THE EFFICIENCY OF NEW, ECOLOGICALLY SAFE MICRO-FERTILIZER "COMPLEX - CO" FOR THE CEREALS CULTIVATION

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INTRODUCTION

Micronutrient deficiencies are major constraints in cereal production in the fucured agricultural programs. Micronutrient fertilizers are gaining importance day by day and would play a major role in bringing stability and sustainability in the production of food grains, pulses in the coming decade. One of the possible directions for the creation of effective new preparations containing micronutrients is the production of compounds with regulable solubility and stability in water and soil environment. In this issue coming importance the special use of their chelating complexes [1].

The three main classes of micronutrient sources are known: inorganic, synthetic chelates and natural organic complexes. Inorganic sources are the most common metallic salts used in the fertilizer industry because of their ready availability and water solubility. In the past 35-40 years, it has been recognized that compounds containing chelated metals could supply many of the micronutrient requirements of plants [2]. These chelates find use in cultivation of a wide variety of agricultural cereals. Applications for chelates vary from fertilizer additives, seed dressing to foliar sprays and hydroponics. Chelating agents strongly affect the efficiency of micronutrient application and the degree of assimilation of micronutrients by plants, as a result of which plants absorb micro elements 6-10 times better than their sulfates or chlorides [3].

Based on natural raw materials (wine-making waste: cream of tartar) preparetions with growth-stimulating properties and trace elements content was developed. These products are distinguished by a simple, affordable, waste-free production method. The main adventage are high susceptibility of plants to active substances, low cost and consumption rates, non-toxicity to humans and environmental objects.

Without fertilizer-N, global food production would be sufficient for less than half of the current population of 7.3 billion [4]. Trends of fertilizer-N application, nitrogen harvested by the crop on a per hectare basis showed linear increases from 1961 to 2010, with 50-year averages of 78 $kg\,ha^{-1}$ for maize, 60 $kg\,ha^{-1}$ for rice and 56 $kg\,ha^{-1}$ for wheat [5]. Nearly half of the N fertilizer supplied is not used by cereals and is lost to the ecosystem through volatilization, run-off, or leaching [6]. These losses lead to environmental problems, such as the release of greenhouse gases, pollution of water bodies, soil acidification, or biodiversity reduction. The atmospheric level of N pollution is expected by, 2050, to be in the range 102–156% higher than in 2010 with the agricultural sector accounting for 60% of this increase [7].Agriculture has been recognized as a major source of nitrate leaching pollution [8].Nitrogen leaching is not only related to the amount of fertilizer applied, but also to othervariables such as the timing and place of fertilizer applied in relation to the cereals growingcycle, irrigation regimes, type of fertilizer, agronomic practices, cereal rotation, soil characteristics,type of soil cover, climate, etc. [9].

Similar problems exist in Armenia due to the widespread use of nitrogen fertilizers in the Sevan Lake area. In particular, in recent years, there has been an increase in the nitrogen content in the water, which leads to the formation of green algae and eutrophication.The use of chelating micro-fertilizers in modern agriculture leads to a reduction in the consumption of traditional nitrogen-containing fertilizers.Taking into account above mentioned, a simple and affordable technology via acid treatment of wine-yeast/cream of tartar sediments, was developed in the base laboratory of NPUA "Creation and quality control of agricultural pesticides" [10]. Based on this technology, a "Complex-Co"new complex preparation with plant growth stimulating effect was elaborated."Complex-Co" contains additives (amino derivatives of natural tartaric acid, colamine and micro-nutrient elements) providing the target properties and improves soil behavior.

METHODS

At the first stage of the technology, natural tartar is subjected to acid treatment, after which all tartaric acid is dissolved, then trace elements are added in the form of salts, monoethanolamine is added to regulate the pH and add additional nitrogen. The content of various trace elements in 1 liter of the drug and some physical parameters are shown in table 1.

Table 1

Composition of the preparation "Complex-Co" and physical characteristics

Content of microelements and supplies g/l:								pH	d_4^{20}
Fe	Zn	Cu	B	K	SO_4	MEA Colamine	BAS		
6	8.7	12.5	5	28	79	142.5	20	3.6	1.31

In order to study the effect of the obtained micronutrient preparation "Complex-Co" on the efficiency of cereal cultivation, experiments were carried out in the conditions of water-abundant, cultivated-irrigated soils of the Armavir region of the Republic of Armenia. Winter triticale was sown annually in the second decade of October 6.0 million pieces, sowing of barley and emmer in the second decade of March, respectively, 5.0 and 4.5 pieces: germinating grains with norm. The experiments were carried out in three variants, with four repetitions; the estimated area of the landfill was 25m^2. To do this, the seeds of legumes (barley, emmer, triticale) were treated with a 1% solution of this drug to combat fungal diseases before sowing. At the stage of the bush in autumn sowing triticale late autumn on (29.11.2021) and early spring (06.03.2022), the grass cover was subjected to a 0.5% solution of the same drug for foliar nutrition.

RESULTS

The effect of the "Complex-Co" preparation on the growth of a number of sowing cereals is presented in table 2.

Table 2

The effect of the "Complex-Co" on the growth rate of barley, emmer and triticale.

Cereal	Version	Plant height at the leaf stage, cm	Degree of leafing		Plant height at earing stage, cm	Length ear, cm	The number of cereals from the ear, Pcs	Diseases, scoring
			General	Effective				
Barley	Test version	13.5	2.11	1.97	71.4	7.4	31.2	4.7
	Cultivated	16.7	3.22	2.24	88.3	9.8	39.8	4.9
Emmer	Test version	12	1.91	1.02	64.3	5.3	24.7	4.8
	Cultivated	14.7	2.42	1.92	71.3	6.4	30.1	5
Triticale	Test version	17.9	3.24	2.01	161.3	9.7	45.4	4.9
	Cultivated	20.9	4.15	2.97	187.4	11.9	55.5	5

The data in the table show that the drug has a significant effect on the growth rate of plants both in the leaf stage and on the height in the earing stage. The height of the latter increased by 2.0-3.5 cm compared to the control in the tested versions in the leaf phase, and this difference became more evident in the earing phase. So, if the preparation "Complex-Co" at the leaf stage contributed to an increase in the height of plants

of emmer wheat by 10.3, barley by 9.2 cm, then in triticale this difference reached unprecedented values, reaching 28.1 cm, which plays a big role, to get straw.

CONCLUSION

Thus, the preparation "Complex-Co", obtained by an optimized technology, showed a rather high efficiency on grain cereals both for pre-treatment of seeds and when used as a foliar feeding method. The preparation can be used during the entire growing season of cereals, which will reduce the consumption of nitrogen fertilizers, which is one of the main goals of green agriculture. Further research is needed for other crops, depending on the species, to determine the range of best working fluid concentrations and application rates.

Acknowledgment

The work was supported by the Science Committee of RA, in the frames of the research project № 21T-4B070. "Evaluation of the effectiveness of growing new varieties of cereal crops in green agriculture".

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