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EFFECT OF NANOPREPARATIONS ON FIELD GERMINATION OF CROTALARIA SEEDS

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Today, preserving soil fertility, increasing crop resistance to stress factors, and obtaining high and high-quality yields with lower resource inputs are among the most pressing scientific and practical issues in agriculture. Especially under conditions of abrupt climate change, water scarcity, soil degradation, and declining nutrient reserves, the inclusion of leguminous crops in cropping systems is of great importance. Legumes contribute to the accumulation of biological nitrogen in soil, increase organic matter content, and improve the agrophysical condition of soils.

One of such promising non-traditional leguminous crops is sunn hemp (Crotalaria juncea L.). In tropical and subtropical regions, sunn hemp is valued as a green manure crop, a fiber crop, a forage source, and a biological soil-improving cover crop. As a legume, it forms symbiosis with rhizobia, converts atmospheric nitrogen into plant-available forms, accumulates high biomass, and contributes to improving the agromeliorative condition of soils.

In Uzbekistan, a number of scientific studies have also been conducted on the introduction of sunn hemp and on its biological characteristics, sowing dates, seeding rates, and the effects of biostimulants. In particular, S.T. Negmatova et al. [2] studied the effects of sowing dates and seeding rates on yield components and the weight of 1000 grains of sunn hemp under the alluvial soil conditions of the Khorezm region. Their study scientifically substantiated that sowing sunn hemp on 20–25 April and selecting appropriate seeding rates are important factors in the formation of high yield components.

The importance of sunn hemp as a non-traditional crop capable of ecological soil remediation and restoration of soil fertility and the agroecological environment has also been demonstrated [3]. In addition, X.K. Berdiqulov [1] studied the effects of such biostimulants as UzGumi, Geogumat, and Fertilife on the seed quality indicators of sunn hemp under meadow sierozem soils of the Jizzakh region. These studies found that the application of biostimulants at sowing and at appropriate growth stages had a positive effect on crude protein and oil content in sunn hemp grain.

Foreign studies have also widely described the importance of sunn hemp as a multipurpose crop. H. Schomberg et al. evaluated sunn hemp as a crop with a high capacity for biomass production and biological nitrogen accumulation [5]. M.K. Tripathi et al. characterized Crotalaria juncea L. as an important leguminous crop used for high-quality fiber, green manure, and improvement of soil reclamation status in tropical and subtropical regions [7].

Analysis of the literature shows that although certain studies have been conducted on the biological characteristics of sunn hemp, sowing dates, seeding rates, the effects of biostimulants, and some quality indicators, the effects of nanopreparations on the field germination of sunn hemp seeds under the takyr-like soil conditions of the Kashkadarya region have not been sufficiently investigated.

S. Nile et al. evaluated nano-priming technology as a modern seed treatment method that can improve seed germination, seedling growth, yield, and resistance to stress factors [4]. Studies by A. Shelar et al. reported that nano-priming accelerates water uptake by seeds, activates metabolic

processes, promotes starch hydrolysis and cell-wall softening, and stimulates root and shoot development [6].

In the conducted experiment, the effect of various pre-sowing seed treatments on the field germination of the non-traditional leguminous crop sunn hemp was studied.

According to the experimental results, during the initial observation period, i.e. on 7 May, germination across the variants was reported in the text of the original article as 41.8–51.0%, and the use of different pre-sowing treatments increased germination by 6.5–8.6% compared with the control. Germination was slightly higher in Variants 2 and 6 treated with the UzGumi stimulant. Pre-sowing treatment with UzGumi can increase seed physiological activity, accelerate water uptake and enzymatic processes, and thereby promote field germination (Table 1).

During the subsequent observations, i.e. on 10 May, germination ranged from 81.0 to 91.7%, while the number of emerged seedlings ranged from 202,500 to 229,200 plants per hectare. Higher results were obtained in the variants treated with the Sila kremniy nanopreparation. With the nanopreparation, germination was 8.8–10.0% higher than in the control and 2.3–2.9% higher than in the variants treated with UzGumi.

Table 1

Effect of nanopreparations on field germination of Crotalaria seeds, 2026

Variants	04.05 plants/ha	07.05 plants/ha	10.05 plants/ha	04.05 %	07.05 %	10.05 %
1-variant	31 500	105 000	202 500	12,6	42,0	81,0
2-variant	45 000	126 500	221 200	18,0	50,6	88,5
3-variant	38 700	121 200	227 500	15,5	48,5	91,0
4-variant	37 500	122 500	228 500	15,0	49,0	91,4
5-variant	41 000	120 500	227 000	16,4	48,2	90,8
6-variant	30 500	104 500	203 700	12,2	41,8	81,5
7-variant	46 200	127 500	220 000	18,5	51,0	88,0
8-variant	39 500	123 500	228 200	15,8	49,4	91,3
9-variant	38 700	124 500	229 200	15,5	49,8	91,7
10-variant	42 000	122 500	226 000	16,8	49,0	90,4

When sunn hemp seeds were treated before sowing with the Sila kremniy nanopreparation, the relatively slower germination rate during the initial days can be explained by the gradual manifestation of the physiological effects of nanosilicon and by a certain slowing of water uptake by the seeds. In the following days, activation of enzymatic processes, intensification of metabolism, and increased stress resistance resulted in higher field germination. This pattern is consistent with the “slow initial germination – improved final germination” characteristic reported in the scientific literature for silicon-containing preparations. Therefore, the relatively lower initial germination should not necessarily be regarded as an adverse effect of the preparation, but rather as a specific manifestation of its physiological mode of action.

Conclusion. Under the takyr-like soil conditions of the Kashkadarya region, pre-sowing treatment of sunn hemp seeds with the Sila kremniy nanopreparation at a rate of 350 g/t increased

field germination by 8.8–10.0% and may be considered an effective agrotechnological approach for promoting more uniform and higher seedling emergence.

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