of plants in the phase of tillering, earing and twofold (tillering + spiking) with complex microelement fertilizers Azosol 36 Extra, Megamix-Azot and Cytovit, the cereal productivity was increased by 0.24 - 1.14 t / ha (7.7 - 36.5%), simultaneously significantly improving the technological properties of the grain. The highest yield of hulless barley grain of 4.26 t / ha was obtained with a double foliar top dressing of plants during the tillering and earing phase, the protein content in the grain (16.7%) increased with respect to the control by 2.5%.

Keywords: hulless barley, microelement fertilizers, photosynthesis parameters, structural elements, yield, grain quality.

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INTRODUCTION

Hulless barley has a wide range of uses in the national economy as a food, grain fodder and fodder crop. At present, interest in hulless barley grows due to a unique combination of a number of economic and biological features - increased protein and essential amino acids, high vitreousness and grain nature [1-4].

In conditions of risky and unsustainable farming in the Middle Volga region, it is possible to obtain stable crop yields using innovative technologies [5-6].

Growth regulators, complex fertilizers with microelements in chelate form and antistress preparations become important elements that ensure the regulation of the production process in the conditions of modern technologies in the production of agricultural crops.

Interest in these products is due to their high physiological activity, which allows them to be used in low concentrations. Agrochemicals easily fit into the technology of cultivation, ensure the production of environmentally friendly products, increase economic and energy efficiency, especially when grown in conditions of lack of certain micronutrients in the soil.

Effective methods of biological correction of crop productivity include seed treatment and spraying of plants with water-soluble chelate complexes with a wide spectrum of action [7,8].

During their ontogeny, plants, as a rule, require a gradually increasing concentration of nutrients, changes in their composition, combination, and the relationship between individual elements of nutrition. Therefore, in order to create optimal nutrition conditions for plants throughout the growing season, the right combination of basic fertilizer and top dressing is necessary.

F.F. Matskov (1957) concludes that the use of feedings of vegetative plants can strengthen weak links in nutrition, change the direction of enzyme activity, and hence the nature of intracellular metabolism, thereby affecting the growth and development of the plant organism, that is, controlling the process of crop formation [9].

Growth regulators and microelements used for foliar dressing of vegetating plants, provide an increase in yield and product quality. This question deserves further study, especially with regard to the introduced new plant species.

MATERIALS AND METHODS

Experimental work on studying the effect of foliar fertilizing with microelement fertilizers on the yield and quality of the hulless barley of the Omskiy Golozeriy variety was conducted in 2015-2017 in Agrofirma "Biokor-S" Ltd. of the Penza region.

The soil of the experimental site is the leached medium-humus medium-thick heavy loam black soil. The soil density is 1.18 - 1.20 g / cm³, the total soil porosity is 55-60%, the content of water-resistant aggregates is 56%, porous aeration is 18-20%, the lowest moisture capacity is 32%. The humus content in the plow layer is 6.5%, mobile phosphorus - 55 mg / kg soil, exchange potassium - 177 mg / kg soil. The availability of mobile forms of molybdenum, boron, manganese, copper, zinc and cobalt is low, the reaction of the soil medium is weakly acidic (pH 5.4).

The precursor of barley is winter wheat. The rate of sowing is 4.5 million germinated seeds per hectare. The plot area is 25 m², the repetition is fourfold, the plotting of the plots is systematic. Objects of research - hulless barley of variety Omskiy Golozeriy, microelement fertilizers Azosol 36 Extra, Megamix - Azot, Cytovit.

In the experiment, except for the studied agro-methods, the technology of cultivation of spring barley was used, generally accepted for the Penza region. The concentration of products is accepted in accordance with the established recommendations: Azosol 36 Extra - 4 l / ha, Megamix - Azot - 1 l / ha, Cytovit - 150 ml / ha.

