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EFFECTS OF NITRAGINE AND MINERAL FERTILIZER RATES USED ON REPEATED LEGUME CROPS ON SEED GERMINABILITY

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ABSTRACT

Nitragine treatment of soybean and mung bean seeds before sowing as a secondary crop after winter wheat had a positive effect on seed germination in laboratory and field conditions, germination was found to be 0.2-0.8% higher in treated soybean and mung bean seeds with nitragine before sowing than untrated seeds. The use of phosphorus and potassium fertilizers in soybean and mung bean crops grown as a secondary crop showed that the germination of seeds in the field was 0.6-0.7% higher than in the control plots sown without the use of mineral fertilizers. The highest germination rates of seeds in the laboratory were observed with Nitragine before sowing of soybean and mung bean seeds, and mineral fertilizers $N_{30}P_{90}K_{60}$ kg / ha was observed in cotton-growing variants next year, 98.7-99.3%. It was found that the germination rate of seeds in laboratory conditions in the next year's cotton cultivation in the variants of mineral fertilizers $N_{30}R_{90}K_{60}$ kg / ha in the background, in which not used nitragine variants before sowing the seeds of soybean and mung bean crops were 97.3-98.0%.

Keywords: Repeated crop; soybean; mung bean; nitragine; nitrogen; phosphorus; potassium; cotton; cotton seeds; germinability.

INTRODUCTION

The first sign of germination of cotton seeds is the appearance of a chit (sprout) in the seed and then a hypocotyl (cotyledon stalk). When the chit emerges out of the seed coat, it penetrates deep into the soil and develops a root system. The minimum temperature required for seed germination is + 10-12^{0}C, the optimum temperature is + 25-30^{0}C, at + 13-14^{0}C the embryo begins to grow, and at + 14-16^{0}C the seed begins to flour, at which time they will have to accumulate 60 percent or more moisture relative to their weight. The seeds germinate in 7-12 days [1].

Nitrogen fertilizers not only help to increase cotton yield but also have a positive effect on seed quality. Under the influence of nitrogen fertilizers, protein content in the seed kernel increases, the absolute and specific weight and size of the seed increases, but at the same time these fertilizers cause a decrease in oil content in the kernel and delay seed maturation. The quality of seeds grown in the fields declined even more when the cotton was over-irrigated and fertilized in abundance [2].

X. N. Atabaeva, F. B. Namozov, A. A. Kurbanov and S. Sh. Khayrullayev [3], in their experiments found availability of micronutrients in soybean crops, is associated with effects on stem height, leaf and root development, root nodule formation, grain quality, and resulted to high yields [3].

According to R. Juraeva, J. Tashpulatov, A. Iminov, H. Bozorov, Khatamov S. R, Khayrullaev S. Sh and L. Zaynitdinova [4], in their experiments conducted in 2015-2017, mineral fertilizers and rhizobium were applied to soybeans. When exposed to strains of nitrogen bacteria group, it was observed that the yields increased by 12.6-12.8 c / ha compared to the control [4,5].

According to Khayrullayev Sardor Shamsiddin ugli (2021), the application of micronutrients in the suspension method 2 times in rates S-1.07, 2.14, 3.21 kg/ha and Mn-1.8, 3.6, 5.4 kg/ha during the application period of soybean varieties in the conditions of meadow-swamp soils provides an increase in grain quality [6].

According to the findings of Atabayeva Khalima Nazarovna, Khayrullaev Sardor Shamsiddin o'g'li, and Usmonova Shohista Usmon qizi (2020), sulfur has a positive effect on the branching of soybean varieties on the background of mineral fertilizers, and in 2018 the number of branches in the variety "Orzu" increased by 0.8-1.3% compared to the control option due to the micro element sulfur. In the "Nafis" variety, this figure was 0.3-0.4%, and good results were obtained from medium and high sulfur rates. In 2019, these indicators increased by 0.3-0.7% in different rates of sulfur compared to the control "Orzu" variety, this increased by 0.1-0.3 % in the "Nafis" variety, and good results were obtained from the medium and high rates of sulfur [7].

