INFLUENCE OF GUMIMAX GROWTH STIMULATOR ON SUNFLOWER *(Helianthusannuus L.)* PRODUCTIVITY

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Abstract: In the southern regions of Uzbekistan, after harvesting winter wheat, there is a frost-free period of 130-140 days, during which the positive temperature for plants is 2400-3200°C. The sum of effective temperatures for sunflower crops is 1850°C for early-ripening varieties and 2150°C for mid-ripening varieties. Therefore, it is possible to effectively use the effective temperatures of this period of the season and grow sunflowers. However, in recent years, unfavorable weather conditions, drought, and water scarcity have negatively affected the steady increase in crop yields.

In the context of global climate change, drought, and extreme weather conditions, it has been established that the use of stimulants in sunflower crops after winter wheat is highly effective for the efficient use of land, growing two harvests per year, and meeting the population's demand for food products and livestock feed.

When creating a scientific basis for improving the agrotechnology of sunflower cultivation after winter wheat, the creation of a scientific theory and the development of theoretical foundations for the technology of applying physiologically active growth regulators before sowing and during the growing season to the plant is relevant.

According to the research results, when treating sunflower seeds with the Uzgumi stimulant at a rate of 0.75 l/t^{-1} before sowing and 0.4 l/ha^{-1} during the period of 3-4 pairs of leaves, seedling emergence, growth and development accelerated, seed yield was 1.97 t/ha^{-1}, and oil content was 48.6%, compared to the control variant, the seed yield was 0.35 t/ha^{-1}, and the oil content in the seed kernel was 0.31 % increase achieved.

Keywords: Repeated crop, sunflower, stimulator, seed, 3-4 pairs of leaves, cultivation, seed yield, oil content

Key findings. Before sowing on sunflower seeds, 0.5; 0.75; 1.0 l/t, during the period of 3-4 pairs of leaves - 0.4 l/ha, the influence on seedling germination, growth and development, dry mass accumulation, leaf surface, net photosynthesis productivity, seed yield and oil content in the kernel was determined. High data were obtained when treating sunflower seeds with the Gumimax stimulant at a rate of 0.75 l/t before sowing and at a rate of 0.4 l/ha during the period of 3-4 pairs of leaves..

1.Introduction

Global climate change on Earth, constant population growth, and industrial development, in turn, lead to an increase in demand for agricultural products. “Currently, sunflowers are planted on 28.4 million hectares worldwide, and 57.0 million tons of seeds are harvested”. As a result of global climate change, in recent years, due to unfavorable weather conditions, water scarcity, and drought, there have been problems in obtaining high and quality yields from repeated crops planted after winter wheat.

In order to eliminate these problems, the development of optimal timing and rates of application of growth regulating substances in the cultivation of repeated sunflower crops after winter wheat is relevant.

Scientific research on the use of physiologically active substances in repeated crops after winter wheat, reducing the side effects of abiotic and biotic factors, and obtaining high and quality yields has been conducted by leading world scientific centers and higher educational institutions, including Icar-Indian Institute of Soybean Research

(India), Indian Central Institute for Cotton Research (India), Agricultural Research Center a Comprehensive Agricultural Renaissance of New Egypt (Egypt), National Institute of Agricultural Technology Argentina (Argentina), Cotton Research and Application Center (Turkey), Cotton Research Institute (Egypt), Cotton Research Institute Anyang Henan Province (China), Faisalabad University of Agriculture (Pakistan), Agricultural research Institute in the United States (USA), Agriculture research institute in Bangladesh (Bangladesh).

As a result of scientific research conducted worldwide on the technology of using stimulants for obtaining high and quality yields of cotton, sunflower, soybean, and sorghum, the following scientific innovations were obtained: when treating crop seeds with stimulants before sowing, starch hydrolysis increases, enzyme activity increases and seedling emergence accelerates, crops mitigate the effects of abiotic and biotic stresses, more carbon and nitrogen compounds are absorbed, immunity increases, antioxidant enzymes are activated, resistance to stresses such as low or high temperatures, water scarcity, and drought increases, active influence on plant respiration processes and water composition, accelerates photosynthesis, improves the movement of ions in cell sap and nutrient assimilation, and important results have been achieved in the development of agricultural techniques for growing fiber, oilseed, legume, and fodder crops after winter wheat.

