Efficiency of the application of mineral fertilizers on the productivity of soy and mung bean (mash) in the conditions of the sogd region of the republic of Tajikistan

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Abstract. The article provides research on the study of the norms of nitrogen-phosphorus fertilizers on the yield of soybeans and masha in the conditions of gray-brown soils. The use of mineral fertilizers has had a significant impact on the formation of soybean and mash yields. Yields of soybean grains, depending on the study variants of experience, range from 15.8 to 27.6 c/ha, and mush - from 13.0- to 24.1 cents per hectare.

1 Introduction

The constant and unceasing growth of the world's population gives rise to an increasing demand for food. To meet this demand, farmers around the world are introducing ever more advanced and sophisticated farming technologies that allow them to get more crops per unit area. In addition, thanks to new technologies, production costs are reduced, and more profit is obtained. One of the most acute problems in Tajikistan at the present time is the unsatisfactory nutrition of people, an acute shortage of protein in their diet, which is the main source of essential amino acids. In order to preserve the health of the nation under the current conditions, it is advisable to take measures to increase the production of vegetable protein, which is several times cheaper than animal protein. This problem can be largely solved by using soybeans, the seeds of which contain up to 50% of biologically complete protein and up to 27% of high-quality edible oil. Unfortunately, in Tajikistan soybeans are currently not sown on large areas [4, 5]. One of the main reserves for the production of seeds of leguminous crops in Tajikistan is to expand the sown area and increase their yield through the rational and efficient use of irrigated land. In this regard, the development of scientifically grounded methods of soybean and mung bean growing technology in relation to the specific zonal conditions of the republic, ensuring an increase in their productivity, is an urgent task of science and practice.

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2 Materials and methods

The objects of research were the zoning of Orzu soybean varieties and mash Tajik-1. Our observations, counts and performed laboratory analysis were carried out according to generally accepted methods of the State variety testing of field crops [1]. It should be noted that the research is based on the “Field Experiment Technique” [2] and the “Field Experiment Technique” according to Dospekhov [3]. Soy and mash crop data were processed by analysis of variance [3].

3 Results and discussions

Our studies to study the norms of mineral nitrogen and phosphorus fertilizers for the yield of soybeans and mung bean showed a significant difference in the onset and passage of the period of phenological phases of plant growth and development (Table 1). According to the data obtained in the control variant of the experiment, the flowering phase for soybeans began on July 9, and for mung bean on July 6, and in the variant of using mineral nitrogen and phosphorus fertilizers, this phase was noted for soybeans on July 13, and for mung bean - on July 11. This pattern persisted until the end of the harvest. The duration of the growing season of soybeans from germination to maturation of plants was 103 days, and for mung bean it was 93 days. With the introduction of mineral nitrogen fertilizers at a rate of 60-90 kg / ha, against the background of phosphorus fertilizers, the period from germination to maturation of plants ranged from 109-111 and 96-100 days.

Table 1. Development of soybean and mung bean plants depending on various doses of mineral fertilizers (average for 2016-2018)

Variants experie e	Date of the main phases plant development			Duration of interphase periods, days			Vegetativ e period, days
	seedlings	mass flowering	maturation	sowing - shoots	seedlings - flowering	seedlings - ripening	
Soy							
Control	25.05.	09.07.	05.09.	11	45	114	103
P ₆₀	25.05.	11.07.	11.09.	11	47	116	105
N ₆₀ P ₆₀	24.05.	12.07.	13.09.	10	49	119	109
N ₉₀ P ₆₀	24.05.	13.07.	13.10.	10	50	120	110
N ₉₀ P ₉₀	25.05.	13.07.	14.10.	11	49	122	111
Mash							
Control	18.05.	06.07.	20.08.	4	49	97	93
P ₆₀	18.05.	07.07.	22.08.	4	50	99	95
N ₆₀ P ₆₀	18.05.	08.07.	23.08.	4	51	100	96
N ₉₀ P ₆₀	17.05.	11.07.	25.08.	3	55	102	99
N ₉₀ P ₉₀	18.05.	11.08.	27.08.	4	54	104	100

Mineral fertilizers had a significant impact on the biometric parameters of soybean and mung bean plants. According to our observations, taller plants of soybeans and mung bean were formed at all stages of development with the introduction of nitrogen and phosphorus fertilizers in the norm - N₉₀ P₉₀. At the same time, the height of soybean plants, in these variants, turned out to be higher compared to the control - by 12.3 cm, and in mung bean plants - by 17.3 cm.

The use of mineral fertilizers also influenced the process of biomass accumulation, which was manifested starting from the flowering phase of plants. In the fruiting phase with the use of mineral nitrogen and phosphorus fertilizers in doses - N90P60 and N90P90, the wet and dry weight of plants turned out to be more than in the control, respectively, in soybeans - by 67.5 - 70.4 and 17.7 - 18.9 g ., and for mung bean - by 4.9-14.9 and 1.9-3.8 g. A high yield of green and dry matter, in all phases of growth and development of soybeans and mung bean plants, was formed when nitrogen was applied from 60 to 90 kg, against the background of phosphorus fertilizers.

Analysis of the data on the formation of the leaf surface area of soybean and mung bean crops, depending on the use of mineral fertilizers, are presented in Fig.1-2.

Fig. 1. Dynamics of the growth of the area of soybean leaves depending on the regime of mineral nutrition, thousand m²/ha (on average, for 2016-2018).

