Effect of Sowing Time and Rate on Growth, Development and Productivity of Crotalaria Juncae. L

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Abstract. In this article, the influence of the non-traditional legume Crotalaria (Crotalaria juncae L.) as the main crop on its growth, development and productivity in conditions of degraded meadow alluvial soils of Khorezm region is described. That is, the highest indicators of seed germination were observed on May 1-5 of crotalaria in the version where 18 kg/ha of germinating seeds were planted, and increasing the sowing rates in all planting periods increased seed germination by 3-5%; as of July, when crotalaria was planted on April 20-25, the plant height was 10-14 cm higher than the options planted in other periods; in the case of September, when the plant was planted at 14 kg/ha on April 20-25, the number of leaves formed was 265.0, which was 85.0 more than when planted early and 15 more than when planted late, and the number of leaves when 14 kg/ha of seed was planted was 10 85.0 units per kg/ha compared to the variant planted with seeds, 111 units compared to the variant planted with 18 kg/ha; the higher seed yield of crotalaria in 20-25.04 when 14 kg/ha of seed is planted is 18.0 t/ha, compared to the option planted in the early period, 5.9 t/ha; 3.7 ts/ha compared to the option planted in the late period; 2.4 ts/ha compared to the option with 10 kg/ha of seeds; Compared to option 6, where 18 kg/ha of seeds were planted, 4.8 ts/ha of additional grain yield was scientifically justified.

Key words: Crotalaria juncae, grassland alluvial soil, legume, duration, rate, fertility, seed, hay, productivity.

1 Introduction

Today, cultivation of non-traditional leguminous crops and increase in productivity are of great importance in maintaining and increasing soil fertility [1], providing livestock with high-calorie feed [2], satisfying the population's need for food products [3], and increasing the volume of export of agricultural products in the republic [4-5].

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Crotalaria is a leguminous plant, and there are about 600 species of it. Of these, 6-7 species are cultivated in India, Australia, Africa and other tropical and subtropical countries as fiber, green manure, fodder, food [6], medicine [7].

In the world, a large-scale scientific research is being conducted on the advanced technology of cultivation of non-traditional leguminous crops [8], especially Crotalaria (Crotalaria juncae L.). Using the potential of Crotalaria, based on the scientific basis of unique cultivation technologies, they grow ecologically clean grain and hay crops, rich in protein and vitamins, and ripe fiber products from species and varieties suitable for soil and climate conditions. At the same time, as a result of research on improving agrotechnologies of the production of high-yielding varieties of crotalaria, i.e., correct determination of the planting period and norms, optimization of feeding with mineral and organic fertilizers, as well as the correct implementation of rotation, soil fertility will be restored and increased, livestock will be provided with nutritious feed, and fiber products of high quality will be obtained. scientific research is being carried out.

2 Materials and methods

Crotalaria juncea L., one of the plants of the genus Crotalaria, is a tropical Asian plant of the legume family. Crotalaria juncea is believed to originate from India, where it has been cultivated since the early days of agriculture. First reported in Sanskrit literature around 400 BC [9].

Crotalaria, a member of the legume family, is an important species of the Crotalaria genus, which consists of more than 350 species, and is cultivated in all tropical regions as a green manure in rotation with several different crops [10].

Crotalaria juncea is now widely cultivated in many tropical and subtropical regions of the world, such as India, Bangladesh, Brazil, and even in cold temperate steppes. In Indian conditions, it grows from 170 C to 300 C and at an altitude of 1500 m above sea level, where the average annual temperature is 15-27.50. It can be grown anywhere with an average annual temperature of 8.40 C, as there is a 2-3 month frost-free growing period. It can withstand mild frost (not less than -20 C), but growth fixation is reduced [11].

Crotalaria juncea L. is a multipurpose tropical and subtropical legume cultivated for its high quality fiber in many countries, particularly in India [12]. Fiber from Crotalaria juncea is used to make cordage for military supplies. Therefore, during the Second World War, interest in Crotalaria junca increased again [13]. Also, Crotalaria juncea is considered as an ecological soil purifier and a biological weed control plant in agriculture. [14].

When Crotalaria juncea is grown as a "green manure", it should be culled within 2 months after planting, as during this period the plants decompose faster and have a positive nitrogen accumulation balance [15]. Also, when Crotalaria juncea is planted in the field as a repeated crop, it produces a large amount of biomass in a short period of time and has a positive effect on the yield of the next crop [16].

The weight of 1000 grains of crotalaria is 35.0-40.9 g. It was observed that the weight of 1000 grains decreases with early planting and increasing the standards. The reason for the decrease in biometric indicators with the increase in planting rates is the decrease in the food area [17].

