Application of optimal solution concentration in mineral fertilizer suspension foliar feeding in winter wheat

Bakhrom Azimov [1*]

[1]Tashkent State Agrarian University, 2, University str., 100140 Tashkent, Uzbekistan

Abstract. Taking into account plant biological properties, soil properties, soil-climatic conditions, and fertilizer properties, the development of the optimal rate, duration, and methods of application of suspensions made from mineral fertilizers, the optimization of the soil nutrient environment, the formation of the necessary chemical composition in the plant, and scientific research aimed at managing plant nutrition, special attention is paid. In Uzbekistan, scientific research aimed at evaluating the effective use of mineral fertilizers in increasing the yield of agricultural crops, including wheat, is being conducted, and certain results are being achieved. It is critical to develop an optimal system of using mineral fertilizers to ensure the cultivation of high-quality grain crops from autumn wheat varieties in the irrigated typical gray soils of the Tashkent province, as well as to determine the nutrient environment formed in the soil during specific periods of autumn wheat development phases and the amount and ratio of nutrients in the plant. Fertilizer is an effective and fast-acting factor that increases the quality of the crop. Therefore, it is important to develop the optimal norm for using a suspension of mineral fertilizers in foliar feeding, taking into account the characteristics of the soil and variety, to grow a high-quality grain crop from wheat, as well as to study the effect of these norms on the growth development, seedling thickness, grain yield, and quality of autumn wheat. Keywords: Nitrogen, phosphorus, potassium, suspension, foliar feeding, autumn wheat, seedling thickness, grain quality.

1 Introduction

Special programs were developed to provide the population of the country with domestically grown grain, as a result of which grain yield increased 2.5–3.0 times [1]. Today, the yield of autumn wheat is 45–50 q/ha. However, this yield cannot fully satisfy the population's growing need for grain products [2-4]. Also, the increase in autumn wheat grain yield under irrigated conditions leads to a decrease in grain quality. Therefore, increasing grain yield and quality is one of the most urgent tasks [2-5]. Increasing the grain yield and improving its quality depend primarily on the quality of the seeds and the use of advanced modern technologies in grain growing [6].

* Corresponding author: b.azimov@tdau.uz

According to the results of the conducted scientific research, today's autumn wheat absorbs 50–55 percent of nitrogen fertilizers, 20–22% of phosphorus fertilizers, and 55–60 percent of potash fertilizers. A part of the nitrogenous fertilizers not absorbed by the plant is released into the air in the form of ammonia, and a part of it is washed into the groundwater in the form of nitrite and nitrate. This situation has a negative impact on the environment [7-10].

Such a situation is avoided when foliar fertilizers are used, as well as when the plant's phosphorus absorption increases dramatically [10]. According to the results of the conducted experiment, about 95–98% of the phosphorus is absorbed by the plant when it is fed outside the roots [7]. Root feeding significantly increases grain vitreousness; grain vitreousness increases by 8–16.0%, grain protein content by 0.8–18%, and gluten content by 1.6-3.5%. Fertilization of autumn wheat beyond the roots provides 6.7–22.5 q/ha of additional grain yield [8].

2 Materials and Methods

The importance and quality indicators of seed in the irrigated fields of Uzbekistan in different years; the effect of foliar feeding on total leaf area and bioproductivity of autumn wheat was researched, and a number of other scientists [4-8]. However, the scientific basis of seed quality improvement and the effects of late nitrogen feeding and root feeding on the technological quality indicators of grain have not been studied.

The purpose of the experiment is to create and introduce into production cultivation technologies that ensure the improvement of the seed and technological quality of various autumn wheat varieties in the conditions of the typical gray soils of the Tashkent province.

The typical irrigated gray soils of Tashkent (Uzbekistan), autumn wheat intensive types Grom, Kroshka, Chillaki varieties developed through local selection, and the Kahrabo durum wheat variety. The different irrigation regimes of wheat varieties, planting and mineral nutrition standards, foliar feeding in addition to roots

Field and laboratory research "The methodology of field experiment" by B.A. Dospekhov [4], in the experimental plots of the Tashkent State Agrarian University (S.U.E.) "Methods of conducting field experiments" [4], "The methodology of agrophysical research" [6], "Methodology of agrochemical research" [6], "Guidelines for determining the quality of plant products" [9].

