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THE EFFECT OF STIMULANTS ON CROTALARIA HAY YIELD AND QUALITY INDICATORS

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Abstract: this article describes the effect of different biostimulants on hay yield and quality indicators of Crotalaria juncea in the cultivation of non-traditional leguminous plant Crotalaria juncea in the conditions of meadow gray soils of Jizzakh region. In order to get a high-quality hay crop from Crotalaria, it should be sown at the rate of 18 kg per hectare in the third ten days of April and along with sowing, 1.0 l of Geogumat biostimulant and 1.8 l at the time of 3-4 true leaves of the growing season, during the weeding period 500.0 /ha higher yield of blue mass was obtained when applied at the rate of 1.8 l/ha, 66.4 c/ha compared to the control option without biostimulant, 32.2 c/ha compared to the 6th option where Geohumat biostimulant was applied only with planting; With the planting of Geohumat biostimulator at the rate of 1.0 l/t and 1.4 and 1.6 l/ha in the 3-4 true leaving and branching periods, an additional yield of 24.5 and 15.8 c/ha was obtained compared to the 7th and 8th options. Also, the amount of nitrogen in crotalaria hay is 1.9-3.3%, and the amount of nitrogen is 0.4-1.4% higher in the options with stimulants than the control option, and the total proteins are 13.2-17.0%. It was explained that the biostimulant of Geohumat was 3.8% more compared to the control option in the options used at the rate of 1.0 l/t and 1.6 and 1.8 l/ha in the 3-4 true leaving and branching periods.

Key words: Crotalaria juncea, Uzgumi, Geohumat biostimulants, nitrogen content, total protein content, blue mass and hay yield.

Introduction. Strengthening the animal feed base is one of the urgent problems that remain in our country. The development and productivity of livestock breeding is closely related to the development of agriculture and intensive use of land. Today, 40% of desert pastures in the Republic are in various degrees of crisis, their average productivity has decreased by 21% in recent years. Irregular grazing of livestock leads to the death of plants. This leads to a crisis of pastures and a decrease in productivity. Especially in the Republic of Karakalpakstan, Bukhara and Navoi regions, the productivity of pastures decreased by 42-43%.

Livestock farms often spend a lot of money on buying fodder. In some farms, fodder expenses exceed 45-50% of gross production, which has a negative impact on the profitability of the industry. Therefore, the solution to livestock problems is the intensification of fodder production.

To solve this problem, it is necessary to expand the fodder base. In recent years, in order to create a feed base for animal husbandry, non-traditional crops with high productivity have entered the cultivated fields of our republic from abroad. Among them is crotalaria (Crotalaria juncea L.) plant, which may be important in the future of our country’s national economy, including improving

soil reclamation, reducing the amount of salt in the soil, increasing its productivity, and strengthening the fodder base for livestock.

Crotalaria is important in agriculture as it improves land reclamation, reduces soil degradation and increases productivity, and is a high-calorie feed for livestock. By using blue mass and dried hay as feed, it is possible to get up to 3-4 times blue mass yield during one operation period. Hay has a very high protein content (from 18% to 22%) and is a high-calorie feed for livestock. Maintaining and increasing the fertility of the soil and the rapid development of the livestock industry remain an urgent issue.

Literature review. Currently, there are about 600 species of Crotalaria plants, and 6-7 species are cultivated in India, Australia, Africa and other tropical and subtropical countries as fiber, green manure, fodder, food, and medicine. The main producers of fiber from Crotalaria juncea are India, Sri Lanka, South and Southeast Asian countries, and the fiber yield in the last decade is 0.12-0.6 t/ha in India, 0.45 t/ha in Sri Lanka, seed yield was up to 10-22 c/ha depending on soil conditions. [17].

Taking into account the possibility of harvesting 2-3 times a year from the irrigated areas of our republic, it is very important to correctly choose the types and varieties of agricultural crops that contain high-quality protein and positively solve the existing protein deficiency problem. N. Rakhimova [6] introduced Crotalaria alata from such plants and studied its biological properties in the soil and climate conditions of Khorezm region.

In the experiments of M. Aberkulov and others [1], it was found that the thicker the Crotalaria alata plant is planted, the faster the plant grows, but the flowering and ripening periods are delayed by 2-3 days, even 4-5 days. Also [2] it was determined in experiments that it is possible to plant Crotalaria alata as a siderate crop and to grow cotton or rice instead, and get an abundant harvest.

The chemical composition and nutritional value of Crotalaria alata were studied by D. Asilbekova and others [3] of the Institute of Plant Substance Chemistry of the Academy of Sciences of the Republic of Uzbekistan. The content of the plant grown in Tashkent was 9.3-13.5% protein, 2.3-3.7% fat, 22.5-28.9% starch, and 10.4-15.3% ash.

Crotalaria juncea leaves are used as high protein feed. For this purpose, its root and leaves are dried. In Sri Lanka, dried leaves, boiled seeds, and husks of ripe pods are fed to livestock [16].

