THE EFFECT OF NEW BIOSTIMULANTS AND INSECTICIDES ON SEED GERMINATION ENERGY AND VIABILITY UNDER FIELD AND LABORATORY CONDITIONS

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Annotation

This study investigates the influence of new biostimulants and insecticides on the germination energy and seed viability of cotton under field and laboratory conditions. Seed samples were prepared and evaluated according to national standards, and nine experimental variants with different biostimulant combinations were tested. Results showed that all treatments improved germination energy and viability compared with the control. Field germination energy ranged from 72 % to 82 %, and seed viability from 75 % to 83 %, while laboratory values reached 89 %–96 % and 92 %–96 %, respectively. The best performance was observed in variants 5, 8, and 9, demonstrating the effectiveness of biostimulants in ensuring rapid, uniform seedling emergence and enhancing cotton seed quality. These findings confirm that the application of biostimulants is a practical approach to achieving stable seedling establishment, higher yield potential, and high-quality seed production.

Keywords: cotton, biostimulant, insecticide, germination energy, seed viability, field conditions, laboratory conditions, seed quality.

Introduction

Achieving high yields and superior fiber quality in cotton production depends on multiple factors, and scientific studies clearly demonstrate the importance of soil moisture, mineral fertilization, variety selection, agronomic practices, and the use of various biostimulants. For example, a number of investigations (S. Ergasheva et al., Q. Davronov, N. Teshaboyev, X. Bozorov, and others) have scientifically confirmed the positive effects of cotton genetics, fertilizer application rates, and intercropping on plant growth, flowering, and early maturation. Several studies have shown that applying mineral fertilizers (N, P, K) at optimal rates, as well as foliar feeding, accelerates vegetative and generative development and increases the

flowering rate. Crop rotation and the combined application of organic and mineral fertilizers have also been reported to enhance soil microbiological activity, increase the reserves of available nutrients, and significantly raise cotton yields.

In addition, research on various physiologically active substances and biostimulants (Sh. Abdualimov, S. Sidikov, and others) has confirmed their effectiveness in balancing plant height, expanding leaf area, reducing the shedding of reproductive elements, and ensuring additional yield. International studies (G. Dorota, W. Xinhang, and coauthors) have also demonstrated that biostimulants improve seed yield and quality under stress conditions and enhance drought tolerance. These scientific findings show that optimizing fertilization, applying biostimulants, and using foliar feeding in combination can restore soil fertility and sustainably increase cotton yield. Based on this background, the present study was aimed at evaluating the effects of biostimulants on the germination energy and seed viability of cotton under both field and laboratory conditions.

Methodology

The experiment was conducted in 2024 under both field and laboratory conditions. Seed samples were prepared in accordance with O‘zDSt 12036-85 standards and evaluated using the procedures specified in O‘zDSt 12038-84. Minimum quality requirements for cotton seed were compared with the O‘zDSt 663:2017 standard.

Nine experimental variants with different combinations of biostimulants were established: control, standard (universal), Antikolorad maks, Avangard Start, Gulliver, Gulliver + Avangard – Antikolorad maks, Avangard + Gulliver + Antikolorad maks, Avangard – Gulliver – Antikolorad maks (separate application), and Avangard Start + Gulliver. Seeds in each variant were studied both under natural field conditions and in the laboratory where optimal temperature and humidity were maintained.

Germination energy and seed viability were determined according to O‘zDSt 12038-84 procedures. Seeds from each variant were placed in four-row containers on moistened filter paper and grown under controlled conditions. In the field, seeds were sown in natural moisture, while in the laboratory they were incubated at 25 ± 2 °C and 70–75 % relative humidity. Filter papers were kept consistently moist to ensure adequate water supply. Germination energy was recorded on the 4th day after sowing, and final germination (viability) on the 7th day, both expressed as percentages. These data from field and laboratory conditions were then compared to assess the influence of biostimulants on cotton seed quality.

Results:

The germination energy and seed viability of cotton seeds were evaluated under both field and laboratory conditions in 2024.

