

# Effect of Copper, Zinc and Molybdenum Micro Elements in Plants When Using Granular and Liquid Nitrogen Fertilizer with Micro Elements Made from Local Raw Materials

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**Abstract.** A new type of micronutrient liquid fertilizers was obtained by treating the calcium nitrate porridge obtained on the basis of research with urea (ammonium nitrate, KAS) and micronutrient (Cu Zn Co) salts in the amount necessary for plant growth. The chemical composition, product properties and rheological properties of liquid fertilizers containing microelements were studied, and a laboratory device for the production of liquid fertilizers was created. As a result of preliminary investigations, it was found that copper, zinc, molybdenum, manganese, calcium, magnesium are the most scarce trace elements in the soils of our republic. In order to apply microelements to the soil as fertilizers, the research was carried out in order to find their various sources, to study various industrial residues, to solve the problems of testing, processing of local raw materials and industrial waste containing trace elements a rational technology for obtaining new types of simple and complex liquid, granular and suspended fertilizers was developed, and its agrochemical properties and the amount of microelements in the plant composition and its effect on the absorption of nutrients (NRK), cotton yield and quality parameters of fiber were determined when used in typical gray soil conditions.

Key words: typical gray soil, nitrogen, phosphorus, potassium, copper, zinc, molybdenum, application periods, cotton yield.

## 1 Introduction

The results of many years of scientific research conducted in our country and abroad show that mineral fertilizers containing trace elements (molybdenum, cobalt, copper, zinc, boron, manganese, etc.) increase the quality and yield of agricultural products [1-3]. As a result of the lack of these elements, the growth and metabolism of plants, their productivity decreases, and their susceptibility to various diseases increases [4, 5]. When adding microelements to fertilizers, their interaction with the components of fertilizers and the study of the forms and properties of the resulting substances is an important task [6, 7].

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E.K.Kruglova (1984) [8], M.A.Belousov (1975) [9], B.M.Isaev (1979) [10], M.M.Alieva (1979) [11] in studying the norms and terms of use of microelements in cotton farming, determining their importance, solving problems of use ), T.P. Pirakhunov (1972), A.A. Nugmanov(1982), A.Z. Atabekov(1987), O.R. Kozak(2001) [12], X.A. Nabieva(2001) [13], A.I. Radjabov (2002), A.A.Karimberdieva (2014) [14], Q.M.Mirzajonov (2014) [15], F.Hoshimov (2017) [16], A.Sanakulov (2018) [17] and other scientists conducted scientific and research work. Finding various sources of microelements as fertilizers, studying various industrial wastes, solving problems of testing are of great importance [18, 19]. In solving these issues, the goal of the research conducted in cooperation with the scientists of the Institute of General and Inorganic Chemistry of the UzR FA is to recycle local raw materials and industrial waste into a new type of simple and complex liquid containing microelements (copper, zinc, molybdenum, calcium, calcium-magnesium, etc.) , is to develop a rational technology for obtaining granular and suspended fertilizers and to determine its effect on the amount of trace elements in the plant and cotton yield when applied in typical gray soil conditions [20-23].

## 2 Materials and Methods

Conducting field experiments and phenological observations were conducted according to UzPITI methods (2007). The agrochemical analysis of soil and plant samples obtained from field experiments was determined according to the methods of "Metody agrokhimicheskikh, agrofizicheskikh i microbiologicheskikh issledovaniy v polivnyx khlopkovyx rayonakh" (1963) and "Metody agrokhimicheskikh analizov pochv i rasteniy Sredney Azii" (1977). The field experiment was conducted at the PSUEAITI experimental site under typical gray soil conditions. This soil has been irrigated since ancient times, the mechanical composition is medium sandy, and the groundwater is deep (18-20 m). According to the initial agrochemical analysis of the typical gray soil, humus is 0.967% and 0.825% in the plow (0-30 cm) and lower (30-50 cm) layers. was found to be low in nitrate nitrogen (1.65 and 1.51 mg/kg), mobile phosphorus (19.1 and 11.4 mg/kg) and exchangeable potassium (150 and 132 mg/kg). The following types of mineral fertilizers were used in the field experiment: granular ammonium nitrate fertilizer with calcium (N-27%, Ca-2-3%), ammonium nitrate with calcium + magnesium (N-27%, Mg-2-3%). Copper (Cu) and zinc (Zn) 1-2 kg/ha and molybdenum (Mo) 0.5-1.0 kg/ha were added to the liquid nitrogen calcium fertilizer according to the standards recommended for the cotton crop.