The Degree to which the Problem has been studied

It is known that in order for the seeds to germinate in a timely manner, the influence of moisture, temperature, light and other external factors on the soil must be sufficient, as well as the quality of the seed must be high [8].

The high seed weight of 1000 seeds in the medium-fiber Omad and Sultan varieties of cotton ensured high germination capacity and germination of seeds in laboratory conditions [9,10]. The germination rate of cotton seed samples ranged from 94.5% to 95.0%, and the germination rate of samples without fibred seeds prepared for sowing was 1 day, the germination rate of samples of fibred seeds was 2 days [9,10].

In the short-term 1:1 (cotton: grain) rotation system, (2019-2020)the germination rate of seeds obtained from cotton sowing variants in the field ploughed without repeated sowing after winter wheat is 91% in the medium-fiber Navruz variety and 93% in the Omad variety. The germination rate of seeds was 96% in Navruz and 97% in Omad. Cultivation of legumes as a secondary and mixed side rate crop after winter wheat ensured that the germination capacity and germination rate of the seeds to be to 2.1-3.7% higher [11,12,8].

In the conditions of light sierozem soils of Andijan region [13], cotton is sown in the system of short-rotation (1:1) sowing (winter wheat + repeated crops), repeated mung bean to obtain high and high-quality cotton from medium-fiber Andijan-36 and "Navruz" varieties at an early stage and to improve seed quality. It is recommended to apply mineral fertilizers at the rate of N-25, P_2O_5-80, K_2O-60 kg / ha in the secondary crop, and in the soybean at the rate of N-60, P_2O_5-90, K_2O-60 kg / ha [13].

MATERIALS AND METHODS

This study was conducted in 2009-2012 in the experimental fields of Andijan Institute of Agriculture and Agrotechnology, where nitrogen and mineral fertilizers were applied in soybean and mung bean crops grown as a secondary crop in the system of short-term rotation 1:1 (cotton-grain), and the effect of application on seed germination in field and laboratory conditions were studied.

In this study, before sowing soybean and mung bean seeds as a repeat crop, it was treated with nitragine in *Bradyrhizobium japonicum SB5* and *Phaseolus radiates 148,* and was tested with P_{90} K_{60}, N_{30} P_{90} K_{60}, N_{60} P_{90} K_{60}, N_{60} P_{90} K_{60}, N_{90} P_{90} K_{60} and N_{90} P_{90} K_{60} rates in background options, which were not treated with nitragine. Cotton was grown next year on these created backgrounds. The norm mineral fertilizers $N_{200}P_{140}K_{100}$ kg / ha was applied in cotton. The soil of the experimental field is meadow sierozem, the mechanical composition is moderately sandy, the groundwater is located at a depth of 4-5 meters, not saline.

Field experiments were conducted in 3 fields (at the time and place) and included 18 options. In 3 repetitions and variants were placed in 1 tier. The total area of each option was 240 m^2, of which 120 m^2 was accounted for. The total area occupied by the experiment is 1296 hectares. In the experiment, soybean variety of Orzu, Pobeda-104 of mung bean and Andijan-37 of cotton were planted.

Placement, calculations and data observations of field experiments were carried out according to the methodical manuals "Methods of conducting field experiments" and "Methods of field experiments with cotton", [14,15].

RESULTS AND DISCUSSION

According to results of this study, field germination of seeds were slightly higher in 2011 than in 2010 and 2012, and in the control options grown in cotton next year on the background of fertilizer-free cultivation without nitrogen before sowing the seeds of soybean and mung bean, the germination rate of seeds in the field was 16.5-17.3% in the first (21.04) period of observation, The seeds of soybean and mung bean crops were treated with nitragine before sowing, and it was found that the germination rate of seeds in the next year's cotton-growing variants was 17.4-18.1% on the background of fertilizer-free variant.

