

EFFECT OF TIMING AND DOSAGE OF BIOSTIMULANT APPLICATION ON THE GERMINATION AND SEEDLING DENSITY OF CROTALARIA SEEDS

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Abstract

This article studies the effects of temperature, biostimulants, and planting conditions on the germination of seeds of the tropical plant *Crotalaria juncea* in field conditions. The studies were conducted in the climatic conditions of the Jizzakh region, and it was found that the seeds reached 99–100% germination at a temperature of 29–33°C. In field experiments, the use of biostimulants increased seed germination by 4.6–7.4% compared to the control option. In particular, the Geohumat stimulator was more effective than UzGumi. The results of this study confirm that *Crotalaria* is resistant to high temperatures, germinates quickly, and has a positive effect on stimulants.

Keywords. *Crotalaria juncea*, Seed germination, Field experiment, Temperature, Biostimulant, Geohumat, UzGumi, Tropical plant, Sowing time, Soil temperature.

Introduction

Field germination of seeds is a complex indicator that depends not only on the quality of the seeds, but also on environmental, agrotechnical and other factors. Seed germination is one of the most important characteristics that determine their suitability for sowing. Seed germination is an important indicator that significantly affects the seedling density, uniform development of plants and other characteristics of the crop.

As is known, the yield and quality of legumes and grain crops depend on the quality and germination of the seed, since the seed embodies the biology of the future plant, as well as the varietal characteristics. For this reason, much attention has been paid to the qualitative characteristics of the seed in the history of agriculture.

Temperature is one of the main factors for the germination of plant seeds. Most seeds of the genus germinate at high temperatures, but some germinate well in a certain temperature range. *Crotalaria* seeds do not germinate at temperatures below 10 °C, and 99-100% germinate at 29-33 °C. Thus, good growth of *crotalaria* seeds is observed at high temperatures. The depth of planting the plant should be 2-3 cm, depending on the type of soil.

In the soil and climatic conditions of the Jizzakh region, *crotalaria* was sown in the last ten days



of April to obtain a grain yield of 14 kg per hectare. Crotalaria seeds were treated with stimulants in various doses according to the experimental system and sown. Usually, seed water was given to crotalaria seeds to germinate, but in the studies, seed water was not given because a stimulant was used along with sowing.

In the field experiment, the field efficiency of the plant (%) was calculated according to the following formula:

$$Vp = (n/N) * 100,$$

Bynda, Vp is the field sensitivity of ypyglap, %;

n - the number of lawns in 1 m layer (seedling thickness);

N is the number of plants planted.

Unlike other crops, crotalaria has a very low dormancy, meaning that the seeds begin to germinate 4-5 days after being sown in the soil. In 2023, when the seeds were sown on April 23, germination was observed on the 5th day in the experimental field. Field germination of the seeds was determined every 3 days. Since the crotalaria plant is a tropical plant, its seeds begin to germinate when the soil temperature is at a minimum of 10-12 °C, but the optimal temperature is 18-20 °C. It was observed that the soil temperature reaches this level in the Jizzakh region at the end of April and the beginning of May.

The seeds planted in the soil fully germinated after 14-15 days. The effect of sowing time and rates, fertilizer rates, as well as biostimulants on seed germination was studied. When Crotalaria plants were planted on April 23 with biostimulants at different rates for grain yield, it was observed that the seeds fully germinated in 14-15 days, and the germination rate was 88.6-91.4%, which was 4.6-7.4% higher than the control variant without the stimulant. It was found that the Geohumate stimulator had a 2.5-2.8% higher germination rate compared to the grape stimulator (see Table 1). Thus, the higher the air and soil temperature, the higher the germination rate, and it was found that stimulants also increase seed germination.

Since the Crotalaria plant is a non-traditional crop among the crops grown in our country, there are no organizations engaged in its seed production and supplying it to farmers. Therefore, in order to obtain a bountiful and high-quality harvest from Crotalaria, it is also important to study the seedling density of the plant and the level of seedling safety.

The rate of planting Crotalaria also depends on the purpose for which it is used, and for green manure or green mass it is 40-50 kg/ha, and for fiber it is 100-240 kg/ha, and the planting depth is 1-2 cm. Crotalaria roots easily form tubers and can accumulate 150-165 kg/ha of biological nitrogen within 60 days [Internet].