60-70% of the annual rate of phosphorus fertilizers (R-100kg/ha), 50% of potassium before autumn plowing (K-50kg/ha), the remaining rates of phosphorus fertilizers together with nitrogen fertilizers during flowering (R-40kg/ha), potassium fertilizer (K-50 kg/ha) was applied during the period of pruning. Nitrogen fertilizers 2nd time (var. 5.6) cotton in the periods of 2-3 new leaves (N-100kg/ha) and tillering (N-100kg/ha) and 3rd time in options 2,3,4,7,8 It was applied during the periods of feeding cotton - 2-3 leaves (N-50 kg/ha), tillering (N-75kg/ha) and flowering (N-75kg/ha) In the field experiment, cotton Navroz variety was planted. The experiment consisted of 8 options and was carried out in 3 repetitions.

## 3 Results and Discussion

Nitrate nitrogen in the soil when applied together with ammonium nitrate fertilizer containing calcium and calcium+magnesium and nitrogen calcium fertilizer containing copper+zinc and molybdenum (N-200 kg/ha) and phosphorus and potassium fertilizers (R-140 K-100 kg/ha), It was found that there is an effect on the amount of mobile phosphorus, exchangeable

potassium and copper, zinc, molybdenum, calcium and magnesium, and the relatively favorable conditions for feeding plants with nitrogen, phosphorus, potassium and microelements of copper, zinc, molybdenum, calcium and magnesium were created. In the agrochemical analyzes conducted at the end of the cotton season, the total amount of copper, zinc, molybdenum, calcium and magnesium in the plant parts was determined, and the total amount of copper in the leaf (4.9-7.8 mg/kg), stem (4.3-7.6 mg/kg), in pods (5.1-6.6 mg/kg), cotton (4.2-7.3 mg/kg), zinc content in leaves (14.5-22.4 mg/kg), pods (13.8-23.1 mg/kg) in stem (16.0-18.6 mg/kg), cotton (15.1-20.1 mg/kg), molybdenum content in leaf (3.7-12.8 mg/kg), in the cup (4.6-6.6 mg/kg), in cotton (1.0-1.8 mg/kg), calcium content in the leaf (5.97-7.2 %), in the stem (1.46-1.80 %), in the cup (1.60-2.26 %), in cotton (0.29-0.36 %), magnesium content in the leaf (0.60-0.94 %), in the cup (0.22-0.35 %) was found to be more accumulated in the stem (0.41-0.61 %), in cotton (0.24-0.32 %). In the control variant used R-140, K-100 kg/ha (1) the total amount of copper, zinc and molybdenum is 4.9 in the leaf, respectively; 14.5 and 7.6 mg/kg (2018); 6.8; 18.9; and 3.7 mg/kg (2019); In 2018, calcium accounted for 6.0%, magnesium for 0.10%, respectively for 2019 for 5.89% and 0.83%, copper, zinc, molybdenum for the stem 4.3; 7.2 and 0.24 mg/kg (2018); 6.5; 16.9 and 0.97 mg/kg (2019); 5.1 in the grain; 16.5 and 4.6 mg/kg (2018); 5.7; 13.8 and 4.7 mg/kg (2019), 4.5 in the root; 7.5 and 0.4 mg/kg (2018); 5.3; 8.7 and 0.6 mg/kg (2019); 4.2 in cotton; 10.2 and 0.6 mg/kg (2018); 5.3; 19.6 and 1.2 mg/kg (2019); in 2018, the amount of calcium and