The highest rate of seed germination under field conditions was observed in nitragine-treated pre-sowing seeds of soybean and mung bean crops, and 19.0-19.8% in cotton-grown variants next year on the background of mineral fertilizers N_{30} P_{90} K_{60} kg / ha. In the variants of mineral fertilizers N_{30} P_{90} K_{60} kg / ha on the backgrounds not treated with nitragine before sowing the seeds of soybean and mung bean, it was found that the germination rate of seeds under the field conditions when growing cotton next year was 17.9-18.6%.

It can be seen from the data obtained that pre-sowing treatment of soybean and mung bean seeds grown as a secondary crop had a positive effect on seed germination under field conditions (Table 1).

By the end of the follow-up period (30.04), soybean and mung bean seeds were not treated with nitragine before sowing, and in the control options for cotton grown in the following year on fertilized backgrounds, the germination rate of seeds in field conditions was 82.9-83.6%. The seeds of mung bean crop were treated with nitragine before sowing, and it was found that the germination rate of seeds in the cotton-growing variants in the following year was 83.5-84.1% on the background of fertilizer-free variant.

Table 1. Influence of Nitragine and mineral fertilizer rates applied on repeated legume crops on seed germination in field conditions, %

№.	Types of repeated crops	Norms of mineral fertilizers used in repeated crops, kg / ha	2010			2011					2012		
			23.04	26.04	29.04	2.05	21.04	24.04	27.04	30.04	20.04	23.04	26.04	29.04
1		Without fertilizer	19,2	43,1	62,0	80,0	17,3	46,4	65,3	83,6	18,4	44,5	63,6	81,8
2		$P_{90}K_{60}$	19,7	44,0	62,8	81,3	18,0	47,1	66,2	84,2	18,9	45,6	64,5	82,5
3		$N_{30}P_{90}K_{60}$	20,3	45,3	63,6	82,1	18,6	48,0	67,0	84,9	19,5	46,2	65,3	83,1
4		$N_{60}P_{90}K_{60}$	20,9	45,9	64,2	83,0	19,3	48,8	67,8	85,1	20,2	46,7	66,0	83,9
5	Soybean	$N_{90}P_{90}K_{60}$	20,7	45,5	64,0	82,5	19,1	48,3	67,5	85,0	19,9	46,4	65,7	83,2
6		Without fertilizer+Nitragine	19,4	44,5	62,9	81,4	18,1	47,0	66,1	84,1	18,8	45,1	64,4	82,3
7		$P_{90}K_{60}$+Nitragine	20,4	45,6	63,8	82,7	18,9	47,9	66,9	84,8	19,6	46,0	65,0	83,0
8		$N_{30}P_{90}K_{60}$+Nitragine	21,0	46,4	64,9	83,5	19,8	49,5	68,3	85,7	20,5	47,4	66,5	83,8
9		$N_{60}P_{90}K_{60}$+Nitragine	20,8	46,1	64,5	83,1	19,4	49,0	68,0	85,3	20,1	47,1	66,2	83,4
10		Without fertilizer	18,3	42,0	60,9	79,2	16,5	45,5	64,7	82,9	17,7	43,8	62,9	81,2
11		$P_{90}K_{60}$	18,6	43,2	61,5	80,5	17,2	46,3	65,5	83,4	18,1	44,9	63,8	81,6
12		$N_{30}P_{90}K_{60}$	19,5	44,5	62,3	81,4	17,9	47,2	66,4	84,2	18,7	45,5	64,6	82,5
13		$N_{60}P_{90}K_{60}$	20,0	45,1	63,1	82,0	18,5	48,1	67,1	84,5	19,0	46,0	65,4	83,3
14	Mung bean	$N_{90}P_{90}K_{60}$	19,6	44,8	63,0	81,9	18,3	47,7	66,9	84,3	18,9	45,7	65,0	82,6
15		Without fertilizer+Nitragine	18,6	43,7	61,8	80,8	17,4	46,4	65,3	83,5	18,3	44,6	63,8	81,7
16		$P_{90}K_{60}$+Nitragine	19,7	44,5	62,9	81,9	18,2	47,1	66,1	84,1	18,9	45,4	64,3	82,3
17		$N_{30}P_{90}K_{60}$+Nitragine	20,5	45,2	64,0	82,6	19,0	48,9	67,6	85,0	19,8	46,7	65,8	83,0
18		$N_{60}P_{90}K_{60}$+Nitragine	20,1	44,9	63,6	82,3	18,7	48,3	67,2	84,7	19,2	46,4	65,5	82,7

