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DEVELOPMENT OF A CONVOLUTIONAL NEURAL NETWORK FOR APPLYING STIMULATORS THAT INFLUENCE THE GROWTH AND DEVELOPMENT OF COTTON

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Abstract:
This article analyzes the results of experiments using the "Tandem" stimulator, "Indoxamektin" insecticide, and "Zeroks" fungicide to regulate the growth and development of plants of the regionalized medium-fiber "Bukhara-8" and fine-fiber "Marvarid" cotton varieties. The study aims to mitigate their harmful effects on the environment and prevent abiotic and biotic stresses observed during their ontogenesis.

Keywords: medium-staple cotton variety "Bukhoro-8" and fine-staple cotton variety "Marvarid," "Tandem" growth stimulator, "Indoksamektin" insecticide, "Zeroks" fungicide, convolutional neural network

The development of a convolutional neural network for monitoring cotton growth, which serves to increase economic efficiency, is a pressing issue in our republic. This involves observing cotton's growth and development periods under natural and anthropogenic factors, studying and assessing changes in its condition, examining the biology of pests and diseases, controlling the phytosanitary state of crops, and monitoring the phenological, age-related, and territorial distribution and development of harmful organism populations. This research aims to develop scientific foundations for pest control.

Experiments were conducted in the light gray soils of the Kashkadarya region to study pest and disease control, germination, growth and development, leaf area, photosynthetic potential, yield, technological quality indicators, and economic efficiency of cotton. The study used the regionalized medium-fiber cotton variety "Bukhara-8" and fine-fiber cotton variety "Marvarid," along with the stimulant "Tandem," the insecticide "Indoxamektin," and the fungicide "Zeroks."

Field experiments, experimental layout, phenological observations, biometric measurements, yield determination, and disease and pest control were carried out according to the methods outlined in "Methodology of Agrochemical, Agrophysical and Microbiological Research in Irrigated Cotton Regions" (1952), "Methodology of State Variety Testing of Agricultural Crops" (1985, 1989), and "Methods of Conducting Field Experiments" (2017). Mathematical analyses were performed using methods developed by B.A. Dospekhov (1985).

Stimulants are widely used to regulate plant growth and development, increase crop productivity, mitigate environmental impacts, and prevent abiotic and biotic stresses observed during plant ontogenesis. Although biotic and abiotic stress conditions reduce the yield potential of all crops, stimulants help counteract unfavorable factors. Currently, stimulants are widely used in sustainable agriculture, replacing chemical fertilizers and pesticides that have limited use in organic agriculture.

In 1933, Professor V.P. Filatov first introduced the theory of "biogenic stimulator" to science. He discovered that biological materials from various organisms, including stressed plants, have a metabolic effect on humans, animals, and plants.

J.J. Herve proposed a systematic approach to understanding how stimulants affect the physiological and ecological processes of agricultural crops, and in what proportions and at what times they can be used to produce high-quality, environmentally friendly products. In his opinion, when these products are used in small quantities and at acceptable rates, they are environmentally beneficial and highly effective in crop cultivation. He also noted that stimulants influence metabolic processes by regulating enzyme and hormone synthesis, and most of these substances stimulate physiological processes in living organisms, thereby contributing to increased yield and early maturation in plants.

In our research experiments, insecticides, fungicides, and stimulants were tested against pests and diseases in cotton fields.

In the experiments, stimulants, insecticides, and fungicides were applied separately and in combination to the medium-fiber cotton variety "Bukhara-8" and the fine-fiber variety "Marvarid," and their effects on diseases and pests were studied. The first variant was the control (st) with no treatment. The second variant used the stimulator Tandem at a rate of 0.5 l/ha. In the third variant, the insecticide Indoxamektin was applied at a rate of 0.7 l/ha. The fourth variant used the fungicide Zeroks at a rate of 1.5 l/ha. In the fifth variant, chemical preparations were combined: Stimulator (Tandem - 0.5 l/ha) + Insecticide (Indoxamektin - 0.7 l/ha) + Fungicide (Zeroks - 1.5 l/ha).

Fusarium is a very harmful disease. This was studied in fields where experiments were conducted.

The degree of fusarium wilt damage to seedlings in cotton fields treated with chemical preparations was determined by monitoring from the first appearance of disease symptoms until the beginning of cotton flowering.

The dynamics of disease manifestation in seedlings showed that the number of diseased plants was higher in cotton grown in the control variant and significantly lower in variants where preparations were applied.

When studying cotton fusarium wilt on May 20, it was found that the medium-fiber cotton variety Bukhara-8 was affected by 8.2% in the control variant, 4.5% in the variant treated with Tandem stimulant at 0.5 l/ha, 6.7% in the variant treated with Indoxamectin insecticide at 0.7 l/ha, 1.9% in the variant treated with Zerox fungicide at 1.5 l/ha, and 1.2% in the variant with combined application of stimulant + insecticide + fungicide. By June 30, in the control, 11.2% were infected and 0.5% died; when using Tandem stimulant at 0.5 l/ha, 8.5% were infected with no plant death observed; when using Indoxamectin insecticide at 0.7 l/ha, 10.6% were infected and 0.6% died; when using Zerox fungicide at 1.5 l/ha, 4.1% were infected with no plant death observed; when using the stimulant + insecticide + fungicide combination, 2.2% were infected with no plant death observed.