magnesium was 0.8 and 0.30% in the stem, 0.9 and 0.22% in the stem, 0.14 and 0.18% in the root, and 0.16 and 0.20% in cotton. , and in 2019, it was 1.46 and 0.52% in the stem, 1.96 and 0.32% in the bole, 0.96 and 0.39% in the root, and 0.29 and 0.24% in cotton. In the 2nd option, where ammonium nitrate fertilizer (N-200 kg/ha) was used against the background of R-140, K-100 kg/ha, the total amount of copper in the leaves was 6.1 mg/kg (2018); 6.8 mg/kg (2019); mg/kg (2020), zinc content 15.6 mg/kg (2018); 18.9 mg/kg (2019); mg/kg (2020), molybdenum content 9.0 mg/kg (2018); 3.8 mg/kg (2019); calcium 6.2% (2018); 5.97% (2019); magnesium 0.12% (2018); 0.86% (2019); In 2018, the total amount of copper in the stem was 4.5 mg/kg, the amount of zinc was 7.5 mg/kg, the amount of molybdenum was 0.26 mg/kg, the amount of calcium was 1.0%, the amount of magnesium was 0.32%, the amount of copper is 5.3 mg/kg, the amount of zinc is 16.5 mg/kg, the amount of molybdenum is 5.2 mg/kg, the amount of calcium is 1.0%, the amount of magnesium is 0.24%, respectively, in 2019, 6.5; 17.5 and 1.02 mg/kg, calcium content 1.54%, magnesium content 0.52%, 5.3 mg/kg in 2018, zinc content 16.5 mg/kg, molybdenum the amount is 5.2 mg/kg, the amount of calcium is 1.0%, the amount of magnesium is 0.24%, in 2019, 5.7 in the pelvis, respectively; 13.8; 5.4 mg/kg, calcium content 2.08%, magnesium content 0.32%, copper content in root 4.6 mg/kg in 2018, zinc content 11.9 mg/kg, molybdenum content 0.6 mg/kg, calcium content 0.16%, magnesium content 0.20%, in 2019, 5.5 in root composition; 9.2; 0.7 mg/kg, calcium content 0.98%, magnesium content 0.41%, copper content in cotton in 2018 4.5 mg/kg, zinc 10.3 mg/kg, molybdenum content 0.8 mg/kg, calcium content 0.18%, magnesium content 0.22% in cotton in 2019, respectively 6.2 in cotton; 19.8; 1.2 mg/kg, calcium content 0.29%, magnesium content 0.24%, was found to be between Granular ammonium nitrate fertilizer containing calcium and calcium magnesium (N-200 kg/ha) was used against the background of R-140, K-100 kg/ha, and in options 3 and 4, when cotton was fed with nitrogen fertilizers for the 3rd time, the total amount of copper in the leaf in 2018 was 6.8-7.0 mg/kg, zinc 15.6-19.6 mg/kg, molybdenum 10.2-12.4 mg/kg, calcium 6.6-7.0%, magnesium 0.14-0.16%, respectively 6.8-7.0 in the leaf in 2019; 19.2-19.5; 3.7-3.8 mg/kg, calcium 6.04-6.05%, magnesium 0.86-0.92%, copper 5.6-5.9 mg/kg in 2018, zinc the amount is 9.6-12.5 mg/kg, the amount of molybdenum is 0.32-0.40 mg/kg, the amount of calcium is 1.2-1.6%, the amount of magnesium is 0.34-0.40%, 6.5-6.6 respectively in 2019; 17.5-17.6; 1.02-1.20 mg/kg, calcium content 1.56-1.58%, magnesium content 0.52-0.54%, copper content 5.6-6.1 mg/kg in 2018 kg, the amount of zinc is 20.1-21.4 mg/kg, the amount of