Crotalaria alata, one of the plants of the Crotalaria family, was introduced in the soil-climatic conditions of Restublica [18], and its biological properties were studied. The chemical composition and nutritional value of Crotalaria alata were studied by the researchers of the Institute of Chemistry of Plant Substances of the Russian Federation, and the content of protein in the plant is 9.3-13.5%, fat is 2.3-3.7%, clechatka is 22.5-28.9 %, ash was found to be 10.4-15.3% [19].
Field experiments were conducted in 2017-2019 in the conditions of meadow alluvial soils in the territory of the Upper Do'rmon massif, Urganch district, Khorezm region, 15 km north of the city of Urganch.

Scientific researches were carried out in laboratory and field conditions, agrophysical and agrochemical properties of the soil "Metody agrofizicheskikh issledovaniy" (1973, 4th edition, Tashkent, SoyuzNIXI), "Metody agrokhimicheskikh analizov pochv i rasteniy" (1977 5th edition, Tashkent, SoyuzNIXI) manuals; phenological observations and biometric measurements "Metodika polevyx opytov s zernovym kulturami" (1971), "Methods of conducting field experiments" (UzPITI, 2007); net productivity of photosynthesis N.N. The results determined by the Tretyakov method (M: 1982), as well as the obtained results, were mathematically analyzed and calculated with the help of the Microsoft Excel program according to B.A. Dospehov's "Methods of Field Experiments".

The research object is one of the plants of the Crotalaria genus, an unconventional legume, Srotalaria juncae L., which is an annual plant belonging to the Fabaceae family, the ancestor of legumes (Leguminosales).

3 Results and discussion

In the conducted experiments, crotalaria was planted as the main crop in 3 different periods (10-15.04; 20-25.04; 1-5.05) and three different rates (10; 14; 18 kg/ha), and the planting period and rates were determined by its growth, development, productivity and the effect on economic efficiency was studied.

Temperature is one of the main factors for the germination of plant seeds. The seeds of most legumes germinate at high temperatures, but some germinate well within a certain temperature range. According to sources from the literature, the seeds of Crotalaria juncea plant do not germinate at temperatures below 10°C, and 99-100% germinate at 29-33°C. Hence, Crotalaria juncea seeds grow well at high temperature.

Water is a necessary external factor for seed germination [20-22]. Therefore, seed water was given after planting Crotalaria juncea seeds. In Crotalaria, dormancy is very rare, that is, the seeds germinate in 3-5 days after being sown in the soil. It should be noted that since the Crotalaria juncea plant is a tropical plant, its seeds germinate when the soil temperature is high, and the optimal temperature is 18-20°C. Soil temperature reaching this level corresponds to the end of April for Khorezm region.

Crotalaria juncea plant seeds April 10, April 21 and May 1 10; 14; The seed was planted at the rate of 18 kg/ha. After 12-14 days, the seed imbibed into the soil fully germinated, and the germinated seeds were counted every 3 days. When Crotalaria juncea is planted on April 10 in the early period, the germination on the 5th day is 7.7-9.9% according to options; 11.9-12.6% when planted on April 21; When it was planted on May 1, it was 13.1-14.6%, and it was observed that the percentage of germination was 3.4-4.8% higher in the options planted in May compared to the options planted early. In the complete germination of Crotalaria juncea, the fertility in the period planted on May 1 is high, 86.0-91.0%, compared to the varieties planted on April 10, the fertility is 15-16%; It was observed that it was 2-3% higher than the variants planted on April 21.

The higher dynamics of germination when Crotalaria juncea is planted in early May can be attributed to the heat-loving nature of this plant, and it can be considered a slight decrease in air temperature in April compared to May. Therefore, it was found that the higher the temperature, the higher the germination rate.

Since Crotalaria juncea is a non-traditional crop among the crops grown in our country, there are no organizations dealing with its seed production and supplying it to farmers. Therefore, it is important to study the thickness of the seedling and the level of preservation
of the lawns of the plant in order to obtain a rich and high-quality harvest from Crotalaria juncea.

According to the results of the study, when Crotalaria juncea was planted in different periods, it was observed that the seedling thickness of the plant and the degree of preservation until the end of the growing season were higher in the variants planted in the later period. Seedling mortality of Crotalaria juncea was 2.9-5.2% when planted on April 10, 3.5-4.2% when planted on April 21, and 2.4-3.4% when planted on May 1.

At the end of the application period, a relatively large amount of plant death was observed in the variants of the experiment with high planting rates. Crotalaria juncea 10 per hectare in the period of May 1; 14; Plant mortality was 2.4-3.4% when planted at 18 kg rates, and 3.4% when seed was planted at higher rates. 1.0% when the plant is planted with 10 kg of seeds per hectare during this period; 0.5% retention rate was high when 14 kg of seeds were planted per hectare.