Table 2. Influence of Nitragine and mineral fertilizer norms applied in repeated legume crops on seed germination capacity and rate, %

№ Bap.	Types of repeated crops	Norms of mineral fertilizers used in repeated crops, kg / ha	2010		2011		2012		Average	
			Germination power (3 days)	Germination rate (5 days)	Germination power (3 days)	Germination rate (5 days)	Germination power (3 days)	Germination rate (5 days)	Germination power (3 days)	Germination rate (5 days)
1	Soybean	Without fertilizer	91,7	94,3	94,0	96,7	93,0	95,3	92,9	95,4
2		$P_{90}K_{60}$	92,0	95,0	95,3	97,3	93,7	96,0	93,7	96,1
3		$N_{30}P_{90}K_{60}$	93,3	96,7	95,7	98,0	94,3	96,7	94,4	97,1
4		$N_{60}P_{90}K_{60}$	94,0	97,3	96,3	98,7	95,0	97,7	95,1	97,9
5		$N_{90}P_{90}K_{60}$	93,7	97,0	96,0	98,3	94,7	97,0	94,8	97,4
6		Without fertilizer+Nitragine	92,3	95,7	95,0	97,0	93,7	96,3	93,7	96,3
7		$P_{90}K_{60}$+Nitragine	93,7	96,3	95,7	98,0	94,3	97,3	94,6	97,2
8		$N_{30}P_{90}K_{60}$+Nitragine	94,3	97,7	97,0	99,3	95,7	98,0	95,7	98,3
9		$N_{60}P_{90}K_{60}$+Nitragine	94,0	97,0	96,7	99,0	95,3	97,7	95,3	97,9
10	Mung bean	Without fertilizer	90,3	93,7	93,7	96,3	92,3	95,0	92,2	95,0
11		$P_{90}K_{60}$	91,7	94,3	94,7	97,0	93,0	95,7	93,1	95,7
12		$N_{30}P_{90}K_{60}$	92,3	95,7	95,0	97,3	93,7	96,3	93,7	96,4
13		$N_{60}P_{90}K_{60}$	93,0	96,3	95,7	98,0	94,3	97,0	94,3	97,1
14		$N_{90}P_{90}K_{60}$	92,7	95,7	95,3	97,7	94,0	96,7	94,0	96,7
15		Without fertilizer+Nitragine	92,3	95,3	94,7	96,7	93,0	96,0	93,3	96,0
16		$P_{90}K_{60}$+Nitragine	93,0	96,3	95,3	98,0	93,7	97,0	94,0	97,1
17		$N_{30}P_{90}K_{60}$+Nitragine	93,7	97,0	96,0	98,7	95,3	97,7	95,0	97,8
18		$N_{60}P_{90}K_{60}$+Nitragine	93,3	96,7	95,7	98,3	94,7	97,3	94,6	97,4

In the last period of observation, the highest rate of seed germination in field conditions was observed in cotton-grown variants in the following year on the background of application of mineral fertilizers $N_{30}P_{90}K_{60}$ kg / ha before sowing soybean and mung bean seeds was 85.0-85.7%, it was found that the germination rate of seeds in field conditions when cultivating cotton next year was 84.2-84.9% in the variants where the norm of mineral fertilizers $N_{30}P_{90}K_{60}$ kg / ha was applied on the backgrounds not treated with nitragine before sowing the seeds of soybean and mung bean crops.

