

## Efficiency of forms and times of entering zinc in sowings of winter wheat

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### **Efficiency of forms and times of entering zinc in sowings of winter wheat**

**The purpose.** To study influence of forms, methods of entering zinc on formation of yield and quality of grain of winter soft wheat. **Methods.** Field, laboratory. Concomitant observation and analysis are executed by standard methods in accordance to standard procedures. Statistical analysis of the gained results was carried out with the use of package of programs Excel and Statistika, methods of dispersive, correlation and regression analysis. **Results.** At entering  $N_{90}P_{60}K_{40}$  in structure of which superphosphate is modified with inoculated zinc coplexonate on the basis of hydroxyethylenedendiphosphonic acid (HEDP), increase of yield made 20,2 % against alternative without fertilizing, including 6,4 % due to zinc. It is expedient to add zinc in the form of its coplexonate with HEDP, increase of yield in comparison with zinc sulphate — 0,16 t/hectare, and over-all share of influence of that factor — 14%. Entering zinc coplexonate under presowing cultivation in dose of 2 kg/hectare had no advantage as compared to single machining of plants in tillering stage in dose of 250 g/hectare, but transmission of that operation on phase of stem growth provided essential increase of yield (0,2 t/hectare at  $HCP_{0,95}=0,18$ ). **Conclusions.** Foliar top dressing with solution of zinc coplexonate (250 g/hectare) increased productivity of grain of winter wheat with the greatest effect at 2-fold machining in tillering stage and stem growth; accretion made 0,2 – 0,54 t/hectare. Efficiency of using Zn in droughty conditions of South Ukraine on 75,7 – 96 % is determined by hydrothermal conditions of spring vegetation, but thus the microelement promotes resistance of plants of winter wheat against temperature stress. Concentration of zinc in grain of test alternatives oscillated within the limits of 18,4 – 22,1 mg/kg (in control — 14,5 mg/kg).

**Key words:** zinc, winter wheat, phases of vegetation, quality, South chernozem.

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**The purpose** research is to study the influence of forms, methods of zinc application on the formation of the crop and the quality of winter wheat soft on the southern chernozems.

**Materials and methods.** The experiments were carried out on the black soil of the southern low-humus hard loam well cultivated.

The size of the plot of 120 m<sup>2</sup>, accounting-50 m<sup>2</sup>, repeat-4 times. Fertilizers were introduced in the form of ammonium nitrate, granulated superphosphate and potassium salt, as well as superphosphate with the inclusion of zinc complexonate (0.75%). Solutions of zinc salts treated vegetative crops of winter wheat with a hand sprayer. The scheme of experience is given in the presentation of the results. The predecessor of winter wheat varieties knop-black steam.

Studied the effectiveness of trace element when it is added in the form of zinc sulphate, chelated forms, where the ligand used oksietilidendifosfonovaya ( HEDP) , superphosphate with zinc chelate-based HEDP (0,75%).

Co-sposterezhennya and analysis were performed by standard methods in accordance with standard techniques. Statistical processing of the results was performed using a package of applications Excel and Statistika, methods of dispersion, correlation and regression analysis

**Research result.** The results of the studies showed that when zinc was applied to the soil, grain growth relative to absolute control (background 1) reached, depending on the form of application, 0.21 t/ha (4.9%) when using zinc sulfate, 0.41 t/ha (9.5%) – zinc complexonate and 0.87 t/ha (20.2%) when using chelated superphosphate as part of complete mineral fertilizer, the difference was 0.20 t/ha and 0.66 t/ha in favor of zinc chelate.

When you use the foliar also saw an advantage complexonate zinc on mineral salt: the level of increase of grain yield in single use fluctuated in the range of 7.9 and 9.3%, depending on the phase of development of plants of winter wheat, two-time -12,4% if used normal salt of zinc and 11,9-14,9% and 17.5%, respectively, when using complexonate zinc.