Several factors such as soil, climate, fertilizer, and water affect the growth and development of plants. Also, certain elements of agrotechnical activities, i.e., the period and norms of sowing seeds, also have an effect. On the first day of each month, phenological observations were made in the experimental field, and the plant height, leaf size, number of leaves, number of side branches, flowers and pods were determined in the observations.

Crotalaria juncea is an upright growing plant that can grow up to 1-3 (4) meters tall. Phenological observations were made to study the growth dynamics of the plant and the number of leaves.

According to the obtained results, the height of the plant was 13.2-19.5 cm in the phenological observation carried out on June 1, and there was no significant difference between the variants. According to the results obtained in 1.07, when Crotalaria juncea is planted in the period of April 10-15, the plant height is 120.0-128.4 cm; 130.0-142.0 cm when planted on April 20-25; It was observed that plant height was 125.5-132.4 cm in variants planted on May 1-5, and plant height was 10-14 cm higher when planted on April 20-25 compared to variants planted in other periods.

Also, increasing the planting rate from 10 kg to 18 kg per hectare resulted in an increase in plant height by 7-12 cm. In all observation dates, the highest result of Crotalaria juncea was observed in the third ten days of April in the variant where 18 kg of seeds were planted per hectare, and it was found that the height of the plant reached 324 cm in the phenology observation at 1.10.

One of the main features of Crotalaria juncea is that its leaves remain dry throughout the summer.

In the phenological observations conducted on July 1, the number of leaves in one bush is 50.0-87.0 pieces according to the options, in proportion to the height and side branches of the plant; 74.6-117.6 units on July 15; 95.9-153.0 units on August 1; 120.4-203.4 units on August 15; 145.0-265.0 pieces on September 1 and 166.3-288.0 pieces on September 15. High results were observed in option 5, where crotalia was planted on April 20-25 at 14 kg of seeds per hectare (diagram 1).
When studying the effect of planting date and rate on the number of leaves per plant, the number of leaves formed when crotalaria was planted at 14 kg per hectare on September 1 was 265.0, compared to the option planted on April 10 and May 1 at the same rate. It was observed that it is 15 units more than the option. Also, the number of leaves in the variant planted with 14 kg of seeds per hectare was 85.0 more than in the variant planted with 10 kg of seeds per hectare, and 111 more than in the variant planted with 18 kg of seeds.

It is known that the most biologically mature period of a plant is its flowering period. If there are enough nutrients and moisture in the soil, this process will be moderate in the plant, and the yield will increase. However, all the flowers produced in the plant are not evenly pollinated, some of the pollinated crop elements are lost due to the lack of nutrients and moisture. It is important to note that how much a plant can save and collect its harvest is directly related to its planting period and rate.

In mid-June, 3-5% of the plant began to bud. In some plants, up to 1-3 buds appeared. At the beginning of July (1.07), the height of the plant reached 120-140 cm, 7-12 pods and 8-11 flowers were formed on each plant. Flowers are beginning to appear on the top and side branches of the main 1st order branch of the plant. In late August and early September, Crotalaria juncea was found to be in full bloom, with up to 35-40 flowers per bush. It was also observed that the number of flowers was up to 80-90 in some plants. On September 15, when the average air temperature was 20.8°C, it was found that 30-40% of the plant had flowered. On September 20, the air temperature during the day was 24-28°C, 40-50% of the plant bushes bloomed, and the leaves began to turn yellow up to a height of 20-30 cm above the ground. Budding, flowering, seed formation phases continued together.

In Crotalaria juncea, the number of spikes and flowers formed in one bush is higher when it is planted on April 20-25, and according to the results of phenological observation on September 1, the number of spikes is 5-8 pieces compared to the variants planted in the early and late period; it was observed that the number of flowers is 15 more. The effect of planting standards on the formation of spikes and flowers was also observed. When Crotalaria juncea was planted at different rates on April 22, the number of spikes and flowers was 30.0-38.0 and 59.0-78.0 according to the options, and the highest result was 14 kg of seeds planted per hectare. in the variant, it was found that 38.0 pieces of the crown and 78.0 pieces of the flower. From this option, compared to the 4th option where 10 kg of seeds are planted per hectare, it is 4 pieces; 19 flowers and 8 seeds compared to the 6th.
option, where 18 kg of seeds were planted; it was observed that the number of flowers increased by 15 pieces.

It is known that the weight of the crop in the plant is determined by the quantity and quality of the elements of the crop collected in the crop. Grain yield in crotalaria also depends on the elements of the crop formed in the plant, that is, the number of pods and the weight and quality of the grain in it. In order to obtain a high and quality grain yield from Crotalaria juncea, it is necessary to set the planting time correctly. Because when Crotalaria juncea is grown for different periods, the effect of physiological processes during the formation of grains in pods is strong, as a result, some grains are fully formed and some remain unripened.