3 Results and Discussion

At the present time, when Uzbekistan has achieved grain independence, the above opinions of the well-known agrochemical scientist are fully confirmed. In the next three to four years, the grain yield from the irrigated fields of Uzbekistan will increase by 40 q/ha on average are fully confirmed. In the next three to four years, the grain yield from the irrigated fields of Uzbekistan will increase by 40 q/ha on average. However, the low amount of protein and gluten in grain and the lack of physical and chemical properties at the required level limit the possibilities of making high-quality bread and bakery products [11].

It is known that grain crops are watered several times during the period of operation. According to most data, there is an inverse relationship between grain quality and the number of irrigations.

Foliar feeding is especially important in grain farming, especially in growing autumn wheat, especially in irrigated conditions, and the use of this method in nitrogen feeding of autumn wheat provides high efficiency [10].

The nitrogen needs of autumn wheat are high throughout the growing season. When the productivity is high (65–70 q/ha), the amount of nitrogen accumulated in the leaves and stems of the plant cannot ensure a sufficient amount of protein in the grain. As a result, the amount of protein in the grain decreases, which leads to a decrease in the technological quality index of the grain.

Therefore, it is advisable to use the method of feeding the plant outside the roots in the cultivation of autumn wheat. As shown in Figures 1, 2, 3, and 4, in the cultivation of autumn wheat, even in conditions of high grain yield, feeding from the leaves is considered effective.

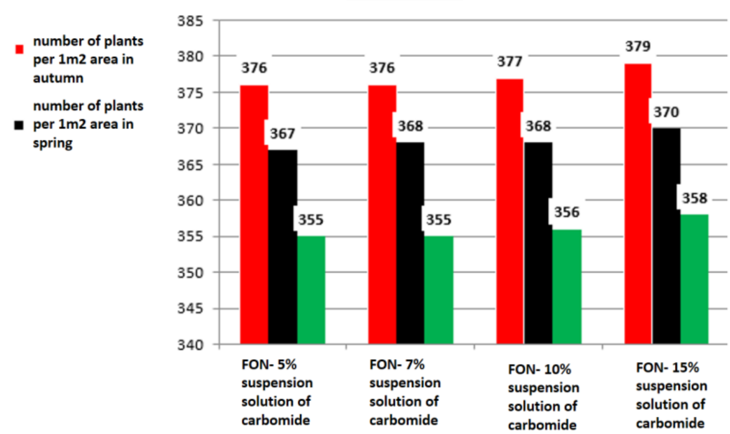

Fig. 1. The seedling thickness of autumn wheat by development phases: Accumulation phase.

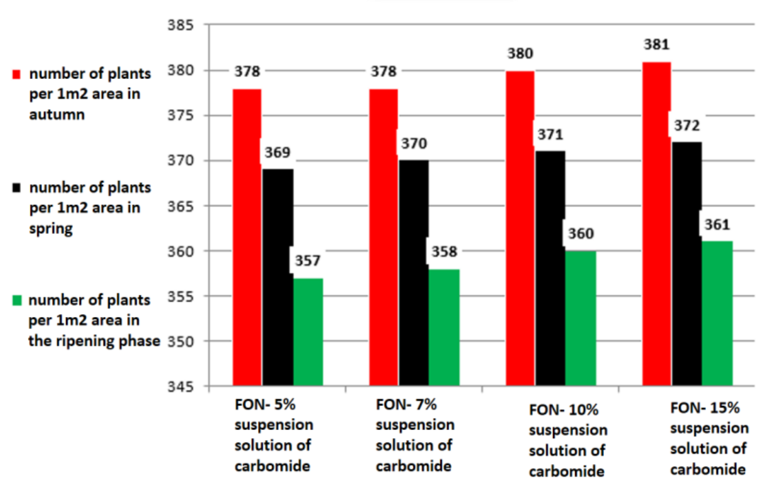

Fig. 2. The seedling thickness of autumn wheat by development phases: Tubulation phase.