It can be seen that pre-sowing nitragine treatment of soybean and mung bean seeds grown as a secondary crop after winter wheat has a positive effect on seed germination in field conditions, which provided the yield was 0.2-0.8% higher. The results of the study also showed that the use of phosphorus and potassium fertilizers in soybean and mung bean crops grown as a secondary crop is 0.6-0.7% higher than the control options for the use of mineral fertilizers in the field.

While the application of mineral fertilizers at different rates on nitrate-treated and non-nitrogen-treated backgrounds before replanting legume seeds had different effects on the growth, development, and yield of replanted crops, laboratory samples of cotton harvested from cotton harvested for analysis in subsequent years were used. It was found that the norms of mineral fertilizers used in previous crops and the effect of nitragine were determined when determining the germination capacity and degree of germination.

The germination capacity and rate of seeds in the laboratory were also slightly higher in 2011 than in 2010 and 2012. The seeds of soybeans and mung bean were not treated with nitragine before sowing, but sown in the laboratory next year in control varieties grown on fertilizers without fertilizers were 93.7-94.0% of the seeds, soybean and mung bean seeds were treated with nitragine before sowing and fertilized without fertilizers. Next year, the germination rate of seeds in cotton varieties was found to be 94.7-95.0%.

The highest germination rates of seeds in the laboratory were observed with nitragine applied before sowing of soybean and mung bean seeds, and the rate of mineral fertilizers $N_{30}P_{90}K_{60}$ kg / ha was observed in cotton-grown variants next year, 96.0-97.0%, in the variants where the norm of mineral fertilizers $N_{30}P_{90}K_{60}$ kg / ha was applied on the backgrounds not treated with nitragine before sowing the seeds of soybean and mung bean, it was found that the germination capacity of seeds in the laboratory under cotton cultivation next year was 95.0-95.7.

It can be seen that pre-sowing nitragine treatment of soybean and mung bean seeds has a positive effect on the germination capacity of seeds in the laboratory. we can see from the data obtained (Table 2).

Accordingly, the data on laboratory germination of seeds, the germination rate of soybean and mung bean crops without nitrogen treatment before sowing in the conditions of their cultivation without fertilizers in the next year in the control variants of cotton was 96.3-96.7%. The seeds of soybean and mung bean crops were treated with nitragine before sowing, and it was found that the germination rate of seeds in the laboratory conditions in the next year's cotton-growing variants on the background of fertilized care was 96.7-97.0%.

The highest germination rates of seeds in the laboratory were observed with nitragine before sowing of soybean and mung bean seeds, and mineral fertilizers N_{30} $R_{90}K_{60}$ kg / ha was observed 98.7-99.3% in cotton-growing variants next year. It was found that the germination rate of seeds under laboratory conditions in the next year's cotton cultivation in the variants of mineral fertilizers $N_{30}R_{90}K_{60}$ kg / ha in the background treated with nitragine before sowing the seeds of soybean and mung bean crops was 97.3-98.0%.

CONCLUSION

Nitragine treatment of soybean and mung bean seeds before sowing had a positive effect on seed germination under both laboratory and field conditions, The germination rate of seeds in the laboratory under the conditions of cotton cultivation in the following year under the background of non-treatment by nitragine before

sowing the seeds of soybean and mung bean crops grown as a secondary crop after winter wheat was 0.3-1.3%, and field fertility was 0.2-0.8% higher. Also, it was found that the use of phosphorus and potassium fertilizers in soybean and mung bean crops grown as a secondary crop was 0.6-1.0% higher in the laboratory, and 0.6-0.7% higher in the field than in the control options without mineral fertilizers in studies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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