According to the results of correlation and regression analysis, the efficiency of zinc by 75.7-96.0% depended on hydrothermal conditions: the correlation coefficient ranged from -0.87 to -0.98, i.e., the more dry conditions of spring-summer vegetation of winter wheat plants, the higher the efficiency of the zinc trace element. When zinc is introduced into the soil, its efficiency is due to the reserves of productive moisture in the layer 0-20 cm during sowing and resumption of vegetation in the spring:  $r = 0.99-0.92$  (very strong bond) when using zinc sulfate,  $r = 0.67-0.50$  (medium bond) when applying zinc chelate and  $r = 0.87-0.69$  (strong bond) – chelated superphosphate.

The number of spikelets per spike of main stem average for years of research on the net control was minimal and amounted to 16.7 per piece, and increased by 0,1-0,7 PCs depending on the shape and length of any trace element. At the same time, THE highest increase in this indicator was in the case of n90p60k40, where the superphosphate is modified by zinc chelate – by 0.7 PCs./ear.

Large grain size (52.3 grains) was provided against the uncomfortable background by double treatment of winter wheat crops with zinc complexate, and on the background of complete mineral fertilizer – when using zinc sulfate twice during the growing season (54.2 PCs.) and on the variants of treatment with chelate in tillering (54.9 grains) and tillering+ stemming (56.2 grains, or 26.3% to pure control and 19.1% - to background 2).

Variants of the use of the trace element zinc naturally influenced the weight of the grain from one ear. So the versions of the forms and the timing of the use of zinc on the background without fertilizers, the mass of grains in one ear of the main stem ranged in the interval of 1.64-1,70 mg, which is 1.9 and 5.6% above the control. On the background of mineral fertilizers grain weight spike 1 exceeded the background 2 1.2-5.8% and background 1 6.8 to 13.0%, and when using complexonate zinc output of grain on 1 spike significantly (11.1 to 13.0%) was greater than the net control.

The use of zinc in the technology of winter wheat cultivation affected the quality indicators of grain and, if the parameters of physical parameters exceeded the backgrounds of nutrition within the validity, the concentration of protein and gluten in the grain significantly increased in all variants of the background 2.

## Summary

1. Among vevcani factors the greatest influence on the yield formation of winter wheat had the nutrition background: the application of mineral fertilizers in the dose of N90P60K40 provided the performance gain is 13.0%, and the introduction of N90P60K40, in which superphosphate is modified by complexonate zinc based on HEDP, 20.2% in comparison with the cultivation of winter wheat without fertilizers.

2. It is more practical to make the trace element zinc in the form of his complexonate with HEDP, the increase in yield in comparison with the zinc sulfate is 0.16 t/ha, and the total proportion of influence of this factor is 14.0%.

3. Adding zinc complexonate under presowing cultivation at a dose of 2.0 kg/ha has no advantage over a single treatment of plants in the tillering phase dose of 250 g/ha, but the transfer of this measure to the phase of oscillation gives a significant increase in yield (0.20 t / ha at NSR<sub>0,95</sub> = 0.18).

4. Spraying of winter wheat crops with a solution of zinc complexonate at a dose of 250 g / ha in the tillering and oscillation phase provides an increase in the yield of winter wheat of 0.23 t/ha (with NSR<sub>0,95</sub> = 0.18) compared with the treatment only in tillering.

5. The efficiency of application of the trace element zinc for pre-sowing cultivation depends on the moisture reserves in the sowing layer of the soil during sowing and during the spring resumption of vegetation. The degree of dependence is due to the form of zinc application: the maximum dependence (at 98.0-84.6%,  $r = 0.99-0.92$ ) - when using a simple salt, the minimum (44.9-25.0%,  $r = 0.67-0.50$ ) – complexonate of zinc and chelation superphosphate occupies an intermediate place: its efficiency depended on moisture reserves at sowing by 75.7%, and in early spring – by 47.6% ( $r = 0.87-0.69$ ).

6. The efficiency of zinc when used in the tillering and oscillation phases by 75.7-96.0 % depended on hydrothermal conditions: the correlation coefficient ranged from (-0.87) to (-0.98), that is, the more dry

conditions of the spring-summer vegetation of winter wheat plants, the higher the efficiency of the zinc trace element.

7. The use of the trace element zinc has a positive effect on the structure of the ear of winter wheat.

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