 https://doi.org/10.1051/e3sconf/202337602004

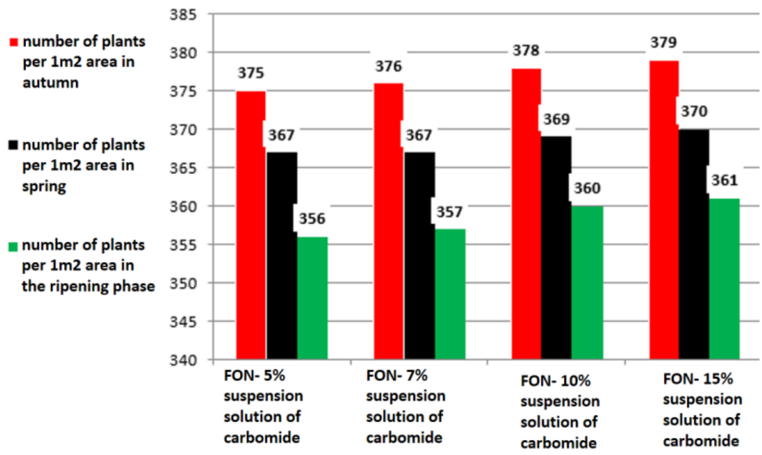

Fig. 3. The seedling thickness of autumn wheat by development phases: Spike phase.

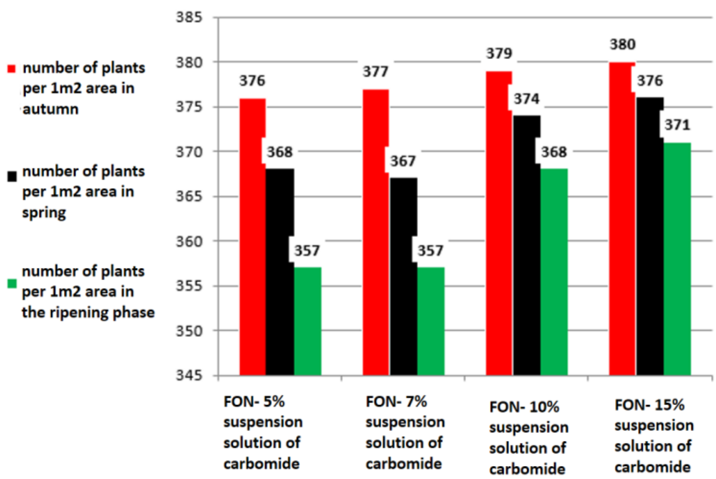

Fig. 4. The seedling thickness of autumn wheat by development phases: Milk wax ripening phase.

In the experiment, the grain yield was 64 tons/ha in mineral FON, i.e., in conditions where feeding was carried out through the roots, while it was 65–71 q/ha in the options where extra-root feeding was used. An increase in grain yield of 1–7 q/ha was observed due to extra-root feeding. The tuber phase of autumn wheat produced the highest grain yield of 71 q/ha when extra-root fed with carbamide 15% suspension solution.

In the experiment, the grain yield was 64 tons/ha in mineral FON, i.e., in conditions where feeding was carried out through the roots, while it was 65–71 q/ha in the options where extra-root feeding was used. An increase in grain yield of 1–7 q/ha was observed due to extra-root feeding. The tuber phase of autumn wheat produced the highest grain yield of 71 q/ha when extra-root fed with carbamide 15% suspension solution. One of the most urgent tasks is to improve the technological quality indicators of grain in grain farming. Because the quality of the product depends primarily on the quality of the grain Technological quality indicators of grain include transparency of grain, flour strength, content of protein, and gluten content in grain. It is known that the increase in grain yield under irrigated conditions often leads to a decrease in technological quality indicators of grain. Because gray soils in Uzbekistan have a low humus content and increased productivity, there is a shortage of nitrogen in the soil. Because of this, it is advisable to feed with nitrogen during the period of grain formation under irrigated conditions.

One of the most effective methods of nitrogen feeding during these phases of development is foliar feeding. The positive effect of extra-root feeding on technological quality indicators of grain is presented in Figures 5, 6, 7 and 8.

