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Influence Of Macro And Microelements On Protein Producing Capacity In Feed Barley Grain.

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ABSTRACT

The study was conducted to investigate the action of Megamix preparation, macro-fertilizers on the content of protein and amino acids in feed barley grain while cultivating it under conditions of the Middle Volga region of the RF.

Keywords: barley, microelements, protein, amino acids.

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INTRODUCTION

At present, one of the most important components of modern plant growing technologies of high quality produce is the application of microelements and growth regulators. In small and extremely small concentrations they stimulate growth and plant development, contribute to the increase of their yielding capacity and the rise of qualitative indexes. Nowadays, several hundreds of compounds of chemical and biological origin have been produced and studied that possess a regulatory effect on the plant 1, 2].

To get high yields with a significant quality the crop to be cultivated should be provided not only with readily available compounds of nitrogen, phosphorus, potassium, but also with microelements that contribute to a more effective use of mineral fertilizers, speeding up the process of plant growth and development. The lack of microelements leads not only to a decline of the yield, causes a number of diseases in plants and sometimes their death, but also reduces the quality of people and animals' food.

It is possible and necessary to control the process of plant nutrition through the differentiation of forms, doses, terms, periods and ways of applying organic and mineral macro –micro-fertilizers and growth regulators in view of biological and physiological features of plants, on the one hand, and objective laws of interaction between the factors of the environment – on the other hand.

Taking account of the above-stated, we assume that one of the ways to deal with these issues is to use growth regulators. Growth regulators of plants have gained a greater popularity in recent years that are capable of improving (regulating) the pattern of mineral nutrition of crops [3,4,5].

OBJECTS AND METHODS OF RESEARCH.

Field experiments were conducted in 2015-2017 on the experimental plot of Ulyanovsk State Agrarian University. The experimental crop - barley of the variety Nutance 553. The plot area is 20 m^2, replication of the experiment is four times, the plot lay-out is randomized. The soil of the experimental field is leached black soil (chernozem) of medium thickness, average clay loam with the following characteristics: humus content is 4,3 %, mobile compounds of phosphorus and potassium (as recommended by Chirikov), 193 and 152 mg/kg of the soil respectively, the content of mobile sulfur is 4,7 mg/kg of the soil, pH of the salt extraction is 5,3. The objects of research were: preparation Megamix, as well as complex mineral fertilizers diammophoska N15P15K15, diammophoska N15P15K15S10. At the beginning of the tillering phase the initial treatment of seedlings with the studied growth regulator was carried out in concentrations recommended by the manufacturer. The application of the experimental preparation was conducted simultaneously with the application of herbicides at a rate of 200 l of the working solution for 1 ha. The analyses, records and observations in the experiment were made in conformity the generally accepted techniques and state standards. Farming techniques in all the variants of the experiment were traditional – generally accepted for this natural and climatic zone of the Ulyanovsk region.

Megamix is a liquid mineral fertilizer for top dressing with a rich content of trace elements (grams per liter): B – 1,7; Cu – 7,0; Zn – 14; Mn – 3,5; Fe – 3,0; Mo – 4,6; Co – 1,0; Cr – 0,3 and macro elements (grams per liter): N – 6; S – 29; Mg -15. A broad and rich composition of the fertilizer is aimed at the comprehensive stimulation of all the processes in the plant. Synergy and antagonism of some nutrition elements are taken into account. The indication of Megamix is to eliminate the shortage of trace elements; prevention and cure of endemic diseases; the stimulation of root nutrition, the activation of enzymes and replenishment of deficient nutrients; the increase in yielding capacity owing to the stimulation of the enzyme processes and vegetation lengthening; the improvement of the yield quality.

RESULTS AND THEIR DISCUSSION

One of the main indicators of the quality of feed barley grain is the protein content. Protein is a long chain of amino acids. From the point of view of feed production, it is very important that the protein composition, especially the content of the so-called essential amino acids, should correspond to the needs of an animal's organism. The deficiency of any important amino acid leads to the situation that only a part of plant amino acids is used by the organism of an animal for the synthesis of protein, the others are выводятся or serve as a source of energy. Protein is a combined complex of high molecular organic compounds, which

contains in its element composition about 53% of carbon, 17% of nitrogen, 7% of hydrogen. The greater part of proteins in the grain is in endosperm, in a solid form as a reserve substance which makes them more resistant to chemical and physical effects. The amount and quality of protein in the plant depends on many factors and, as the studies have shown, weather conditions of the vegetation period have a great importance, especially during the phase of grain filling.