molybdenum is 5.6-6.2 mg/kg, the amount of calcium is 1.2-1.6%, the amount of magnesium is 0.26-0.30%, respectively 6.2-6.2; 14.5-14.6 in 2019; 5.6-5.8 mg/kg, calcium content 2.12-2.24%, magnesium content 0.34-0.35%, copper content in root 6.1-6.5mg/kg in 2018 , the amount of zinc is 14.0-16.0 mg/kg, the amount of molybdenum is 0.8-1.2 mg/kg, the amount of calcium is 0.18-0.24%, in 2019, respectively, 5.7-6 ,0; 9.4-9.8; 0.7-0.8; calcium content is 1.14-1.24%, magnesium content is 0.42-0.45%, copper content in cotton is 5.1-5.8 mg/kg in 2018, zinc is 12.1-13.6 mg/kg kg, molybdenum content 1.0-1.4mg/kg, calcium content 0.20-0.26%, magnesium content 0.26-0.34%, respectively 6.4-6.4 in 2019; 19.8-20.0; 1.4-1.5; calcium content was 0.29-0.30%, magnesium content was 0.25-0.26%. Granular ammonium nitrate fertilizer (N-200 kg/ha) containing calcium and calcium+magnesium (N-200 kg/ha) in the background of R-140, K-100 kg/ha 2-3 leaves of 100 kg/ha in the 2nd feeding of cotton and applied in options 5 and 6 In 2018, the total amount of copper in the leaves was 6.5-6.8 mg/kg, the amount of zinc was 19.5-19.5 mg/kg, the amount of molybdenum was 9.8-11.0 mg/kg, calcium was 6.4-6 .5%, magnesium 0.13-0.15%, respectively 7.2-7.2 in 2019; 19.2-19.5; 3.7-3.7 mg/kg, calcium 5.89-5.98%, magnesium 0.86-0.92%, the total amount of copper in the stem in 2018 was 4.6 -5.8 mg/kg, zinc content 9.5-11.8mg/kg, molybdenum content 0.30-0.36mg/kg, calcium content 1.1-1.4%, in 2019 6.5-6.6; 17.5-17.9; 1.10-1.10 mg/kg, calcium content 1.56-1.56%, magnesium content 0.52-0.54 % in 2018, the amount of copper is 5.4-5.9 mg/kg, the amount of zinc is 19.3-20.4 mg/kg, the amount of molybdenum is 5.4-6.0 mg/kg, the amount of calcium is 1, 1-1.4%, magnesium content 0.25-0.27%, 5.7-5.7 mg/kg in 2019, respectively; 13.8-13.8 mg/kg; 5.6-5.8 mg/kg; the amount of calcium is 2.08-2.14%, the amount of magnesium is 0.32-0.35%, the amount of copper in the root is 5.2-5.6 mg/kg in 2018, the amount of zinc is 13.3-15.7 mg/kg, molybdenum content 0.7-1.0mg/kg, calcium content 0.20-0.22%, magnesium content 0.21-0.24% in 2019 respectively 5.7-5 ,7; 9.4-9.8; 0.8-0.8 mg/kg, calcium content 0.98-1.20%, magnesium content 0.42-0.42%, copper content in cotton 5.0-5.2 mg/kg in 2018 , zinc 11.4-12.2 mg/kg, molybdenum content 0.9-1.2 mg/kg, calcium content 0.19-0.22%, magnesium content 0.27-0.32% in 2019, respectively 6.4-6.4; 19.8-19.8; 1.5-1.5 mg/kg, calcium content was 0.30-0.30%, magnesium content was around 0.25-0.26%. Nitrogen-calcium fertilizer containing copper+zinc and molybdenum was used against the background of R-140, K-100 kg/ha. In options 7 and 8, the total amount of copper in the leaf was 7.8-7.6 mg/kg in 2018, and the amount of zinc was 22.4-20 ,6 mg/kg, molybdenum content 12.6-12.8 mg/kg, calcium 6.7-6.8%, magnesium 0.16-0.18%, respectively 7.2- 7.6; 20.0-20.0; 4.2-4.5 mg/kg, calcium 6.04-6.08%, magnesium 0.93-0.94%, the total amount of copper in the stem is 6.5-7.6mg/kg in 2018, zinc content is 13.7-16.0 mg/kg, molybdenum content is 0.46-0.48 mg/kg, calcium content is 1.7-1.8%, magnesium content is 0.35-0.38% ni, 6.6-6.8 respectively in 2019; 18.4-18.6; 1.24-1.26; calcium content is 1.65-1.65%, magnesium content is 0.54-0.61%, copper content is 6.5-6.6 mg/kg in 2018, zinc content is 21.7-23.1 mg/kg, molybdenum content 6.4-6.6 mg/kg, calcium content 1.3-1.5%, magnesium content 0.260-0.28%, respectively 6.2-6 in 2019 ,2; 14.5-14.7; 6.4-6.5 mg/kg, calcium content 2.24-2.26%, magnesium content 0.35-0.35%, copper content in root 7.8-8.2 mg in 2018 /kg, the amount of zinc is 17.5-18.2 mg/kg, the amount of molybdenum is 1.4-1.6mg/kg, the amount of calcium is 0.25-0.26%, the amount of magnesium is 0.23-0 .25%, respectively 5.7-6.0 in 2019; 9.8-10.3; 0.8-0.9 mg/kg, calcium content 1.24-1.24%, magnesium content 0.42-0.45%, copper content in cotton 6.4-7.3 mg/kg in 2018 kg, zinc 13.8-15.1 mg/kg, molybdenum content 1.6-1.8 mg/kg, calcium content 0.24-0.28%, magnesium content 0.28-0.30% ni, 6.4-6.7 respectively in 2019; 19.8-20.1; 1.5-1.6 mg/kg, the amount of calcium was 0.32-0.34%, and the amount of magnesium was 0.26-0.27%. In 2020, at the end of the cotton growth period, total copper, zinc , molybdenum, calcium and magnesium amounts were also determined in the results of agrochemical analysis. Compared to the control option, the highest results were obtained with the use of granular ammonium nitrate fertilizer (N-200 kg/ha) containing calcium and

