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THE IMPORTANCE OF THE FERTILIZATION SYSTEM IN SESAME CULTIVATION (CV. "QORA SHAHZODA")

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Annotation. *In the article, the effectiveness of foliar application of biofertilizers based on suspension preparations in sesame (Sesamum indicum L.) cultivar "Qora Shahzoda" was studied.*

The results showed that the biofertilizers increased photosynthetic intensity, improved nutrient uptake, and ensured a significant increase in yield and oil quality indicators compared to the control.

Keywords: *sesame (Sesamum indicum L.), "Qora Shahzoda" cultivar, suspension preparations, biofertilizers, foliar feeding, photosynthetic intensity, capsule, oil quality.*

Аннотация. *В статье изучена эффективность внекорневого применения биоудобрений на основе суспензионных препаратов на кунжуте (Sesamum indicum L.) сорта «Qora Shahzoda». Результаты показали, что биоудобрения повышали интенсивность фотосинтеза, улучшали усвоение элементов питания, обеспечивая существенное увеличение урожайности и показателей качества масла по сравнению с контролем.*

Ключевые слова: *кунжут (Sesamum indicum L.), сорт «Qora Shahzoda», суспензионные препараты, биоудобрения, внекорневая подкормка, интенсивность фотосинтеза, коробочка, качество масла.*

Introduction

Sesame (*Sesamum indicum* L.) is one of the oldest oilseed crops known to humanity. Its seeds contain high-quality oil, proteins, and biologically active compounds, which are widely used in ensuring food security as well as in pharmaceutical and industrial applications.

In recent years, as global demand for sesame products has been increasing, issues related to improving yield and quality traits have become a central focus of scientific research. In Uzbekistan, sesame has long been a traditional crop.

However, introducing high-yielding varieties that meet modern requirements, optimizing agronomic practices, and, in particular, scientifically substantiating fertilization systems have become especially relevant today. The "Qora shahzoda" variety of sesame has recently attracted considerable attention as a promising cultivar, distinguished by high adaptability, productivity, and oil content.

Nevertheless, the effects of fertilizers on the growth, development, and yield of this variety under different agroclimatic conditions have not been sufficiently studied[3].

Agrochemical studies indicate that the integrated use of mineral and organic fertilizers significantly influences not only the growth dynamics of plants but also the stability of yield.

Nitrogen, phosphorus, and potassium perform different physiological functions during the vegetative stages of sesame: nitrogen promotes leaf mass formation, phosphorus supports energy

metabolism and the development of generative organs, while potassium ensures oil accumulation and enhances resistance to stress factors.

Therefore, determining and scientifically substantiating the efficiency of the fertilization system for cultivating the "Qora shahzoda" variety of sesame is a crucial factor not only for increasing yield but also for improving seed quality traits[2].

Methods

Dospexov, B.A. "*Metodika polevogo opita*" – a fundamental guide for organizing field experiments and conducting statistical analysis. Kjeldahl, J. – method for determining total nitrogen in plants and soil. Molchanov, A.G. "*Fenologiya rasteniy*" – methodology for conducting phenological observations. Ushkho, A.S. – morphometric measurements in grain and oilseed crops, including plant height, number of branches, leaf area, and number of capsules.

Materials

The experiment was conducted in Qibray district, Tashkent region. This area is predominantly composed of typical sierozem soils located on uneven low- and high-gradient hilly terrain. On such lands, erosion and soil washout often occur due to heavy rainfall and irregular furrow irrigation.

As the slope steepness and length increase, the speed of surface runoff intensifies, accelerating soil erosion. The climate of the region is sharply continental, with very hot and dry summers and relatively mild winters. The annual average air temperature ranges from 13.5 to 14.5 °C. During the coldest month (January), temperatures are around −3…−5 °C, while in the hottest month (July), they rise to +30…+35 °C. During the growing season (April–September), the average temperature is +25…+28 °C, which corresponds well to the high heat demand of sesame.

The annual precipitation is about 350–400 mm, mostly concentrated in winter and spring, while rainfall during the growing season is very low (30–50 mm), making irrigation the primary water source. In Qibray district, irrigated farming mainly relies on furrows and collector-drainage networks. Sesame is typically irrigated 4–5 times depending on the growth stage, with a total irrigation norm of 6000–6500 m³/ha.

The soils are predominantly sierozems, containing 0.87–1.34 % humus, 0.049–0.052 % total nitrogen, 33.86–37.20 mg/kg available phosphorus, and 220–284 mg/kg exchangeable potassium. Soil reaction is neutral, with a pH of 7.11–7.4. The mechanical composition is light to medium loamy sand, with field moisture capacity ranging from 22–25 %, providing favorable conditions for the development of sesame's deep root system.