The studies conducted show that that under the influence of the factors involved the content of protein in barley grain increases from 0,14 to 1,34%, depending on the variant (table 1). The greatest content of protein was obtained in 2016 in the variant Megamix after the initial application of mineral sulfur-containing fertilizers. Irrespective of the weather conditions more intensive accumulation of protein in the grain of the experimental crop takes place under the influence of Megamix in all fertility patterns during the years of studies.

Table 1 – Influence of Megamix and mineral fertilizers on the content of protein in barley grain, % (2015-2017)

Variants	Protein content			
	2015	2016	2017	Mean
Control group	9,3	9,5	9,2	9,33
Megamix	9,5	9,5	9,4	9,47
Control + NPK	10,5	10,9	10,2	10,53
Megamix + NPK	9,8	10,4	10,3	10,17
Control + NPKS	9,1	10,5	10,4	10,00
Megamix + NPKS	10,3	11,0	10,7	10,67

Protein in barley contains all required amino acids including the most significant and valuable (lysine and threonine). Barley grain is widely used as a highly concentrated fodder. One kilogram of grain contains 1, 27 feed units and 100 grams of digestible protein for all animal species. It has a broad application in feeding pigs. The proportion of barley in the mixed fodder composition reaches up to 50 % and higher.

The results of the studies show that the total amount of amino acids increased after the use of Megamix in the cultivation technology both under conditions of the natural fertility and after fertilization with mineral fertilizers which is connected with the intensification of nitrogen and carbohydrate metabolisms. The increase in the protein content in comparison with the control group amounts to 0,73 – 3,64 mg\g, depending on the variant. This tendency is also observed while considering the accumulation of some amino acids in feed barley grain (table 2).

The qualitative composition and quantitative content of essential amino acids characterize the biological value of protein. The more quantitatively one or another essential amino acid in protein, the higher its biological value, especially for limiting amino acids.

It is also important to consider the balance of essential amino acids in products. Too much excess of one of them may increase the need for another limiting amino acid. It is also possible to observe the phenomenon of antagonism, when the excess of one single amino acid reduces the use of another with a similar structure.

In this regard, the amino acid score is determined, which most fully characterizes the biological value of the grain. The FAO / WHO amino acid scale was used to identify the ideal protein.

In our experiments, the limiting amino acid is methionine. Under the influence of the factors used, the amino acid score of individual amino acids increase with respect to the control up to 2.1% (Table 3).

Mineral plant nutrition is the main regulated factor used for the purposeful management of the growth and development of plants in order to create a high yield of good quality.

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Table 2 – Influence of Megamix and mineral fertilizers on the amino acid composition of barley grain, mg/g (mean values for 2015-2017)

Variants	Valine	Leucine	Isoleucine	Threonine	Methionine	Histidine	Lysine	Phenylalanine	Σ amino acids
Control group	4,68	7,35	2,63	3,91	0,97	3,22	3,81	4,28	30,87
Megamix	4,81	7,51	2,90	3,93	0,98	3,33	3,83	4,46	31,78
Control group + NPK	4,85	7,61	2,78	3,98	1,07	3,42	4,02	4,48	32,21
Megamix + NPK	4,65	7,58	2,78	3,95	1,15	3,38	3,81	4,45	31,60
Control group + NPKS	5,25	8,16	3,10	4,25	1,13	3,68	4,18	4,75	34,51
Megamix + NPKS	5,01	7,83	2,88	3,98	0,95	3,45	3,92	4,62	32,65

Table 3 – Influence of Megamix and mineral fertilizers on the amino acid score of barley grain , % (mean values for 2015-2017)

Variants	Valine	Leucine	Isoleucine	Threonine	Methionine	Histidine	Lysine	Phenylalanine
Control group	9,4	10,5	6,6	9,8	2,8	14,6	6,9	7,1
Megamix	9,6	10,7	7,3	9,8	2,8	15,1	7,0	7,4
Control group + NPK	9,7	10,9	6,9	9,9	3,0	15,5	7,3	7,5
Megamix + NPK	9,3	10,8	6,9	9,9	3,3	15,4	6,9	7,4
Control group + NPKS	10,5	11,7	7,7	10,6	3,2	16,7	7,6	7,9
Megamix + NPKS	10,0	11,2	7,2	9,9	2,7	15,7	7,1	7,7

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CONCLUSIONS

Thus, the use of the liquid mineral fertilizer «Megamix» in the technology of cultivating feed barley, as well as classical mineral fertilizers, contributed to the rise of grain quality of the experimental crop. The studied factors gave a higher level of mineral nutrition of plants during the whole vegetation period of the crop which became the basis of a greater use of the genetic potential of plant yielding capacity. Top dressing of vegetating barley plants with the experimental preparation improves technological and feeding values of grain – the content of protein and amino acids which will make it possible to use it for production of feeds of a high nutrition value.

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