

THE IMPACT OF THE COLLOIDAL SOLUTION OF ZINC AND COPPER IN THE PROCESS OF SEED GERMINATION OF OATS

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Abstract. *The article shows results of impact colloidal solution various concentrations of zinc and copper and their complex on laboratory germination of oats seeds. Noted, that copper concentration 1:1 had reduced seed germination for 3-14%, which has a negative impact on subsequent processes of growth oats. Concentration of copper 1:10 was affecting on germination of seeds at the same level as control variant, so is not evident phytotoxicity of copper in that solution concentration. Established, that with copper concentration 1: 100 seeds germination of all surveyed crops was increased, what allow argue about the effectiveness of solution at this concentration.*

Key words: *Oats, seeds colloidal solution of copper and zinc, concentration phytotoxicity*

Formulation of problem. One of the current problems is significant anthropogenic pollution of environment, which has an impact on plants and seeds [6]. Presence of available micronutrients in seeds makes enzymatic processes more active [2]. Treatment of seeds before sowing by growth stimulating agents provides fast and friendly germination, increases plant resistance to unfavorable factors, such as lack of moisture and defeat by diseases, significantly improves competitive properties of crops in relation to weed [7].

Analysis of recent research and publications in which was started solution of the problem. Between accumulation of heavy metals in plants and pollution of environmental are direct, although disproportionate, relationship: the higher concentration of metals in environment, the more their in plants [7]. Contamination of farmland by heavy metals mainly occurs due to atmospheric emissions of enterprises, livestock farms and because of application fertilizers and pesticides [4, 6].

However, some heavy metals in minimum quantities are necessary to carry out the biochemical and physiological processes in plants. Absence of these metals breaks plants growth and development [1, 8]. Under natural conditions in soils simultaneously exist different metals. Some of them are interacting. The available in the scientific literature data regarding reaction-answer of plants for action some (over twenty) different metals, which accumulating in different organs of plants and affect on their growth and development [4, 5]. For these studies it is important to determine how the heavy metals spreading in various organs, tissues, cells and organelles. The

study of growth processes of plants under the influence of heavy metals, research mechanisms of plant resistance and accumulation of heavy metals – important task of modern plant biology [5].

Zinc affects on growth of plants through its participation in the synthesis of auxin (growth hormone). Lack of zinc inhibits rate of cell division that leads to external changes [1].

Number of copper at the time of sprouting roots plants decreases and restoring again only for transition to independent power supply. That's why plants are most susceptible to feeding by copper at early stages of development. Seeds, which were treated by copper, were ahead of control by speed of development on 20%. As a result, plants are more resistant to temperature changing and easier tolerate soil drought. With feeding by high doses of nitrogen fertilizer is heightened needs of copper by plants, which also contributes to worsening of copper deficiency symptoms [5].

Weighty value for getting high performance of grain cereals has initial intensity of growth processes. One of the measures for solving the problem – selection of optimum complex for treating seeds with using of trace elements and bacterization before sowing, which is basis for healthy, friendly shoots and improves the quality of sown seeds [1].

Purpose of research. In connection with said, purpose of our study was investigating effect of colloidal solution different concentrations of zinc and copper, and their complex effect on laboratory germination of oats seeds.

The main goal is to maximize yields of agricultural crops, foundation of which is seed material.

Material and methods of research. Was studied plants oats (*Avena L.*) variety Busol. Seeds was germinated in distilled water (control) and in colloidal solution Zn and Cu with concentrations 1:1; 1:10 and 1:100. The study was performed in triplicate.

The main indicator quality of material is seed germination, which mostly ensures biopotential of crops. Planting density and uniformity of its distribution depends from seed germination. Germination of seeds (Lab) - is correlation of number of germinated cereals seeds to the number of analyzed seeds, which is explored in the laboratory, expressed as a percentage.

Seeds treated according to scheme: 1. Control (distilled water); 2. Zn at concentration 1:1; 3. Cu at concentration 1:1; 4. Zn at concentration 1:10; 5. Cu at concentration 1:10; 6. Zn at concentration 1:100; 7. Cu at concentration 1:100.

By scientists of NULES (Lopatko K. G., Aftandilyants E. G., Zasekin, D. A., Kalenska S. M., Tonha O. L.), was developed technology for getting biogenic water-based metal colloidal solution by physical method, such as Fe, Mn, Zn, Mo, Co, Cu, Ag, which are necessary for the implementation of biological potential of plants and was patented mother colloidal solution of above metals [3].

Results of research. As subject of study was selected seed variety of oats Busol. Oats seeds absorb 60-65% water of its own weight for germination. With using of colloidal solution Cu at concentration 1: 1 seed oats in 3 days were not germinated. There were some sprouts of seeds.

After analyzing results of sprouting and calculation of oat seed germination was found that concentration of copper 1:1 is phytotoxic during germination of oats (fig. 1).