Currently, in the world, it is necessary to create conditions that ensure the rapid emergence of seedlings of agricultural crops, increase their resistance to unfavorable environmental conditions, and improve the growth and development of plants.

In-depth research is being conducted on the development of optimal norms for the use of humin-containing preparations before sowing seeds and during the growing season, which do not have a negative impact on the environment and convert mineral elements into a form favorable for plant assimilation. Growth regulators increase plants' resistance to unfavorable conditions and immunity, accelerate metabolic processes, and activate the synthesis of proteins and carbohydrates. This creates the basis for the development of factors for obtaining high and quality yields of agricultural crops, providing the population with food products, livestock with feed, and increasing the economic efficiency of farms.

Sunflower (*Helianthus annuus L.*) belongs to the *Asteraceae (Compositae*) family of the genus *Helianthus*, numbering more than 60 species. Sunflower (*Helianthus annuus L.*) is the fourth most important oilseed in the world, primarily used for seed oil production [Nwokolo 1996; Pilorge 2020].

The main factors influencing sunflower growth rate, the quantity and quality of oilseed crops are climatic factors, the geographical location of its cultivation areas and soil composition, the use of growth regulators and fertilizers to increase seed yield and oil content in sunflower seeds, as well as means of protection against pathogens and pests [Anitha et al., 2007; Borra et al., 2021; Chaves et al., 2015; Kamaraj1999; Secondo and Reddy 2018; Shcatula2021; Tahsin and Kolev 2005; Tsyliuryk et al., 2021; Yeremenko et al., 2017].

The creation of new environmentally friendly sunflower growth regulators to improve the growth and increase the yield of this crop is an urgent task for modern agricultural biotechnology. The most promising for solving this problem are synthetic low molecular weight heterocyclic compounds, derivatives of pyridine and pyrimidine, which are currently used as plant growth regulators, herbicides, and fungicides [Boussemghoune et al., 2012; Cansev et al., 2014; Kawarada et al., 1974; Mansfield et al., 2010; Minn 2013].

Scientific literature indicates that the optimal temperature for good plant growth and development is up to +380°C, and higher temperatures alter the natural hormonal structure of plants, meaning the levels of growth-stimulating hormones like auxin, cytokinin, gibberellin, and natural growth-stimulating phenol decrease, while the levels of abscisic acid and ethylene increase [Polevoy 1989].

When applying the Gumimax stimulant to sunflowers sown on fields freed from winter wheat, seedling emergence accelerated, growth and development improved, the number and weight of vegetative and generative organs increased, and a high and quality yield was obtained [Tadjiyev and Abdualimov 2021; Tadjiyev 2022].

In the conditions of the Surkhandarya region, the use of growth stimulants Humimax to obtain an early and high-yielding second crop of sunflower. With the use of growth stimulants Humimax (seeding rate 0.75 l/t^{-1}; spraying plants in phase 3-4 leaves 0.4 l/ha^{-1}), it had a positive effect on all seeds, growth, development, and productive seeds [Tadjiev 2022].

The article examines the effect of the VL-77 biostimulator on the growth, development, and yield of the “Dilbar” oilseed sunflower variety in the conditions of typical irrigated gray soils of the Tashkent region by cultivating seeds for sowing infield in 6 different doses and 2-4 leaves. The stems and leaves were processed [Yuldasheva et al., 2020].

2. Materials and methods

Observations and calculations in laboratory and field experiments in all research works were carried out in accordance with the “Methodology of Field Experiments with Cotton" and "Methods of Conducting Field Experiments”. Mathematical processing of yield indicators was carried out in B.A. Dospekhov's “Methodology of Field Experiments” was mathematically processed by the method of dispersion analysis.

Also, “Brief Methodological Guidelines for State Testing of Growth Regulators” and “Methodological guidelines for the testing of insecticides, ascaricides, biologically active substances and fungicides”. Agrochemical analyses of plants and soil were carried out according to the method “Methods of Agrochemical, Agrophysical and Microbiological Research in Irrigated Cotton Regions”. The amount of humus in the soil was determined by I.V.Tyurin, total nitrogen and phosphorus by I.M.Maltseva and L.I.Gritsenko, nitrate nitrogen by the ionometric method, the amount of mobile phosphorus and exchangeable potassium by B.P.Machigin and P.V.Protasov. Weighing of plants on a scale with a leaf surface was carried out by A.A.Nichiporovich was determined by the method.