Table. Percentage of cotton plants infected with Fusarium wilt

№	Experimental options	20.05	30.05	10.06		20.06		30.06	
				Infected	Deceased	Infected	Deceased	Infected	Deceased
	Buxoro-8								
1	Control (st)	8,2	9,1	9,6	0,7	10,5	0,9	11,2	0,5
2	Stimulator	4,5	5,3	6,1	0	7,6	0	8,5	0
3	Insecticide	6,7	7,4	8,7	0,5	9,3	0,6	10,6	0,6
4	Fungicide	1,9	2,2	2,5	0	3,3	0	4,1	0
5	Stimulator+ Insecticide+ Fungicide	1,2	1,8	1,9	0	2,1	0	2,2	0
	Marvarid								
1	Control (st)	6,5	7,3	8,8	0,1	9,8	0,3	9,5	0,2
2	Stimulator	3,8	3,9	4,5	0	6,4	0	6,6	0
3	Insecticide	4,7	7,1	8,6	0,4	9,3	0,1	9,4	0,2
4	Fungicide	1,4	1,6	1,9	0	2,2	0	2,5	0
5	Stimulator+ Insecticide+ Fungicide	0,9	1,1	1,5	0	1,7	0	1,9	0

When studying the incidence of fusarium wilt in the fine-fiber cotton variety Marvarid, it was found that on May 20, the infection rate in the control variant was 6.5%, with the use of Tandem stimulator at 0.5 l/ha - 3.8%, with the use of Indoxamectin insecticide at 0.7 l/ha - 4.7%, with the use of Zerox fungicide at 1.5 l/ha - 1.4%, and with the combined use of stimulator + insecticide + fungicide - up to 0.9%. By June 30, in the control, 9.5% were infected and 0.2% died. When using Tandem stimulator at 0.5 l/ha, 6.6% were infected with no plant death observed. When using Indoxamectin insecticide at 0.7 l/ha, 9.4% were infected and 0.2% died. When using Zerox fungicide at 1.5 l/ha, 2.5% were infected with no plant death observed. When using the stimulator + insecticide + fungicide together, 1.9% were infected with no plant death observed.

Thus, the highest level of Fusarium damage to plants in the control variant was observed in the Bukhara-8 variety, where 11.2% of plants were infected and 0.5% died, and in the Marvarid variety, where 9.5% were infected and 0.2% died. The use of Tandem stimulator at a rate of 0.5 l/ha increased the immunity of cotton, with 8.5% of plants infected in the Bukhara-8 variety and 6.6% in the Marvarid variety, with no deaths observed. With the application of Zerox fungicide at a rate of 1.5 l/ha, 4.1% of plants in the Bukhara-8 variety and 2.5% in the Marvarid variety were infected, with no deaths observed. With the combined use of stimulator + insecticide + fungicide, 2.2% of plants in the Bukhara-8 variety and 1.9% in the Marvarid variety were infected, with no deaths observed.

Double application of stimulator + insecticide + fungicide at the beginning of the flowering and ripening phases has a positive effect on the growth and development of cotton, increasing the yield by 35% and economic efficiency.

In conclusion, the highest degree of fusarium damage to cotton in the control variant was observed in the Bukhara-8 variety, where 11.2% of plants were infected and 0.5% died, and in the Marvarid variety, where 9.5% were infected and 0.2% died. The use of Tandem stimulator at a rate of 0.5 l/ha increased the immunity of cotton, with 8.5% of plants infected in the Bukhara-8 variety and 6.6% in the Marvarid variety, with no deaths observed. With the application of Zerox fungicide at a rate of 1.5 l/ha, 4.1% of plants in the Bukhara-8 variety and 2.5% in the Marvarid variety were infected, with no deaths observed. With the combined use of stimulator + insecticide + fungicide, it was found that in the Bukhara-8 variety, 2.2%, and in the Marvarid variety, 1.9% of plants were infected.

The duration of cotton developmental periods in the control variant was delayed by 4-6 days, while with the use of Tandem stimulator at a rate of 0.5 l/ha, it was accelerated by 5-6 days, with the use of Indoxamectin insecticide at a rate of 0.7 l/ha by 4-5 days, with the use of Zerox fungicide at a rate of 1.5 l/ha by 4-5 days, and with the combined use of stimulator + insecticide + fungicide by 6 days.

It was found that the use of stimulants, insecticides, and fungicides, along with improving the phytosanitary state of cotton, also had a positive effect on its growth. The plant height was 8-29 cm higher in the medium-fiber Bukhara-8 variety and 16-21 cm higher in the fine-fiber Marvarid variety compared to the control variant.

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