According to Z. Yulivasi [8], when Crotalaria alata L. species of the Crotalaria family is planted as a repeated crop, additional income can be obtained by obtaining 50-60 centners of dry hay per hectare. Crotalaria juncea also produces a large amount of biomass in a short period of time when planted as a repeated crop, which has a positive effect on the yield of the next crop [10].

According to Sarkar et al. [14], Crotalaria juncea has a worldwide siderate yield of 18-27 t/ha, while the forage yield is approximately 5-19 t/ha. Green biomass production in pre-monsoon planting in India was 22-27 t/ha, in Cuba 3.4 t of hay was obtained from two harvests, and in Thailand a higher yield of 2 t/ha was obtained in 6-8 weeks when grown as green manure after rice [15].

When Crotalaria juncea is harvested for fiber, the upper part of the stem is mixed with rice straw and used for fodder or hay. According to J. Obeid, J. Gomide [13], a mixture of maize and Crotalaria juncea grown for silage in Brazil (6:20 seed ratio) yielded 16.2 t/ha, compared to 12.9 t/ha when grown alone. As a result of the mixture, the protein in the corn stand was 1.30-1.45% at a rate of 0.30 t/ha. The amount of protein in silage was 30.6-32.4%.

Crotalaria juncea plant is adapted to different soil and climate conditions by its biological properties. Its seeds are used as a food product, hay is used as a high-calorie fodder in animal husbandry, in agriculture to increase soil fertility and improve land reclamation, in medicine to treat various diseases, as nectar in beekeeping, as a source of fiber for light industry [5, 9, 11].

As it can be seen from the analysis of the literature, due to the lack of information in the literature on the agrotechnics of cultivation of crotalaria, a non-traditional leguminous crop grown for grain and hay in different soil-climatic conditions of our republic, fertilizer and water standards, the period and standards of using biostimulants, scientific research works have been carried out on the solution of these issues. Therefore, the solution of the above-mentioned problems was the basis for conducting these scientific studies.

Research methods. Field experiments were conducted in the conditions of meadow gray soils of Jizzakh region, and the effect of stimulants on crotalaria germination, seedling thickness, growth and development, hay yield and quality indicators were studied.

In the experiment, Uzgumi biostimulant was taken as ethanol, and Geogumat biostimulants, when used in the recommended norms at the time of 3-4 true leaving and branching periods, were studied according to the experimental system.

Researches were carried out in field conditions, based on methodological manuals such as ”Methodology for state variety testing of agricultural crops”, “Methods of conducting field experiments”, “Methods of conducting field experiments on non-traditional leguminous crops”. Crude protein content of Crotalaria hay was determined in laboratory conditions by the Keldal method. Productivity indicators were mathematically processed in the dispersion analysis method based on the manual “Field experience method” by B.A. Dospehov.

Results and discussion. The main task of agricultural research is scientific justification of the effect of agrotechnical measures and external influencing factors on plant productivity.

In order to expand the feed ration in livestock farming, one of the urgent issues is the introduction of a new non-traditional crop - crotalaria as a main, repeated and intermediate crop and the development of agrotechnologies. In the experiment, crotalaria was cultivated as a main crop for blue pulp yield, and three times of blue pulp yield was harvested during one operation period.

M.Nurullaeva and others [4, 12] stated that in the soil and climate conditions of the Khorezm region, planting crotalaria in the last ten days of April at a rate of 18 kg of seeds per hectare is considered an acceptable period and standard for blue mass, and during the period of validity up to 600 t/ha of blue mass yield can be obtained.

When legumes are grown for forage, they should be harvested at the flowering and subsequent stages. Then the level of nitrogen enrichment of the soil will be high. Therefore, the first crop was harvested 2 months after crotalaria planting, that is, when the plant was in full bloom. According to the received information, the first blue mass harvest will be harvested on June 30 in 2023, and the blue mass yield according to the options will be 148.0-168.0 c/ha; and the yield of hay is 41.4-47.0 t/ha, and high yield is determined in the 9th variant, which is applied at the rate of 1.0 l/t with Geohumat biostimulator planting and 1.8 l/ha in 3-4 true leaving and branching periods, blue pulp yield was 168.0 t/ha and hay yield was 47.0 t/ha (Table 1).