2.1.Statistical analysis

Economic efficiency “The basis for determining the economic efficiency of using the results of R&D, new equipment and inventions, and rationalization proposals in agriculture” was calculated and determined based on the manual.During the ripening period of sunflower, the number of seeds in 5 plant baskets was counted and the average was calculated, the weight of 1000 seeds was weighed on scales. The oil content in sunflower kernels was determined in the laboratory using the Soxhlet method.

In the experiment, all agrotechnical measures were carried out on the basis of agrotechnical measures adopted on the farm.

Field experimental variants consisted of 4 rows, of which 2 rows were calculated, and the 2 outermost rows were calculated as protective rows.

The row spacing of the repeated sunflower planting was 70 cm wide, the area of the variants was 28 m2, the height was 10 m. Seeds were sown by hand in nests of 3-4 seeds every 25 cm. Before sowing, 1 ton of seeds was treated with the Gumimax stimulator at a rate of 0.5; 0.75 l; Taking into account the 1.0 liter norms, the corresponding amounts were mixed with 15 l of water to prepare a solution. Sunflower seeds were sown at a rate of 7-8 kg per hectare.

The soil of the experimental field is takyr-like meadowing soil, poor in humus, rich in carbonates, groundwater is located at a depth of 2-3 meters.

In the Surkhandarya region, there is a predominance of westerly, southwesterly, and northeasterly winds in summer, with an average speed of 2.6 m/sec, but sometimes up to 15 m/sec. However, the Afghan wind, blowing from the southwest, is a dry, dusty wind with a speed of 15 m/s or more. This leads to soil erosion and partially negatively affects the growth and development of plants. On the hottest days of summer, the air temperature

reaches 39.5-48^{0}C.The hot and dry garmsel winds blowing during these months raise air temperature and reduce relative humidity to 12-20 percent or even lower. In such conditions, stress occurs in plants, disrupting their hormonal activity, resulting in the loss of many yield traits.

2.2.Description of the stimulant used

Gumimax - produced at the Russian CJSC "Uralekosoil" in liquid form, is an adaptogenic, antidot, immunostimulating, environmentally friendly peat-humic compound. It contains biologically active substances such as potassium and sodium humates, humic acids, and 8 types of fulvic acid compounds. It can be used in combination with pesticides and agrochemicals. Class IV, low toxicity.

2.3.Description of the sunflower variety studied in the experiment.

Description of the Jahongir sunflower variety

The “Jahongir” variety was created by group individual selection from the collection sample No. 26 (K-Uz007085 A 502 Turkey) of the Research Institute of Plant Growing of Uzbekistan. The plant's average height is 140-160 cm. The plant's stem is moderately pubescent. The leaves are heart-shaped, moderately pubescent. The basket is dense, 25-30 cm in diameter, curved downwards. The seeds are black, dark gray, medium-sized. The weight of 1000 grains averages 70.0-78.0 g, medium-early ripening. In the conditions of the Tashkent region, it ripens in 98-108 days. To stay overnight,Tear resistance 5.0 points. Yield 1.92-2.20 t/ha^{-1}, resistant to diseases (false powdery mildew, white and gray rot) and insects. The oil content in the grain is 58%, and the protein content is 19%.

3.RESULTS AND DISCUSSION

In our experiment, a positive effect of treatment with the Gumimax stimulant on the yield of sunflower seeds, repeatedly sown after winter wheat, and in the period of 3-4 pairs of leaves was revealed (Fig. 1).

According to the research results, the average seed yield in the control variant was 1.62 t/ha^{-1}. When treating seeds with the standard sodium humate preparation at a rate of 0.8 kg/t^{-1}, the yield was 1.79 t/ha^{-1}, which is 0.17 t/ha^{-1} more than in the control variant.Sunflower seeds were treated with the Gumimax stimulator at a rate of 0.5;0.75; 1.0 l/t^{-1}during standard processing (var. 3; 5; 7) respectively, the average seed yield was 1.85;1.87; 1.85 t/ha^{-1}, which is 0.23; 0.24; 0.23 t/ha^{-1}.