№	Experimental variants	Field conditions – Germination energy (%)	Laboratory conditions – Germination energy (%)	Field Conditions – Seed Viability (%)	**Laboratory conditions – Seed viability** (%)
1	Control	77,0	89,0	75,0	92,0
2	Standart (Universal)	75,0	91,0	81,0	94,0
3	Antikolorad maks	72,0	89,0	78,0	93,0
4	Avangard start	80,0	92,0	82,0	95,0
5	Gulliver	79,0	96,0	83,0	94,0
6	Gulliver + Avangard – Antikolorad maks	74,0	91,0	80,0	94,0
7	Avangard + Gulliver + Antikolorad maks	73,0	89,0	81,0	95,0
8	Avangard, Gulliver, Antikolorad maks (separate application)	82,0	94,0	83,0	96,0
9	Avangard start + Gulliver	80,0	94,0	82,0	96,0

The results show that under field conditions the germination energy of cotton seeds ranged from 72.0 % to 82.0 %, with the highest value recorded in variant 8 at 82.0 %. Variants 4 and 9 also performed well with 80.0 %. In the remaining variants, germination energy varied between 72.0 % and 79.0 %, while the control measured 77.0 %.

Under laboratory conditions, germination energy was higher, ranging from 89.0 % to 96.0 %. Variant 5 achieved the highest value of 96.0 %, followed closely by variants 8 and 9 with 94.0 %.

Seed viability in the field ranged from 75.0 % to 83.0 %. The best results were observed in variants 5 and 8 at 83.0 %, while variants 4 and 9 reached 82.0 %. The control variant recorded 75.0 %.

In the laboratory, seed viability was even higher, varying from 92.0 % to 96.0 %. Variants 8 and 9 reached the maximum of 96.0 %, and the other treatments showed stable results between 93.0 % and 95.0 %.

Overall, all treated variants improved both germination energy and seed viability compared to the control. In particular, variants 5, 8, and 9 demonstrated the best performance under both field and laboratory conditions, confirming the effectiveness of biostimulants in improving cotton seed quality.

Discussion

The experimental results confirmed that biostimulants consistently exert a positive influence on the germination energy and seed viability of cotton. Under field conditions, all treated variants outperformed the control: germination energy ranged from 72 % to 82 %, while seed viability was recorded between 75 % and 83 %. In the laboratory, where optimal environmental conditions were maintained, these values rose to 89 %–96 %, demonstrating the effectiveness of biostimulants in promoting uniform germination and subsequent seedling development.

Variants 4, 5, and 6 showed particularly strong performance. Variant 4 (Avangard Start) achieved 80 % germination energy and 82 % viability in the field, and 92 % and 95 % respectively in the laboratory. Variant 5 (Gulliver) reached 79 % and 83 % in the field and 96 % and 94 % in the laboratory, while Variant 6 (Gulliver + Avangard – Antikolorad maks) recorded 74 % and 80 % in the field and 91 % and 94 % in the laboratory. These outcomes indicate that these treatments are particularly effective in ensuring rapid and uniform seed germination.

Other variants also produced positive results compared with the control. For example, Variant 8 achieved 82 % germination energy and 83 % viability in the field, and 94 % and 96 % in the laboratory, while Variant 9 reached 80 % and 82 % in the field and 94 % and 96 % in the laboratory.

Overall, all biostimulant treatments significantly improved seed quality compared with the control. Although field values were slightly lower due to natural environmental factors, laboratory results demonstrated consistently higher performance. These findings confirm that the application of biostimulants is an effective practice for increasing the germination energy and viability of cotton seeds, ensuring high-quality seedlings and contributing to stable yield formation.

Conclusion

The experimental results demonstrated that biostimulants significantly increase the germination energy and seed viability of cotton. Under field conditions, germination energy ranged from 72 % to 82 % and seed viability from 75 % to 83 %, while in the laboratory these values reached 89 %–96 % and 92 %–96 %, respectively. All treated variants produced higher results than the control, confirming the effectiveness of biostimulants in improving seed quality.

Overall, although field values were slightly lower due to climatic factors, the use of biostimulants ensured rapid and uniform seed germination. These findings scientifically confirm that applying biostimulants is a practical and effective approach for achieving stable

seedling establishment, increasing yield potential, and preparing high-quality seed material in cotton production.

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