calcium+magnesium in the background of R-140, K-100 kg/ha. the total amount of copper is 6.8-7.0 mg/kg, the amount of zinc is 17.6-18.8 mg/kg, the amount of molybdenum is 6.6-7.0 mg/kg, calcium is 6.5-6.8%, magnesium 0.54-0.58%, the total amount of copper in the stem is 5.9-6.2 mg/kg, the amount of zinc is 13.0-13.4 mg/kg, the amount of molybdenum is 0.68-0.72 mg/kg, calcium content 1.26-1.30%, magnesium content 0.45-0.48%, copper content 5.9-6.2 mg/kg, zinc content 15.4- 15.6 mg/kg, molybdenum content 5.4-5.8 mg/kg, calcium content 1.60-1.72%, magnesium content 0.31-0.34%, copper content in root 5, 4 and 5.8 mg/kg, zinc content 11.7 and 12.6 mg/kg, molybdenum content 0.80 and 1.00 mg/kg, calcium content 0.60 and 0.64%, magnesium content 0.34 and 0.36%, the amount of copper in cotton is 5.4 and 5.6 mg/kg, the amount of zinc is 13.4 and 13.6 mg/kg, the amount of molybdenum was 1.26-1.30 mg/kg, the amount of calcium was 0.30 and 0.34%, magnesium was 0.28 and 0.30%. Also, in options 7 and 8, where nitrogen-calcium fertilizer containing copper + zinc and molybdenum was used against the background of R-140, K-100 kg/ha, due to the good supply of nutrients in the soil, the amount of microelements calcium and magnesium in the plant composition is also higher compared to the control option. received. In this case, the total amount of copper in the leaf is 7.6 and 7.4 mg/kg, the amount of zinc is 19.2 and 19.0 mg/kg, the amount of molybdenum is 7.4 and 7.6 mg/kg, the amount of calcium is 7.2 and 7.0%, the amount of magnesium is 0.60 and 0.57%, the amount of copper in the stem is 6.6 and 6.4 mg/kg, the amount of zinc is 13.8 and 13.6 mg/kg, the amount of molybdenum is 0.74 and 0.76 mg/kg, calcium content 1.136 and 1.34%, magnesium content 0.50 and 0.48%, copper content 6.4 and 6.2 mg/kg, zinc content 17.0 and 16.8 mg /kg, the amount of molybdenum is 6.2 and 6.4 mg/kg, the amount of calcium is 1.80 and 1.76%, the amount of magnesium is 0.36 and 0.34%, the amount of copper in the root is 6.2 and 6.0 mg/ kg, zinc content 13.2 and 13.0 mg/kg, molybdenum content 1.10 and 1.05 mg/kg, calcium content 0.70 and 0.68%, magnesium content 0.38 and 0.34%, the amount of copper in cotton is 6.0 and 5.8 mg/kg, the amount of zinc is 14.0 and 13.8 mg/kg, the amount of molybdenum is 1.30 and 1.32 mg/kg, the amount of calcium is 0.36 and 0.34% , magnesium content was 0.32 and 0.30%. The lower values of total copper, zinc, molybdenum, calcium and magnesium in the plant parts are in the control variant (N-0, R-140, K-100 kg/ha background), copper content in leaves is 5.8 mg/kg, zinc content is 16, 7mg/kg, molybdenum content 5.6mg/kg, calcium content 5.9%, magnesium content 0.46%, copper content in stem 5.4mg/kg, zinc content 12.0mg/kg, molybdenum content 0.60 mg/kg, calcium content 1.13% and magnesium content 0.41%, copper content 5.4 mg/kg, zinc content 15.0 mg/kg, molybdenum content 4.6 mg/kg, calcium content 1.44% and magnesium content of 0.27%, the content of copper in the root is 4.9 mg/kg, the content of zinc is 8.1 mg/kg, the content of molybdenum is 0.50 mg/kg, the content of calcium is 0.55%, the content of magnesium 0.28%, the amount of copper in cotton is 4.7 mg/kg, the amount of zinc is 12.8 mg/kg, and the amount of molybdenum is 0.90 mg/kg. calcium content was 0.24%, magnesium content was 0.22%.