Also, sunflower seeds were treated with the Gumimax stimulator at a rate of 0.5; 0.75; 1.0 l/t^{-1} and 3-4 pairs of leaves at a rate of 0.4 l/t^{-1} (var. 4; 6; 8) seed yield 1.89; 1.97; 1.88 t/ha^{-1}, compared to the control –0.27; 0.35; 0.26 t/ha^{-1} more was observed.

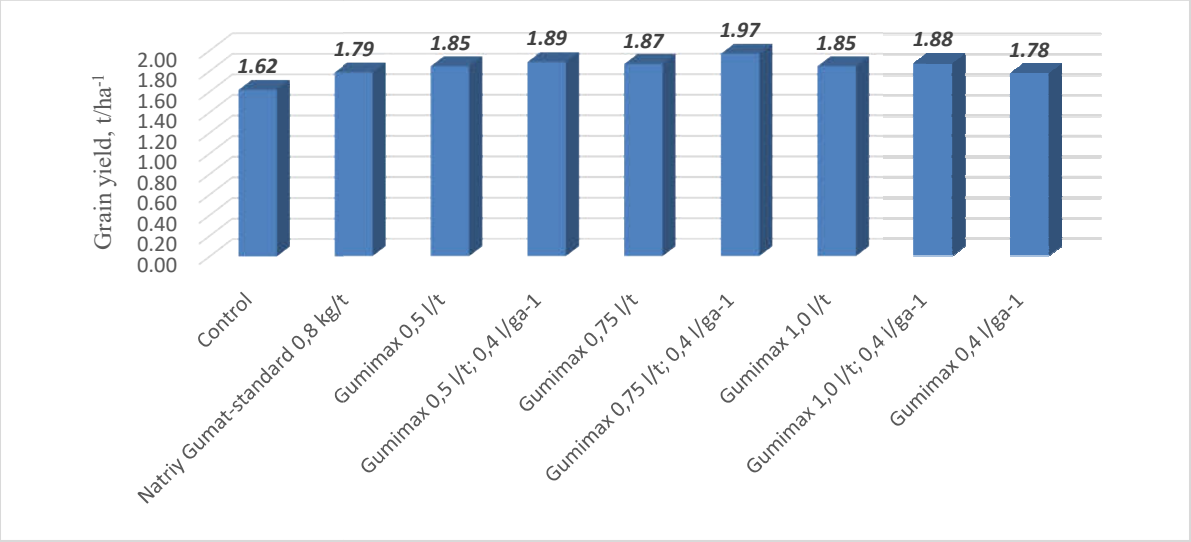

Figure 1. Influence of treatment with Gumimax stimulant on sunflower seed yield after winter wheat

When treating sunflower with the Gumimax stimulant at a rate of 0.4 l/ha^{-1} during the period of 3-4 pairs of

leaves, the average seed yield was 1.78 t/ha^{-1}, which is 0.16 t/ha^{-1} more compared to the control.

Based on the above data, it can be concluded that when treating repeated sunflower seeds with the Gumimax stimulant at a rate of 0.75 l/t before sowing and at a rate of 0.4 l/ha^{-1} during the period of 3-4 pairs of leaves, seedling emergence accelerates, plant growth and development are coordinated, and the seed yield increases by 0.35 t/ha^{-1}.

In our experiments, the influence of the Gumimax stimulant on the oil content of sunflower kernels was determined. According to the results obtained, the oil content of sunflower kernels in the experimental variants averaged 45.5-48.6%, in the control, this indicator was 45.5% (Fig. 2).

47.0% with the application of sodium humate at a rate of 0.8 kg/t^{-1}, as well as 0.5; 0.75; In variants with treatment at a rate of 1.0 l/t^{-1} (var. 3; 5; 7) respectively 47.4; 47.6; 47.4%, with the Gumimax stimulator - 0.5; 0.75; 1.0 l/t^{-1} and at the stage of 3-4 pairs of leaves at a rate of 0.4 l/ha^{-1} (var. 4; 6; 8) 48.0; 48.6; 47.8% and when treated with the Gumimax stimulant at a rate of 0.4 l/ha^{-1} in the period of 3-4 pairs of leaves - 46.4%.