At the beginning of July, the height of the main stem is 120-142 cm according to the variants, 140-155 cm in some bushes, and 1-2 green pods started to form in each of these bushes. The size of the pod is 0.5-2 x 0.5-1 cm and it is found that there are up to 3-5 seeds inside it. During the period of operation, one bush of Crotalaria juncea produces up to 50-100 pods. It was also observed that 242 pods were formed in one plant during the phenological observation in the experimental variants 1.10.

When studying the effect of seeding dates on the formation of pods in one plant, the number of pods according to the options was 47-71 units in the case of October 1, and the highest result of Crotalaria juncea was 71 units in option 7, where 10 kg of seeds were planted per hectare on May 1-5. At the same rate, it produced 15 more pods than option 1 planted on April 10-15 and 11 more pods compared to option 4 planted on April 20-25.

The number of pods produced when 10, 14, 18 kg of seeds per hectare of Crotalaria juncea were planted on April 10-15 was 47.7-56.0 units on October 1, and the higher result was in the case of planting 10 kg of seeds per hectare observed. The number of pods formed in this option was 56, which was 4 more pods compared to the option planted with 14 kg of seeds per hectare and 9 more pods compared to the option planted with 18 kg/ha. Also, it was observed that the ripening of the formed pods decreased with the delay of planting dates. In the phenological observations conducted before harvesting on November 1, ripe pods were 84.6-89.3% when planted on April 10-15; 84-90.4% when planted on April 20-25 and 68.1-73.2% when planted on May 1-5. It is recommended to plant Crotalaria juncea in early periods to obtain high-quality grain yield.

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

It should be noted that, as mentioned above, the different levels of influence of planting dates and norms on plant growth, development, yield and biometric parameters were ultimately reflected in the grain yield of crotalaria.

Table 1. Grain yield of Crotalaria juncea.

<table>
<thead>
<tr>
<th>Options</th>
<th>Planting period</th>
<th>Planting rate, kg/ha</th>
<th>Productivity, t/ha</th>
<th>Additional crop</th>
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<tr>
<td></td>
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<td>2017</td>
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<td>2019</td>
</tr>
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<td>9,4</td>
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<td>10-15.04</td>
<td>14</td>
<td>10,7</td>
<td>12,6</td>
</tr>
<tr>
<td>3- option</td>
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<td>8,4</td>
<td>11,0</td>
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<tr>
<td>4- option</td>
<td>20-25.04</td>
<td>10</td>
<td>14,3</td>
<td>15,6</td>
</tr>
</tbody>
</table>

Table 1. Grain yield of Crotalaria juncea.
According to the data obtained on grain yield of crotalaria in the conditions of meadow alluvial soils of Khorezm region in 2017-2019, when the seed is sown on April 10-15, the average grain yield in 3 years is 9.7-12.1 tons/ha, and this indicator is 20-25 13.2-18.0 ts/ha when planted in April; When planted on May 1-5, it was found to be 10.6-14.3 ts/ha (Table 2).

The highest result of Crotalaria juncea was 18.0 t/ha observed in option 5, which was sown with 14 kg of seeds per hectare in the third ten days of April. From this option, 5.9 ts/ha compared to option 2 planted on April 10-15; Compared to the 8th option, which was planted in the period of May 1-5, 3.7 ts/ha more additional harvest was obtained. Also, in the same period, 2.4 ts/ha compared to the 4th option, where 10 kg of seeds per hectare were planted; Compared to option 6, where 18 kg of seeds were sown, an additional yield of 4.8 ts was obtained.

4 Conclusion

Taking into account that the climate of the Khorezm region, the conditions of the meadow alluvial soils are very favorable for the cultivation of abundant and high-quality crops from crotalaria as the main crop, and the fact that the soil fertility is decreasing in the region in recent years, it is intended to include this non-traditional crop belonging to the leguminous family as the main and repeated crop in short-rotation cropping systems. according to:

- Sowing 14-18 kg of crotalia plant seeds per hectare on May 1-5 in the alluvial soil conditions of the meadow of Khorezm region is considered an optimal condition for uniform germination, and sowing seeds 15-20 days later compared to the early period will increase their yield by 3.43-4, provides up to 8% early germination;
- crotalaria as the main crop in the soil and climate conditions of Khorezm region in the period of April 20-25, when seeds are sown at the rate of 14 kg per hectare, the formation of leaves per plant is high. As a result, the ground is created for the formation of more organic matter by the plant;
- in order to produce more buds and flowers, planting 14 kg of seeds per hectare on April 20-25 will create a basis for obtaining a high grain yield. one of the important features of crotalaria is that it is a source of nectar for bees;
- 10 kg per hectare on April 20-25 in order to obtain a quality seed crop from crotalaria in the degraded alluvial soils of the Khorezm region; 14 kg/ha of fertile seed is recommended for high grain yield.

References