Ammonium nitrate fertilizer containing calcium and calcium magnesium and nitrogen calcium fertilizer containing copper + zinc and molybdenum (N-200 kg/ha) together with phosphorus and potassium fertilizers (R-140 K-100 kg/ha) during cotton growth period and had a positive effect on the increase of cotton yield due to the good supply of nutrients with microelements. First of all, it should be said that nitrogen fertilizer containing calcium, calcium-magnesium, copper + zinc and molybdenum and without it had an acceptable effect on cotton yield, regardless of the application. The average cotton yield is 27.9 ts/ha (2018) in option 1 with R-140 K-100 kg/ha applied background; 28.5 t/ha (2019); 36.1 t/ha (2020) and averaged 30.8 t/ha in three years. In option 2, where ammonia nitrate fertilizer (N-200 kg/ha) was used against the background of R-140 K-100 kg/ha, the cotton yield was 34.1 tons/ha (2018); 34.7 ts/ha (2019); It was 41.1 t/ha (2020) and averaged 36.6 t/ha in three years, which was 5.8 t/ha more than the control option. In the field experiment, the highest cotton yield (38.5-39.5 and 37.9-39.0 t/ha) was obtained on the background of R-140 K-100 kg/ha,

ammonium nitrate fertilizer containing calcium and calcium magnesium and copper+zinc and molybdenum nitrogen-calcium fertilizer (N-200 kg/ha) compared to the control, the additional cotton yield was 7.7-8.7 and 7.1-8.2 tons/ha, compared to option 2 where ammonium nitrate fertilizer was used It was 1.9-2.9 and 1.3-2.4 ts/ha.

## 4 Conclusion

Relatively optimal conditions for the growth and development of cotton, accumulation of dry mass and assimilation of nutrients are in the background of R-140 K-100 kg/ha, ammonium nitrate fertilizer containing calcium and calcium magnesium and nitrogen calcium fertilizer containing copper + zinc and molybdenum (N- 200 kg/ha) 50 kg/ha in 2-3 leaves, 75 kg/ha at tillering and 75 kg/ha at the beginning of the flowering period or depending on soil fertility ammonium nitrate fertilizer with calcium and calcium+magnesium in 2-3 leaves (N-100 kg/ha ) and was found to be created when applied in planing (N-100 kg/ha).

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