Especially when treating seeds with sodium humate, the oil content in sunflower kernels was 1.6% compared to the control, as well as 0.5% before sowing seeds with the Gumimax stimulant; 0.75 l/t^{-1}; In variants with treatment at a rate of 1.0 l/t^{-1} (var. 3; 5; 7) 2.0; 2.1; 2.0%, and when treating seeds with the Gumimax stimulant at a rate of 0.5-0.75-1.0 l/t^{-1} and 0.4 l/ha^{-1} during the period of 3-4 pairs of leaves (var. 4; 6; 8) 2.5; 3.1; 2.4% and when treated with the Gumimax stimulant at a rate of 0.4 l/ha^{-1} during the period of 3-4 pairs of leaves, an increase of 1.0% was observed.

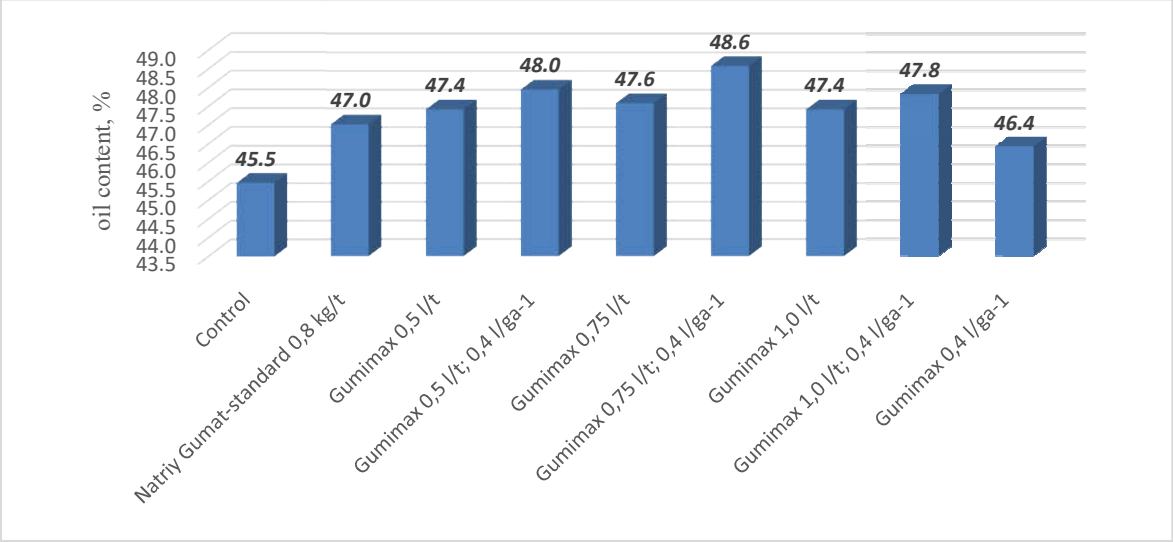

Figure 2. Effect of the Gumimax stimulant on the oil content in sunflower kernels

4. Discussion

Four-week sunflower (Helianthus annuus L.) Synthetic growth stimulants Methyur, Kamethur, as well as fertilizers Rostock extra and Radix Tim forte plus, when applied separately or in combination, had the greatest stimulating effect on the growth of sunflower shoots and roots [Tsygankova et al., 2023].

Summarizing the data obtained, it should be noted that the effect of synthetic plant growth regulators Methyur, Kamethur, and Ivin, when used separately or in combination with fertilizers Rostok extra and Radix Tim forte plus, on plant growth is similar to the regulatory effect of phytohormones auxins and cytokinins, which control the elongation, division, and differentiation of plant cells, as well as the formation and growth of plant tissues and organs [Tsygankova et al., 2022].

5. Conclusion

Effective use of land in the context of global climate change, drought, extreme weather conditions, growing crops twice a year, as well as increasing the availability of food products for the population

Meeting the needs of livestock for feed,it was found that the application of the stimulant to sunflower crops sown

after winter wheat is highly effective.Based on the data, it can be concluded that when treating sunflower seeds with the Gumimax stimulant at a rate of 0.75 l/t^{-1} before sowing and 0.4 l/ha^{-1} during the period of 3-4 pairs of leaves, seedling emergence, growth and development accelerated, seed yield was 1.97 t/ha^{-1}, and oil content 48.6%, compared to the control variant, seed yield increased by 0.35 t/ha^{-1}, and oil content in the seed kernel by 3.1%.

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