Azsol 36 Extra - a multicomponent liquid fertilizer for foliar top dressing, with a high content of magnesium and microelements (%): N - 36.3, MgO - 4.3, Mn - 1.35, Cu - 0.27, Fe - 0.027, B 0.027, Zn 0.013, Mo 0.0067.

Megamix - Azot is a liquid nitrogen fertilizer for foliar top dressing with a rich content of microelements (g / l): Cu - 2.5, Zn - 2.5, Fe - 1.0, Mn - 1.0, B - 0.8, Mo - 0.6, Co - 0.12, Se - 0.06 and macroelements (g / l): N - 210, S - 8, Mg - 6.

Cytovit is a complex of organic microelements with a small addition of N, P, K-containing salts. The composition of the fertilizer Cytovit includes the following elements (g / l): common nitrogen - 30, phosphorus - 5, potassium - 25, microelements (g / l): magnesium - 10, brimstone - 40, iron - 35, manganese - 30, boron - 8, zinc - 6, copper - 6, molybdenum - 4, cobalt - 2.

In carrying out the research, the agronomic science methods of laying down and conducting experiments were used [10, 11].

In accordance with the research program, a two-factor field experiment was laid down according to the following scheme.

Factor A - preparations Azsol 36 Extra, Megamix - Azot, Cytovit.

Factor B - terms of foliar top dressing: tillering phase, earing phase, tillering phase + earing.

The research tasks included: to study the regularities of the growth and development of hulless barley; to determine phytometric parameters of agrophytocenosis; to justify and experimentally determine the optimal terms for foliar top dressing of hulless barley with preparations Azsol 36 Extra, Megamix-Azot and Cytovit; to determine their influence on the formation of elements of the crop structure, yield and grain quality of the grain of barley; to give an economic and energy assessment of technological methods of hulless barley cultivation.

EXPERIMENTAL PART

A.A. Nichiporovich (1970) considers the area of the assimilating surface and the photosynthetic potential as one of the most important indicators of the photosynthetic activity of plants in crops that determine the yield of agricultural crops. Therefore, all agrotechnical methods should be aimed at creating optimal conditions for the formation of a photosynthetic apparatus and its productive activity [12].

The analysis of the production process showed that the preparations Azsol 36 Extra, Megamix-Azot and Cytovit promoted an increase in the leaf surface of barley in the variants of the experiment by 6.0-12.2%, the index of seeding PP - 6.2-2.3%, NPF-6 , 0 - 22.5%. The most favorable conditions for the photosynthetic activity of agrocenoses of hulless barley were formed by double treatment in the phases of tillering and ear-raising with Azsol 36 Extra. The leaf area was 47.2 thousand m² / ha, the photosynthetic potential was 1.98 million m² / ha, the net productivity of photosynthesis was 4.57 g / m² per day. Similar indices were noted when using for the foliar application of Megamix-Azot preparation (Table 1).

Table 1: Photosynthetic activity of agrocenosis of hulless barley

Factor A - product	Factor B – processing phase	Area of leaves, thousand m ² / ha	PP, mln. m ² d./ha	NPF, g/m ² . day
Without treatment (control)		31,3	1,53	3,32
Azsol 36 Extra	tillering	36,9	1,80	3,94
Azsol 36 Extra	earring	35,0	1,71	3,85
Azsol 36 Extra	tillering + earing	42,7	1,98	4,57

Megamix - Azot	tillering	36,3	1,77	3,89
Megamix - Azot	earring	34,4	1,68	3,68
Megamix - Azot	tillering + earring	41,6	1,96	4,45
Cytovit	tillering	35,0	1,71	3,74
Cytovit	earring	33,7	1,01	3,61
Cytovit	tillering + earring	38,9	1,90	4,16

Complex micronutrients contributed to the formation of larger ears, with a large number of grains and a larger mass of an ear, the level of grain content according to the variants of the experiment increased by 10.7-39.3%, the productivity of the ear was 14.9-36.8%, the mass of 1000 grains - 1,7 - 10,3%.