Fig. 2. Dynamics of the growth of the area of mung bean leaves depending on the regime of mineral nutrition, thousand m² / ha (on average, for 2016-2018).

According to the data shown in the figure, in the sprouting phase of soybeans formed from 2.6 to 2.8, and in the budding phase - from 6.3 to 9.4 thousand m² / ha; for mung bean, respectively, from 1.9 to 2.4 and from 5.1 to 7.9 thousand m² / ha of leaf area.

However, by the flowering phase in the variant of applying phosphorus at a dose of 60 kg / ha, the leaf area increased, compared to the control, in soybeans - by 2.4 thousand m² / ha, and when N60P60 was applied, its growth reached 4.7 thousand m² / ha. An increase in leaf area by 7.0 and 10.7 thousand m² / ha occurred with the application of N90P60 and N90P90. The same pattern is observed for wagging. The maximum amount of leaf area in soybeans is 46.9-50.0 thousand m² / ha and mung bean 43.3-44.9 thousand m² / ha was formed when mineral nitrogen and phosphorus fertilizers were applied at a dose of N90P60 and N90P90.

The analysis of the obtained experience data on the study of the consumption of mineral fertilizers by plants shows that in the germination phase, nitrogen consumption was in the first variant - 3.01 kg / ha, in the second - by 0.39; in the 3rd - by 0.41; in the 4th - by 0.49 and on the 5th - by 0.67 kg / ha more, compared to the option where no fertilizers were applied.

In the flowering phase, the amount of nitrogen consumed increased significantly: in the variant without fertilization - by 17.5 times, with the introduction of P60 - by 16.5; N60P60 - at 20.4; N90P60 - by 22.4 and N90P90 - by 24.5 times, compared to the germination phase.

During the interfacial period of flowering-seed filling, there was a significant increase in nitrogen consumed by crops, and these values corresponded to the maximum consumption of this element. In the variant without fertilization (control), nitrogen consumption was 158 kg / ha, in the second - by 16.9; in the third - by 26.2; in the fourth - by 37.3 and in the fifth - by 46.2 kg / ha more than in the first variant.

Phosphorus consumption was significantly less than nitrogen, but the consumption pattern remained the same. In the germination phase, phosphorus consumption was 0.50-0.57 kg / ha, in the flowering phase it reached 9.6-16.8 kg / ha, and in the ripening phase - 26.0-39.0 kg/ha.

The maximum consumption of potassium by soybean plants coincided with the ripening phase. It was 63.0 kg / ha in the variant without fertilization, in the variant with the application of P60 - by 9.7; N60P60 - by 15.5; N90P60 - by 22.7 and N90P90 - by 33.3 kg / ha, more than in the first variant.

The same pattern in the consumption of NPK by plants persisted in the case of mowing.

The results of our research showed that by the ripening phase, nitrogen removal per 1 centner of soybean seeds in the variant without fertilization was 5.4 kg, and with the introduction of P60 - by 0.3 kg, N60P60 - by 0.8, N90 P60 and N90 P90 - 1.2-1.6 kg / ha more removal than control.

The removal of phosphorus and potassium, depending on the variants of the experiment, ranged from 1.22-1.50 and from 3.10-3.75 kg / ha.

Indicators on the removal of NPK by the mung bean plant allow us to draw the following conclusions: the removal of N, depending on the variants of the experiment, ranged from 6.3-7.6; P₂O₅ from 1.2 -1.6 and K₂O from 3.10-3.70 kg / ha.

The research results show that when applying mineral nitrogen and phosphorus fertilizers in a dose of N90P9, the best conditions are provided for the formation of elements of the structure of the crop of soybeans and mung bean. At the same time, the results of the analysis to determine the structure of the crop show that the number of beans increased, compared with the control, in soy-25.9; for mung bean -80.0 pcs., The number of seeds per plant increased by -105.6 and- 180.8 pcs., The mass of seeds per plant increased by 9 and 28.4 g., And the mass of 1000 pcs. seeds - by 30.0 and 1.9 g, respectively.

The data on the accounting of yields show that in the control variant the grain yield of soybeans was 15.8, and for mung bean 13.0 c / ha. The increase in the yield of soybeans and mung bean came from the application of mineral fertilizers. In our studies, the yield of soybean grain, depending on the studied options for applying mineral nitrogen and phosphorus fertilizers, ranged from 19.5 to 27.6 c / ha, and for mung bean - from 17.3 to 24.1 c / ha (Figure 3).

Thus, the results of the conducted studies show that a high yield of soybeans and mung bean was obtained with the application of fertilizers at a dose of N90P90. The increase in the yield of soybeans in relation to the control was 11.8 c / ha; in relation to the second option (P60) - by 8.1 centners / ha; in relation to the third (N60P60) - by 3.9 c / ha and to the fourth (N90P60) - by 1.5 c / ha; for mung bean culture, yield growth, respectively, increased by 11.1; 6.8; 4.0; and 2.1 c / ha.

Fig. 3. Influence of different norms of mineral fertilizers on the yield of seeds of soybeans and mung bean (on average for 2016-2018).

4 Conclusion

Based on the studies, optimal norms of fertilizers were developed and recommended for production. It has been established that the decisive condition for obtaining high and stable yields is the use of mineral nitrogen fertilizers on the background of phosphorus fertilizers. When optimizing the regime of mineral nutrition, a real opportunity is created for obtaining a high yield in the conditions of gray-brown medium-stony soils of Northern Tajikistan - 26-28 c / ha of soybeans, and - 22-24 c / ha of mash.

References

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