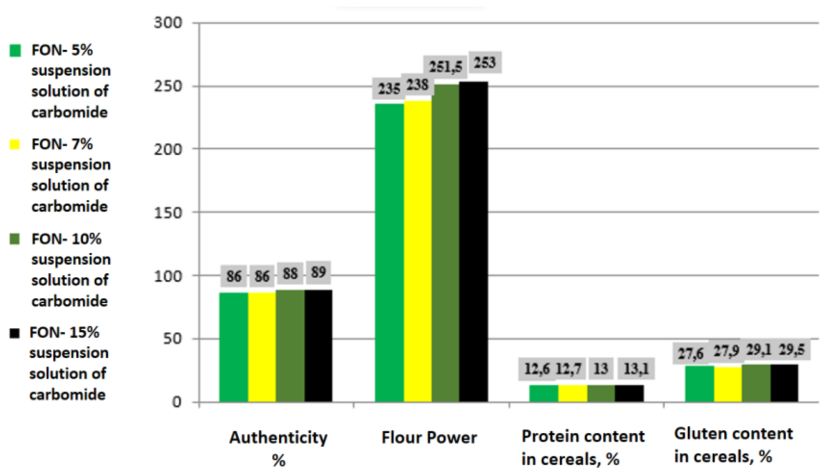

Fig. 5. The positive effect of foliar feeding on technological quality indicators of grain: Accumulation phase.

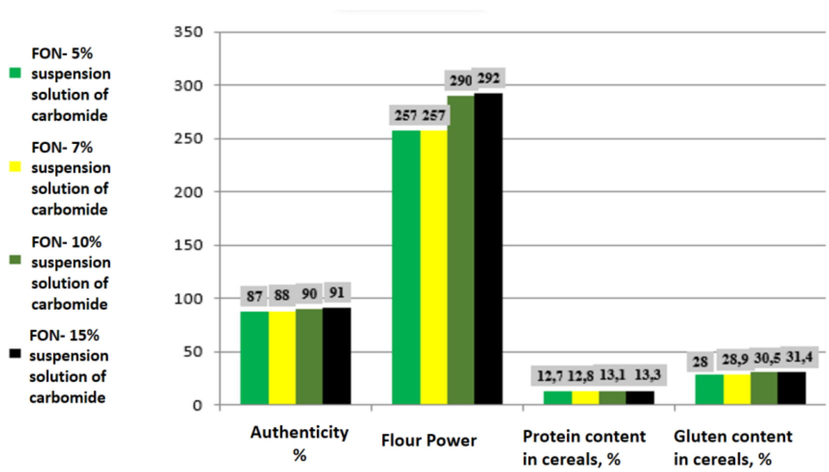

Fig. 6. The positive effect of foliar feeding on technological quality indicators of grain: Tubulation phase.

 https://doi.org/10.1051/e3sconf/202337602004

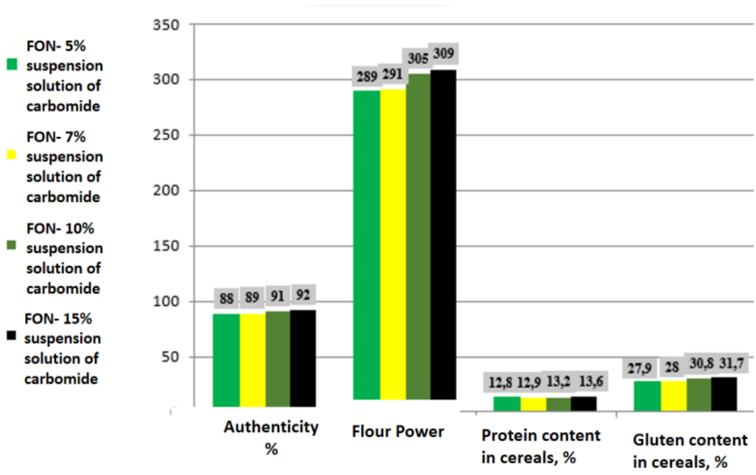

Fig. 7. The positive effect of foliar feeding on technological quality indicators of grain: Spike phase.

