British Journal of Global Ecology and Sustainable Development
Volume-01, February, 2022
ISSN (E): 2754-9291

METHODS TO INCREASE IRON CONTENT IN THE BREAD WHEAT GRAIN

Begimkulova Dilnoza Meyliyevna,
PhD Student. Southern Agricultural Research Institute, 180100,
Karshi city, Kashkadarya Region, Uzbekistan.

Abstract
This article analyzes the methods of increasing the amount of iron in wheat grains using various drugs. Today, the world is talking about the need for iron in the human body and its satisfaction from wheat products.

Keywords: bread wheat, biofortification, iron content, agrotechnology.

Introduction

Nearly two billion people worldwide suffer from iron and zinc deficiency. Today, 60% of women of childbearing age and 50% of young children in the country are diagnosed with anemia due to iron deficiency. One of the main reasons for this is the lack of micronutrients necessary for the human body in the composition of foods derived from cereals. Many studies to date have focused on discovering a natural change in the iron and zinc content of wheat grains from generation to generation. Most of the world's wheat exports are made by the United States, Australia, Canada, Argentina, the European Union, Russia, Kazakhstan and Ukraine. The United States ranks first among these states. From 1950 to 1990, production significantly increased productivity due to the combined effects of genetic improvement and new agronomic methods. Nitrogen use has increased ninefold since the 1960s, and scientists predict it could increase by another 40-50 percent in the coming years. Cultivation of high-quality grain of soft wheat is one of the most pressing issues today, and research is being conducted in many foreign countries to improve the agro-technologies for growing quality grain.

Iron is one of the most abundant elements on Earth, with a soil content of around 0.02-0.1%. There are very few forms of this element that can be used by plants, and in many cases there are cases of metabolic disorders due to iron deficiency in the mineral nutrients absorbed from the soil. Chlorosis is also caused by disruption of chlorophyll synthesis in plants. The most important compound of iron that plants can assimilate is iron (III) - an alkali ($Fe(OH)_3$), which is often reabsorbed to the form of divalent iron. Under the influence of the enzyme reductase on stem cell membranes, the change in the appearance of Fe^{3+} ions is accelerated. In addition, the iron element regulates the respiration of plants. Its deficiency leads to disruption of photosynthesis and, as a result, chlorosis of the young three leaves (loss of green color and whitening), and in some cases even damage to the branches [1, 2].

According to the main results of the largest national nutrition survey conducted in the country in 2019, every seventh child under the age of five (15.6%) suffers from anemia, and at the same time, 1% of sick children have a severe form of anemia. The highest rates of this disease are observed among children aged 6-11 months, with approximately 75% of cases developing due to iron deficiency, and iron deficiency among children is observed to be of alarmingly high level. Iron deficiency can lead to delays in children's cognitive development, even if it does not cause anemia. Adolescent girls (15–19 years old), pregnant, lactating, and women of reproductive age (15–49 years old), and one in five (20%) of anemias were diagnosed with anemia, 80 percent of whom were associated with iron deficiency. and threatens the future of humanity as well. Although wheat grains and flour products are the most important sources of calories, the amount of protein and minerals in wheat grains currently grown is much lower. Due to the small share of iron in the composition of wheat grains, as in many basic food products, there is a shortage of iron in the main layer of the country.

In this regard, the country has established a national legal system for fortification of flour products for artificial enrichment of iron products with iron preparations, which, despite a significant solution to the problem, consists of flour products enriched by 30% of domestically produced and imported flour products. According to the results of several years of research in our country, the content of elements such as iron and zinc, which are important for human health, in the composition of wheat grown in the soil climate of our region is much lower than the established norm [2, 3].

Level of study of the problem J. Balk, J. J. Connorton, Y. Van, A. Lovegrove, KL Moore, C. Wauy, PA Sharp, PR Shewry, A. Morgunov, Extensive experiments are being carried out by H. Brown, R. Sharma, M. Keser, K. Nazari, A. Dababat, RMWelch, RDGraham, I. Chakmak and others. These scientists are conducting experiments on the enrichment of wheat grain with iron and zinc elements using analytical and synthetic selection methods, genome technologies, and experimenting with the development of new methods to increase the content of these elements in wheat grain.

The object of study were irrigated light gray soil, nitrogen fertilizers, Shukrona variety of soft wheat, Aydamin jelly.

Research subjects. When winter wheat is treated with iron-enriched drugs in different nutrient media and planting methods, the effect on plant growth, development, yield and grain quality is determined.

Irrigated agro-plots of the Southern Agricultural Research Institute are carried out in the central experimental fields and in the laboratory of the test complex of the institute.

Research Methods and Materials

Laboratory, field and production experiments, biometric measurements, phenological observations, physiological and biometric analyzes in the research work "Methods of the State Commission for Testing Varieties of Agricultural Crops" (1989), "Methods of agrochemical analysis of soil and plants in Central Asia", "Methods of agrophysical research", "Methods of field experiments" The amount of humus in the soil by the

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Tyurin method, GOST 26213-91, mobile compounds of phosphorus and exchangeable potassium Machigin, GOST 26205-91, statistical analysis of data (ANOVA) for all options, valuable is carried out on the analysis of productivity, including the characteristics of the economic character. All statistical analyzes are conducted on the basis of methodological manuals, such as those conducted using the 18th edition of Genstat (Genstat-2017).