The experimental object was a promising variety of sesame (*Sesamum indicum* L.) – "Qora shahzoda," belonging to the oilseed crop group. This variety was developed in Uzbekistan through selection and possesses several important biological and agronomic traits. The "Qora shahzoda" variety is characterized by high oil content (54–56 %) and rich protein composition. Its seeds are small, black, and contain kernels rich in easily digestible fatty acids.

This variety is widely recommended for irrigated farming in Tashkent, the Fergana Valley, and central regions of Uzbekistan[6].

The "Qora shahzoda" variety belongs to the medium-maturing group, with a growing season of 120–130 days. Plants reach a height of 120–150 cm, with erect stems and partial branching. Leaves are large, ovate, and pointed at the tips.

Flowers are white or light pink, located mainly in the middle part of the plant. The flowering period is prolonged, with pollination occurring mostly through self-pollination and partially with the help of insects. The fruit is a capsule, 2.5–3.0 cm long, containing 50–60 seeds.

Capsules can split quickly under high temperatures; therefore, strict adherence to agrotechnical rules is required during harvesting.

The weight of 1000 seeds is approximately 3–3.2 g. The integrated application of mineral fertilizers and suspension preparations improves the physicochemical properties of the soil while providing the plant with both fast- and slow-acting nutrients.

Fertilization adapted to phenological stages is important: nitrogen is particularly needed during the branching stage, while phosphorus and potassium demand increases during flowering and capsule formation.

In irrigated farming, it is essential to maintain nutrient balance during each irrigation event.

Nitrogen (N) – the main element for increasing yield. Adequate nitrogen promotes vigorous leaf mass development, enhances photosynthetic intensity, increases branching, and raises the number of capsules.

However, excessive nitrogen leads to overgrowth of vegetative mass and reduced oil content in seeds. Phosphorus (P) – essential for energy metabolism (ATP) and root system development.

It supports deep root penetration, accelerates flowering and capsule formation, and enhances oil accumulation in seeds. Potassium (K) – regulates water metabolism and osmotic pressure. It increases plant resistance to drought and heat, activates enzymes necessary for oil biosynthesis, and ensures rapid capsule maturation[5].

Foliar application of suspension preparations increases the photosynthetic activity of sesame (“Qora shahzoda” variety), expands leaf area, enhances branching, and improves both yield and seed oil content. In addition, it increases resistance to stress factors (drought, heat) and ensures the stability of the agroecosystem.

Physiological changes: Photosynthetic intensity rises, and biofertilizers or biopreparations applied through leaves increase chlorophyll content, thereby improving light-use efficiency.

Transpiration and respiration processes are balanced, reducing unnecessary water loss and enhancing the plant’s drought tolerance.

The activity of oxidoreductase and phosphatase enzymes in leaf tissues also increases.

Morphological changes: Leaf area expands and leaf blades enlarge, increasing the total photosynthetic surface. The formation of new leaves accelerates, while existing leaves live longer (senescence slows down).

Branching intensity increases, as nutrients supplied through the leaves stimulate vegetative growth. Effects on yield components: Flowering begins 1–3 days earlier. The number of capsules increases, and seeds within capsules develop more fully. Seed oil content rises by 1.5–2.0 %, and overall yield increases by 10–18 %.

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Figure 1

“Effect of Foliar-Applied Suspension Preparations on Yield Components in Sesame Plants”

The figure illustrates the main physiological and morphological changes observed in the “Qora shahzoda” variety of sesame when suspension preparations are applied foliarly, including the expansion of leaf area, earlier onset of flowering accompanied by enhanced photosynthetic activity, increased branching, improved seed fullness and oil content, and accelerated capsule formation.

Conclusion

Experiments conducted on sesame cultivation indicate that yield formation depends not only on genetic traits but also directly on the fertilization system and the integration of agronomic practices. The use of suspension preparations in the trials activated the internal physiological mechanisms of the plants, significantly modifying their responses to external environmental factors.

Analysis showed that foliar application of suspension preparations establishes a balance in the morphophysiological development of the plants: stable growth of vegetative organs, timely formation of generative organs, and proportional distribution of yield components, which collectively ensure high and stable productivity. This is particularly important in regions with variable soil and climatic conditions. From an agrochemical perspective, foliar feeding enhances the efficiency of nutrient uptake. As a result, plants use energy resources more economically, positively affecting not only yield quantity but also quality traits. In particular, the improved balance of fatty acids and increased levels of antioxidants demonstrate the economic effectiveness of suspension preparations. Observations also indicated that foliar application increased the plants' resistance to stress factors.

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