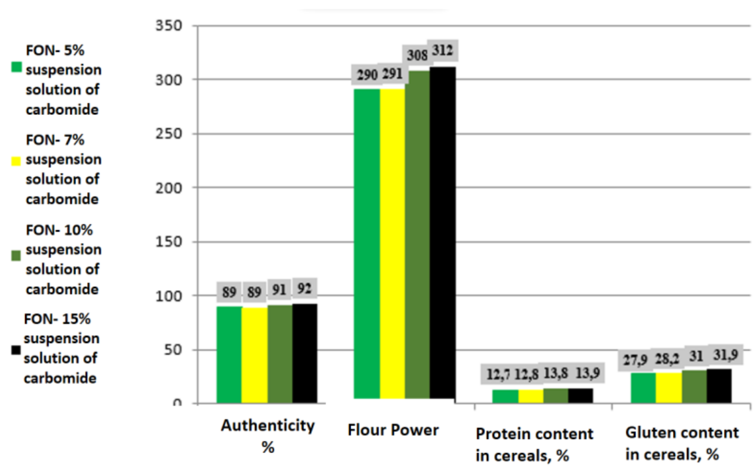

Fig. 8. The positive effect of foliar feeding on technological quality indicators of grain: Milk wax ripening phase.

In the experiment, grain transparency was 80%, flour strength was 210, grain protein content was 11.6%, and gluten content was 26.8% in the control variant.

In the experiment, the indicators of grain technological quality were higher in all studied options than in the control option. It was observed that grain transparency was 86–91%, grain protein content was 12.6–13.6%, and gluten content was 27.6–31.7% in non-root-fed variants. Relatively high indicators of grain quality were observed in the variant fed from the roots with a 10% suspension solution of carbamide during the flowering phase of autumn wheat. In this version, the amount of protein in the grain was 13.6%, and the amount of gluten was 31.7%. The quality of the grain fully meets the requirements of the strong wheat pattern.

4 Conclusions

Grain yield is one of the most important indicators in grain farming. Cereal crops, including autumn wheat, are grown for grain. Therefore, increasing grain yield is one of the most urgent tasks.

In order to increase grain yield, it is necessary to use new innovative technologies in grain growing. One of these innovative technologies is the foliar feeding of autumn wheat in addition to the roots.

In the experiment, the grain yield was 54 tons/ha in mineral FON, i.e., in conditions where feeding was carried out through the roots, while it was 65–71 q/ha in the non-root feeding options. An increase in grain yield of 11–17 q/ha was observed due to extra-root feeding. We observed that the maximum grain yield increased by 71–72 q/ha under conditions of foliar feeding with a 10% suspension solution of carbamide in the tuber phase of autumn wheat.

References

1. D. Kadirova, M. Usmanova, M. Saidova, G. Djalilova, N. Namozov, E3S Web of Conferences **258**, 03025 (2021)
2. N. Namozov, B. Teshaboev, M. Saidova, D. Kodirova, M. Usmanova, M. Tursinbaev, IOP Conference Series: Earth and Environmental Science **1068(1)**, 012033 (2022)
3. N. Namozov, M. Saidova, M. Urmanova, D. Burxanova, X. Rasulov, M. Tursinbayev, IOP Conference Series: Earth and Environmental Science **1068(1)**, 012035 (2022)
4. Z. Abdullaev, D. Kendjaeva, S. Xikmatullaev, International Conference on Information Science and Communications Technologies (ICISCT) (2019)
5. G. Shodmonova, U. Islomov, O. Abdisamatov, S. Khikmatullaev, U. Kholiyorov, S. Khamraeva, IOP Conference Series: Materials Science and Engineering **896(1)**, 012117 (2020)
6. P. Charzyński, M. Urbańska, G.F. Capra et al, Geoderma **425**, 116053 (2022)
7. U. Makhmudova, A. Djuraev, T. Khushvaktov, IOP Conference Series: Earth and Environmental Science **937(3)**, 032024 (2021)
8. B. Matyakubov, G. Goziev, U. Makhmudova, E3S Web of Conferences **258**, 03022 (2021)
9. S. Isaev, A. Mambetnazarov, B. Khalmuratova et al, IOP Conference Series: Earth and Environmental Science **1068(1)**, 012044 (2022)
10. A. Shamsiev, S. Isaev, G. Goziev, S. Khusanov, N. Khusanbaeva, IOP Conference Series: Earth and Environmental Science **1068(1)**, 012025 (2022)