The highest values of the structural elements of the harvest of hulless barley were noted with a double application of the preparation Azosol 36 Extra for foliar fertilizing of plants in the phase of tillering and earring. Thus, the grain size of barley ears increased by 39.3%, the mass of grain from the ear increased by 36.8%, the grain size - 10.3% (Table 2).

Table 2: Structure of the grain yield of hulless barley

Factor A - product	Factor B – processing phase	Height of plants, cm	Number of grains in the ear, pcs.	Mass, g	
				of grain from ear, g	1000 grain, g
Without treatment (control)		78	28	0,87	47,5
Azosol 36 Extra	tillering	89	34	1,03	49,6
Azosol 36 Extra	earring	84	32	0,98	51,2
Azosol 36 Extra	tillering + earring	95	39	1,19	52,4
Megamix - Azot	tillering	88	33	1,01	49,2
Megamix - Azot	earring	83	31	1,00	50,7
Megamix - Azot	tillering + earring	94	38	1,16	52,1
Cytovit	tillering	86	32	0,98	48,3
Cytovit	earring	81	31	0,94	48,9
Cytovit	tillering + earring	92	36	1,11	50,8

The studied technological methods had a positive effect on the formation of the crop of hulless barley. It was manifested in an increase in the yield of grain according to the variants of the experiment by 0.24-1.14 t / ha. The most effective was the use of the preparation Azosol 36 Extra. Thus, the yield of grain during the cultivation of crops in the tillering phase was 3.68 t / ha, the earring phase - 3.49, with two-fold cultivation in the tillering and earring phases - 4.26 t / ha, which exceeded the control values in the tillering phase by 0, 56 t / ha (17.9%), the earring phase - by 0.37 t / ha (11.8%), tillering + earring phases - by 1.14 t / ha (36.5%). Similar results were obtained with foliar top dressing with a microelement fertilizer Megamix-Azot.

The use of Azosol 36 Extra, Megamix - Azot and Cytovit for foliar top dressing contributed to the improvement of the technological properties of the grain of holer barley of the Omskiy Golozerniy 1 variety. Thus, the grain nature of the experiment variants increased by 37-55 g / l, the protein content in the grain by 0.4 - 2.5%. Grain with a higher protein content was formed when processing plants Azosol 36 Extra in the phase of tillering and earring - 16.7% (Table 3).

Table 3: Yield and Quality of Grain of Hulless Barley

Factor A - product	Factor B – processing phase	Productivity, t/ha	Protein content, %	Nature of grain, g/l	Grain uniformity, %	Protein collection, kg/ha
Without treatment (control)		3,12	14,2	668	78,7	443,0
Azsol 36 Extra	tillering	3,68	14,8	690	82,8	544,6
Azsol 36 Extra	earring	3,49	15,9	712	83,9	554,9
Azsol 36 Extra	tillering + earring	4,26	16,7	723	85,8	711,4
Megamix - Azot	tillering	3,62	14,6	689	82,6	528,5
Megamix - Azot	earring	3,43	15,7	710	83,7	538,5
Megamix - Azot	tillering + earring	4,15	16,4	720	85,6	680,6
Cytovit	tillering	3,49	14,6	686	82,1	509,5
Cytovit	earring	3,36	15,4	705	83,0	517,4
Cytovit	tillering + earring	3,97	16,2	714	84,5	643,1
HCP _{0,5} , t/ha		0,18				

CONCLUSIONS

Complex microelement fertilizers, used for foliar top dressing of vegetating plants, contribute to an increase in the yield and quality of grain of hulless barley. The highest yield of grain of hulless barley of 4.26 t/ha was obtained with a double foliar top dressing in the tillering and earring phase with the preparation Azsol 36 Extra, the protein content in the grains was 16.7%, which is 2.5% higher than the control variant.

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