Table 1

Effects of stimulants on blue mass and hay yield of Crotalaria, (2023 year)

Option №	1-harvest (30.06.)		2-harvest (29.07.)		3-harvest (30.08.)		total yield, c/ha		Additional yield compared to the control, c/ha	
	1	2	1	2	1	2	1	2	1	2
1	148,0	41,4	152,8	42,5	132,8	37,0	433,6	120,9	-	-
2	154,4	43,2	160,0	44,8	140,2	39,2	454,6	127,2	21,0	6,3
3	158,0	44,2	164,0	46,0	144,0	40,3	466,0	130,5	32,4	9,6
4	161,0	45,1	165,5	46,3	145,5	40,7	472,0	132,1	38,4	11,2
5	165,0	46,2	170,2	47,6	150,4	42,0	485,6	135,8	52,0	14,9
6	157,0	43,9	165,4	46,3	145,4	40,7	467,8	130,9	34,2	10,0
7	160,0	44,8	167,8	47,0	147,7	41,4	475,5	133,2	41,9	12,3
8	164,0	45,9	170,0	47,6	150,2	42,0	484,2	135,5	50,6	14,6
9	168,0	47,0	178,0	49,8	154,0	43,0	500,0	139,8	**66,4**	**18,9**
HCP_{05} =2,31 c/ha, HCP_{05} =2,8%										

Note: 1st is blue mass crop, 2nd is hay crop

4.8-10.0 c/ha of blue mass yield was collected from the second harvest compared to the first harvest. Because, before the 2nd harvest, when the height and side branches of the plant were measured, it was found that the side branches of crotalaria were relatively increased. At the end of August, the 3rd harvest was harvested, the yield of blue mass was equal to 132.8-154.0 t/ha according to the options, and the yield of blue mass was 20-25 t/ha less than the 2nd harvest.

433.6-500.0 t/ha of green mass yield was obtained from crotalaria during one operation period, and the 9th variant applied at the rates of 1.0 l/t and 1.8 l/ha during 3-4 true leaving and branching periods with Geohumat biostimulator planting the yield was 500 c/ha. 66.4 c/ha from this option compared to the control option without biostimulant; 32.2 c/ha compared to the 6th variant, which used Geohumat biostimulant only with planting; With the planting of Geohumat biostimulator at 1.0 l/t and in 3-4 true leaving and branching periods, an additional yield of 24.5 and 15.8 t/ha was obtained compared to options 7 and 8, which were used at the rates of 1.4 and 1.6 l/ha .

So, in order to grow abundant blue mass crop for livestock, applying Geohumat biostimulant to crotalaria at the rate of 1.0 l/t and 1.8 l/ha in 3-4 true leaving and branching periods is considered as the optimal period and norm for harvesting high blue mass or hay crop.

Strengthening of livestock fodder base, continuous supply of livestock with various vitamin foods throughout the year is the main condition of livestock breeding. Another important factor in the development of livestock industries is their specialization, expansion and acceleration. For this, it is necessary to create a strong and stable fodder base, to use fodder efficiently, to increase their nutritional value and quality, especially to increase the protein content.

To assess the importance of any new crop in the national economy, it is important to study its biochemical composition first. Therefore, the amount of nitrogen and total protein in crotalaria hay was determined (Table 2).

Table 2

Effect of biostimulants application period and rates on the biochemical composition of Crotalaria hay, 2023.

Options	Nitrogen content, %	Difference compared to the control option, %	Total protein content, %	Difference compared to the control option, %
1-option	1,9	-	13,2	-
2- option	2,3	0,4	14,1	0,9
3- option	2,8	0,9	16,0	2,8
4- option	3,0	1,1	16,8	3,6
5- option	3,1	1,2	16,8	3,6
6- option	2,5	0,6	14,8	1,6
7- option	2,9	1,0	16,5	3,3
8- option	3,3	1,4	17,0	3,8
9- option	3,3	1,4	17,0	3,8

When the amount of nitrogen in Crotalaria hay was determined, it was 1.9-3.3% according to the options, and it was found that the nitrogen content of the options with biostimulants was 0.4-1.4% higher than the control option. High results were obtained in the variants used at the rates of 1.6 and 1.8 l/ha in the 3-4 true leaving and branching periods. It was found that the amount of nitrogen was 0.2-0.3% higher in the options using the Geohumat biostimulator compared to the options using the Uzgumi biostimulator.

When the amount of total proteins in Crotalaria hay was also determined, the total proteins according to the options were 13.2-17.0%, and here, too, with Geohumat biostimulant planting, 1.0 l/t and 1.6 and 1.8 in the 3-4 true leaving and branching periods. Higher values were observed in the options used in l/ha norms. The amount of total proteins in these variants is 3.8% compared to the control variant; Geohumat biostimulator was 2.2% more than the option used only with planting.

Therefore, to obtain high-quality hay from crotalaria, it is an optimal time and norm to apply Geohumat biostimulator at the rate of 1.0 l/t and 1.6 and 1.8 l/ha during 3-4 true leaving and branching periods.

Conclusion. In order to grow and develop crotalaria for blue mass production in the conditions of gray grassy soils of Jizzakh region, to obtain abundant and high-quality high-calorie hay from it, in the last ten days of April, it should be planted with 18 kg of seeds per hectare, along with planting Geogumat biostimulant at 1.0 l/t and it was observed that 1.8 l/ha application at the rate of 1.8 l/ha during the 3-4 true leaving and branching periods and the norm was considered to be the optimal period and norm, 66.4 t/ha of additional green mass was obtained, and the amount of total proteins in the hay was improved up to 3.8%.

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