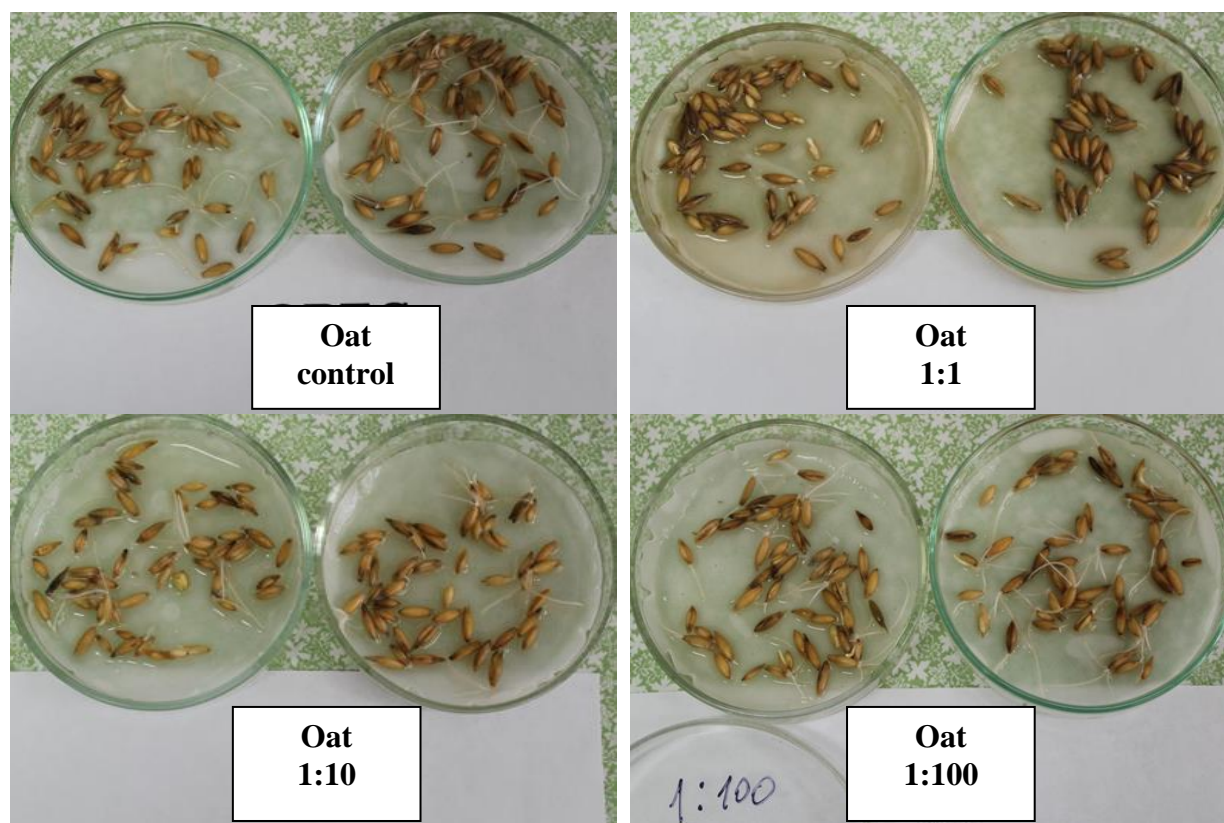


Fig. 1. The effect on seed germination oats varieties Busol colloidal solution of Cu, after 3 days

Was determined that concentration of copper 1:1 reduces seed germination for 3-14%, what is negative for further oats growing. As with decrease of laboratory germination also decreases field germination, that's leading to low plant density of these crops. It should be noted, that with decreasing concentration of colloidal solution copper and zinc were increased laboratory germination, as evidenced by the data accordingly 81% and 79% in comparing with 75% control variant.

Was detected close correlation relationship between concentration of colloidal solution and laboratory germination, which is $R = 0,841$ and was received regression equation $y = -0,1125x^5 + 2,6515x^4 - 22,778x^3 + 87,083x^2 - 143,12x + 151,43$ (fig. 2).

For copper concentration 1:10 germination of seeds was at the same level as at control samples, that is tells about null phytotoxicity of this solution, but also about absence of reasons for introduction this component.

