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Latest News

Wheat agronomic biofortification with zinc

A serious and current problem of concerns is the mineral deficiency of the population which relates to the "*food or medicine*" controversy. Is the increase in zinc content in wheat intended for the bakery industry, part of a solution?

The "Gheorghe Ionescu Şişeşti" Academy of Agricultural and Forestry Sciences, Bucharest, Romania in collaboration with the National Research Center Cairo, Egypt carried out a research project during 2019-2022 through which they highlighted the increase in zinc content in wheat intended for the bakery industry, given the fact that worldwide the mineral deficiency of the population is a serious and current problem, which needs to be solved through food and not through synthetic, pharmaceutical products. Taking such debates into consideration, we believe that the present research is relevant in the "*food or medicine*" controversy.

Biofortification is the process by which the aim is to increase the content of micronutrients in the edible portions of crop plants, either by plant improvement (genetic biofortification) or by fertilization (agronomic biofortification). Biofortification includes both the creation of new varieties with the genetic potential to accumulate a high content of Zn (for cereal crops) and the use of Zn-based fertilizers to increase the content of Zn from grains to cereals. Genetic biofortification, i.e. the identification and transfer of appropriate genes to important crops that increase their absorption capacity, is probably the most cost-effective approach, but plant breeding programs in this direction are ongoing, while the use of zinc-based fertilizers may lead to a faster increase in Zn content in diets.

Soil types, the growth stage of plants also play a key role in the effective use of Zn fertilizers, such as ZnSO4, therefore these factors must be taken into account during the application of fertilizers.

Another practice to mitigate Zn deficiency includes the foliar application of zinc, through which it can significantly increase the Zn content in the grains. Foliar application of zinc is considered

an effective method of agronomic biofortification; however, there are large differences between plant species in terms of the effectiveness of foliar application of zinc.
In addition, the biofortification of cereals with Zn can bring beneficial effects for human health, helping to overcome malnutrition in populations with grain-based diets. Studies have shown that foods of plant origin are important sources of Zn for humans. It is estimated that 17.3% of people worldwide are at risk of inadequate intake of Zn and the Zn deficit leads to the estimated annual deaths of 433,000 children under the age of five. Deficiency of Zn in humans can cause decreased appetite, anemia, growth retardation, hypogonadism, depression of mental function, and in certain cases impaired keratosis and teratogenic effects. Other serious health complications, such as: depressed immune system, decreased learning capabilities, risk of infections, DNA damage are also reported as being associated with Zn deficiencies.
Several factors can contribute to different deficiencies of Zn, such as: differences in soil composition in different areas of the world, traditions of food preparation in different countries, food processing and accessibility, cultural practices and environmental pollution.
During 2019-2022, the research project "Biofortification with zinc of wheat" was carried out, a project funded by the ASAS Heritage Foundation. The researchers who carried out this project come from the Agricultural Development Research Station Lovrin and from the Agricultural Development Research Station Turda, research centers under the patronage of the Academy of Agricultural and Forestry Sciences "*Gheorghe Ionescu Şişeşti*", Bucharest.
Four varieties of wheat (autumn and spring) were tested and the zinc content in the green plant, in the grain, in different types of flours (white and wholemeal) and in the bread from the biofortified wheat was determined.
The analysis of some types of commercially sourced bread shows a very low zinc content, which is around 2-3 mg/kg of the product, in white bread and 6-7 mg/kg produced, in whole meal bread.
Following the agronomic biofortification of wheat, treated with zinc sulfate solution, applied in different periods of its growth and development, a 23-97% increase in the zinc content in the wheat grain was obtained, with favorable consequences on human nutrition.
Between the two types of flour studied, white and wholemeal, the highest zinc content was recorded in wholemeal flour, with an increase in the range of 30-90%.
Of the two types of wheat studied, autumn and spring, spring wheat has a superior reaction to treatment with zinc sulfate solution, as it also has a higher native zinc content.
Besides the increase of the zinc content in the wheat harvest and its special importance for the human diet, the agronomic biofortification with zinc of wheat also has the role of potentiating the effect of the fungicide.
Numerous researches have shown over time that seeds with a high content of Zn can have a better germination, plant vigor and stress tolerance caused by biotic and abiotic factors, obtaining results similar to ours.
Seed treatment with zinc-based solution has the advantage of a very low-cost price compared to conventional treatment.
The conclusion that emerges from this study is that the agronomic biofortification with zinc of wheat, correctly applied also in the phase of optimal plant development, leads to an increase in the content of this chemical element by up to 96%, with favorable effects on human nutrition, and that zinc has the role of potentiating the effect of fungicide, through this effect reducing by half the dose of fungicide, or it can substitute the fungicide in the case of spring wheat varieties.
The zinc seed treatment method can be framed in the EU strategy for promoting sustainability in the field of chemicals by supporting a toxic-free environment.