Table 1 Effect of timing and rates of stimulant application on field germination of Crotalaria seed. (year 2023)

№	Name of biostimulants	Duration and norms of biostimulants			Average germination, units/ha				Average germination, %			
		With sowing, l/t	During the period of 3-4 chinbar g, l/ha	During plowing, l/ha	28.04	30.04	03.05	06.05	28.04	30.04	03.05	06.05
1	Control	-	-	-	50 050	140 000	240 450	294 000	14,3	40,0	68,7	84,0
2	UzGumi	0,4	-	-	89 950	159 950	260 050	310 100	25,7	45,7	74,3	88,6
3	UzGumi	0,4	0,3	0,4	79 800	149 800	240 100	310 800	22,8	42,8	68,6	88,8
4	UzGumi	0,4	0,5	0,6	100 100	179 900	260 050	311 850	28,6	51,4	74,3	89,1
5	UzGumi	0,4	0,7	0,8	89 950	170 100	249 900	311 150	25,7	48,6	71,4	88,9
6	Geohumat	1,0	-	-	89 950	149 800	249 900	319 900	25,7	42,8	71,4	91,4
7	Geohumat	1,0	1,4	1,4	109 900	179 900	269 850	319 550	31,4	51,4	77,1	91,3
8	Geohumat	1,0	1,6	1,6	100 100	179 900	280 000	318 500	28,6	51,4	80,0	91,0
9	Geohumat	1,0	1,8	1,8	100 100	170 100	260 050	319 900	28,6	48,6	74,3	91,4

Table 2 Effects of timing and rates of stimulants on Crotalaria seedling thickness (2023)

№	Name of biostimulants	Duration and norms of biostimulants			Seedling thickness, bush/ha		Seedling preservation, %	Seedling death, %
		With sowing, l/t	During the period of 3-4 chinbar g, l/ha	During plowing, l/ha	Beginning of the action period	End of validity period		
1	Control	-	-	-	294 000	272 244	92,6	7,4
2	UzGumi	0,4	-	-	310 100	290 873	93,8	6,2
3	UzGumi	0,4	0,3	0,4	310 800	292 152	94,0	6,0
4	UzGumi	0,4	0,5	0,6	311 850	294 074	94,3	5,7
5	UzGumi	0,4	0,7	0,8	311 150	292 792	94,1	5,9
6	Geohumat	1,0	-	-	319 900	300 706	94,0	6,0
7	Geohumat	1,0	1,4	1,4	319 550	301 016	94,2	5,8
8	Geohumat	1,0	1,6	1,6	318 500	300 345	94,3	5,7
9	Geohumat	1,0	1,8	1,8	319 900	301 345	94,2	5,8

According to the data obtained, when stimulants were applied to crotalaria at different times and rates, the plant density at the beginning of the treatment period was 294,000-319,900 plants/ha, which was 16,800-25,900 plants/ha more than the control option. By the end of the treatment period, the plant density decreased from 272,244 to 301,345 plants/ha according to the options, to 18,555-21,756 plants/ha (see Table 2).

The decrease in seedlings at the end of the treatment period is influenced by agrotechnical measures during the treatment period, namely, feeding, the introduction of machinery for inter-row work, weeds, pests and diseases, sampling of plants during phenological observations, and adverse weather conditions.



In the experiment, the highest mortality of seedlings was in the control variant, in which the stimulant was not used along with the planting of crotalaria, 7.4%, which was 1.2-1.7% more than in the variants where biostimulants were used. When using biostimulants, the increased resistance of the plant to various diseases and the acceleration of growth and development ensured the survival of seedlings. Compared to the variants where the grape biostimulant was used, the survival of seedlings in the variants where the Geohumate biostimulant was used was slightly higher. Thus, in the conditions of the pasture gray soils of the Jizzakh region, sowing crotalaria seeds for grain production at a rate of 14 kg per hectare in the third decade of April and using biostimulants along with sowing are considered optimal conditions for uniform germination, a high level of seedling survival, and the subsequent growth and development of the plant, which creates the basis for greater accumulation of crop elements and increased yield.

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