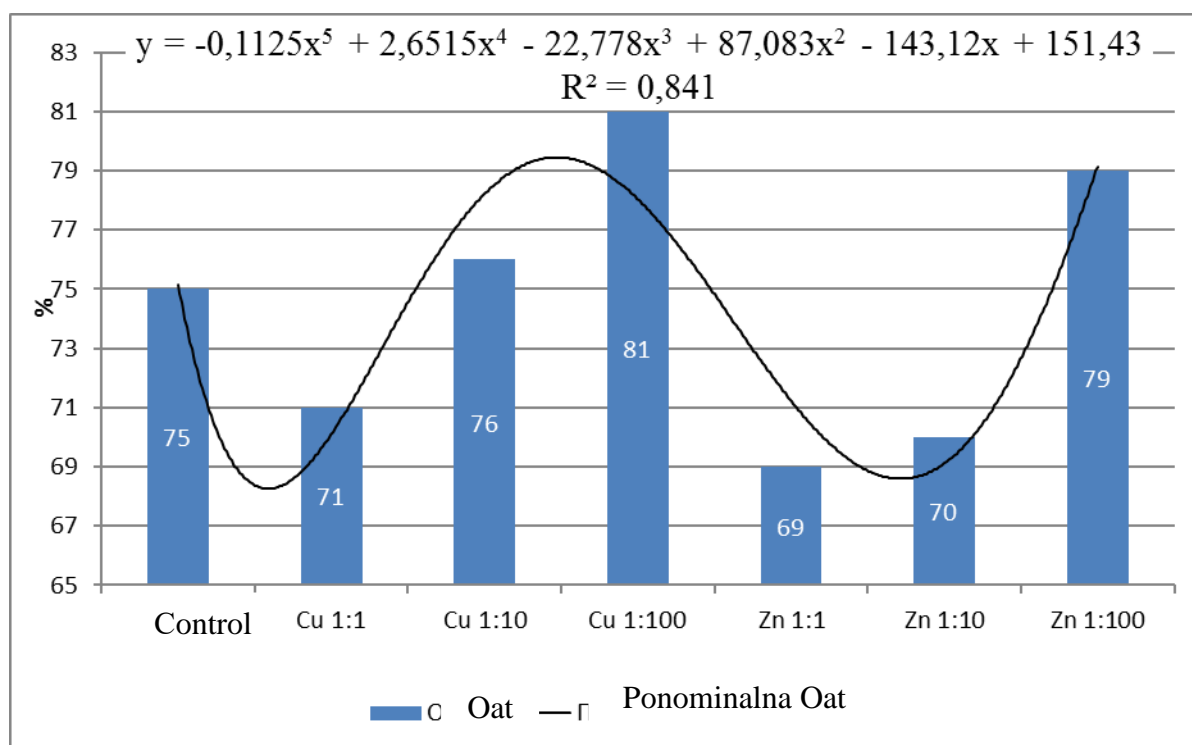


Fig. 2. Germination of cereal seeds, depending on the studied component, %

It should be noted, at copper concentration 1:100 seed germination of investigated culture is grew, allowing argue about the effectiveness of this solution at given concentration;

Was established, that germination of seeds oats was reduced by zinc concentrations 1:1 and 1:10, only with concentration 1:100 percentage of observed germinated seeds was increased.

Conclusions. Treatment seeds by colloidal solution of nanometals increases field germination of seeds depending on variety potential and low concentrations of colloidal solution that is very important.

Also protects seeds and shoots from infection, can save to 50% of protectants, or completely replace it without sacrificing quality of preplant seeds treatment, shows a synergistic effect, eliminates shaking off protectants during transportation, loading and sowing.

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ВПЛИВ КОЛОЇДНОГО РОЗЧИНУ ЦИНКУ ТА МІДІ НА ПРОРОСТАННЯ НАСІННЯ ВІВСА

Гончар Л. М., Шень О. С.

Анотація. У статті приведено результати впливу колоїдного розчину різної концентрації цинку і міді та їх комплексу на лабораторну схожість насіння вівса. Встановлено, що дія концентрації міді 1:1 є фітотоксичною під час пророщування насіння вівса. Зазначено, що за

концентрації міді 1:1, знижується схожість насіння на 3–14%, що має негативний вплив у подальших ростових процесах вівса. Встановлено, що концентрація міді 1:10 впливає на схожість насіння на рівні контрольного варіанту, тобто не прослідковується фітотоксичність даної концентрації розчину міді. Відзначено, що за концентрації міді 1:100, схожість насіння усіх досліджуваних культур підвищилася, що дає змогу стверджувати про ефективність розчину за даної концентрації.

Ключові слова: овес, насіння, колоїдний розчин міді та цинку, концентрація, фітотоксичність.

ВЛИЯНИЕ КОЛЛОИДНОГО РАСТВОРА ЦИНКА И МЕДИ НА ПРОРАСТАНИЯ СЕМЯН ОВСА

Гончар Л. Н., Шень О.С.

Аннотация. В статье приведены результаты влияния коллоидного раствора различной концентрации цинка и меди и их комплекса на лабораторную всхожесть семян овса. Установлено, что действие концентрации меди 1:1, является фитотоксичным во время проращивания семян овса. Отмечено, что при концентрации меди 1:1, снижается всхожесть семян на 3-14%, что оказывает негативное влияние в дальнейших ростовых процессах овса. Установлено, что концентрация меди 1:10 влияет на всхожесть семян на уровне контрольного варианта, то есть не прослеживается фитотоксичность данной концентрации раствора меди. Отмечено, что при концентрации меди 1:100, всхожесть семян всех исследуемых культур повысилась, что позволяет утверждать об эффективности раствора в данной концентрации.

Ключевые слова: овес, семена, коллоидный раствор меди и цинка, концентрация, фитотоксичность.