Place and conditions of research. The research will be conducted in 2022-2024 in the fields of the experimental field of the Southern Agricultural Research Institute in Karshi district. The experimental site is located in the steppe region of the region. The soils of this region are sandy, gray, brown, bald and saline. The climate is changing dramatically. Annual precipitation is 100-200 mm. The old irrigated light glacial soils are distributed in Kasbi, Karshi and partly in Chirakchi districts. Here the humus layer exceeds 60 cm, the humus content of the soil is 0.7-0.8%, nitrogen 0.043-0.061%. It is a heavy, medium and light sandy soil according to its mechanical composition. Due to the fact that these lands have been irrigated for a long time, they are desalinated, fertile and highly economical. Irrigated light-colored ice soils occupy a large area, spread around the Karshi main canal, and groundwater is located at a depth of 2-3 m.

Results

Wheat biofortification is a method of increasing the amount of essential elements in the consumable parts of grain through agrotechnical or genetic and genomic selection. Advances in biofertilization could be beneficial in introducing micronutrient-rich varieties of wheat into production as a sustainable solution to the “hidden hunger” problem. Biofortification Enrichment of wheat grain with nutrients and trace elements involves the search for genotypes with high potential to accumulate beneficial elements in the grain in subsequent modern selection and biotechnological processes to transfer these properties to cultivated varieties [4, 5, 6].

According to the results of several years of research in our country, the content of elements such as iron and zinc, which are important for human health, in the composition of wheat grown in the soil climate of our region is much lower than the established norm [7, 8, 9, 10].

In the last 100 years, the amount of nutrients in wheat crops has decreased by more than 40%. That is why today it is becoming a necessity to add elements of iron and zinc to it. Therefore, it is necessary to create grain varieties that contain large amounts of iron and zinc. It is known that some varieties are higher than other varieties, which provides a theoretical basis for the creation of varieties (genotypes) that are able to accumulate more micronutrients necessary for health in the grain - biological fortification. The identification of new varieties that will allow agricultural producers to reduce diseases associated with nutrient deficiencies through the creation of varieties rich in protein and micronutrients remains relevant [11, 12, 13, 14].

The most important iron compound that plants can assimilate is iron (III) hydroxide ($Fe(OH)_3$), which is often reabsorbed to the form of divalent iron. Stem cells accelerate the breakdown of Fe^{3+} ions in the plasma membranes by reductase enzymes. Activation of proton secretion in the root acidifies the rhizosphere, which accelerates the absorption of iron in the soil.

In addition, the iron element regulates the respiration of plants. Its deficiency leads to disruption of photosynthesis and, as a result, chlorosis of the young three leaves (loss of green color and whitening), and in some cases, damage to the branches [15, 16, 17, 18].

That the root hairs can absorb Fe^{2+} , Cu^{2+} , Mn^{2+} on the surface of sand particles. That it was not necessary to return Fe^{3+} to its valence in order to be assimilated, which would act as an additional mechanism to enhance iron transport during periods of increased iron demand.

The optimal amount of manganese has an alternative effect on the absorption of iron from the soil. The absorption of these two elements helps each other.

An increase in the concentration of potassium ions and K^{+} / Ca^{2+} in plant cell sap, and a decrease in Ca^{2+} and Mg^{2+} also lead to an increase in the amount of iron assimilated.

The optimal amount of manganese has an alternative effect on the absorption of iron from the soil. The absorption of these two elements helps each other.

The total amount of all iron-retaining enzymes in plant cells is about 0.1 mM, and the local content of iron accumulated in the membranes of redox enzymes and iron sulfide proteins is high. However, a group of anaerobic bacteria do not contain iron or copper at all, probably because they do not contain enzymes that can react with oxygen.

Iron-rich particles are found in the protoderm, in the primary meristem and procambium, in all parts of somatic cells, and in the ovary, where the proplastids in plant seeds bind to phytates. The globoids in the procambium tissue of the ovary contain small amounts of iron and, unlike other somatic cells, retain iron, which is more prone to phosphorus. Iron-rich seeds and somatic cells contain more phosphorus and iron, and less potassium and magnesium.

Decreased synthesis of green and yellow pigments in plant plastids leads to profound changes in the metabolism of plants, primarily in the systems of iron-containing enzymes, including cytochrome oxidase, catalase, peroxidase enzymes. Wheat is one of the leading sources of consumption around the world and, unfortunately, wheat crops contain small amounts of Fe and are mainly found in the outer bran layers. During the processing of wheat, the substances stored in the main parts of the bran are separated in the form of bran.

Flour fortification is the process of adding a certain amount of beneficial micronutrients to wheat flour, which is lost when the grain is removed from the mill. Wheat is the most widely grown cereal crop in the world. Large quantities of cultivated wheat are consumed by humans. When a person consumes this product, depending on the diet, 17% to 45% of the energy requirement is covered by wheat. Bread and flour are consumed every day. Due to its versatility, universality and dailyity, it is an effective tool in providing people with essential micronutrients such as iron, folic acid and many vitamins.

Wheat grains are rich in V1 (thiamine), V2 (riboflavin), niacin, V6 (pyridoxine), iron and zinc. However, because all of these micronutrients are located in the meristem section of the grain husk, most of them are excreted in the mill. In addition, over the past 100 years, the amount of beneficial micronutrients in cereals has decreased by more than 40 percent. That is why today it is necessary to add these nutrients to it.

Conclusion

Using biostimulants enriched with iron, it is possible to analyze the biochemical composition of wheat grains obtained as a result of multifactorial field experiments and develop agrotechnologies for the application of biostimulants to varieties with high iron accumulation.

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