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The Importance of Micronutrients in Utilization of Beneficial Air Temperature of Soybean Varieties

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Abstract: In this paper, Information is given about importance of micronutrients on growth, development and embezzle of useful temperature in the atmosphere. According to the information, it was observed that the vegetation period was different under the influence of macro fertilizers and micronutrients, under influence of sulfur the vegetation period was shortened to 108-110 days in the Orzu variety, to 132-130 days in the Nafis variety, and, on the contrary, under the influence of manganese, it was extended to 110-113 days in the Orzu variety, and to 132-135 days in the Nafis variety, in turn, it was determined that this is directly related to the absorption of useful temperature by the plant and that under the influence of sulfur, it absorbed relatively little useful temperature due to the shortening of the effective period, and under the influence of manganese, the sum of useful temperature was high due to the extension of the effective period.

Keywords: air temperature, development, growth, macro and microfertilizers, manganense, soybean, sulfur, vegetative periods.

1. Introduction

Soybean production is a branch which appeared in an ancient period. According to sources, it appeared in the northern, central and southern regions of China 5000 years ago. The development of soy farming is closely related to the development of agriculture. Soybean is a very ancient crop. Studying the diversity of soybean species and forms, scientists believe that it was formed mainly in three centers: Southeast Asia, Australia and East Africa. But many scientists recognize the center of China as the origin of the plant - China, Korea, India, Japan. Soya appeared in Europe and the USA in 1712. For many centuries, soybean and its products served as the main source of protein for the people of eastern countries. Soybean was cultivated in China 6-7 thousand years ago. It has been cultivated since ancient times in Japan, India and Indonesia, Vietnam and other Asian countries. Soybean entered the Far East from China 3 thousand years ago. Soybeans have long been grown in Russia's Amur region, Khabarovsk and Primorsky regions, where natural and climatic conditions are favorable. Later, it began to be cultivated in Georgia, Ukraine, the Kuban and the North Caucasus. During evolution, soybean species and varieties were grown and adapted to different soil and climate conditions far from their homeland, the morphological and biological characteristics of the plant partially changed [1].

Soybean plant plays an important role in solving some of the existing problems in agriculture. Oil, margarine, cheese, milk, flour, confectionery products are obtained from soybeans. Soybean flour is added to bread and sausage products and increases the nutritional value, taste and strength of these products. Soybean products are recommended for diabetes. Soybeans are rich in minerals such as potassium, calcium, and phosphorus [2].

Kh.N. Atabaeva., F.B. Namozov., A.A. Kurbanov and S.Sh. Khayrullaev in their experiments conducted in 2018-2020, when they applied micronutrients to the soybean crop, micronutrients affected the height of the soybean stem, leaf, root development, nodule formation, grain quality and productivity, and provided a high yield [3].

According to R. Jo'raeva., J. Toshpol'atov., A. Iminov., Kh. Bozorov and L. Zaynitdinova, S. Khatamov and S. Sh. Khayrullaev, in their experiments conducted in 2015-2017, soybean plant mineral fertilizers and belonging

to the rhizobium group it was observed that the yield increased by 12.6-12.8 c/ha when exposed to azotobacteria strains compared to the control variant [4, 7].
According to Khayrullayev Sardor Shamsiddin ugli (2021), the application of micronutrients in the suspension method 2 times during the application period of soybean varieties in the conditions of meadow-swamp soils provides an increase in grain quality [9]. According to data 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 standards. In 2019, these indicators increased by 0.3-0.7 in the variants of sulfur compared to the control in the "Orzu" variety, increased by 0.1-0.3 in the "Nafis" variety, and good results were obtained from the medium and high standards of sulfur [6]. According to Iminov Abduvali Abdumannobovich, Khayrullayev Sardor Shamsiddin ugli, et al, 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 mungbean 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 [5]. According to Umarova Nigora Sadriddinovna, Bo'riboyev Bekzod Yetmish ugli, Khayrullayev Sardor Shamsiddin ugli, Usmonova Shokhista Usmon kizi, & Turdaliyeva Shokhista Tulkinjon kizi, the demand of the soybean plant for mineral fertilizers, it was observed that when NPK and liquid fertilizer were used together, all the biometric parameters and yields of the plant increased by varieties compared to other methods. The use of mineral fertilizers in different ways in typical sierozem soil conditions affects the grain yield of local and foreign varieties. In other words, the average yield of medium-ripe soybean varieties "Nafis" was 43.4 c / ha, "Vilana" was 42.4 c / ha, and the best way to increase the yield is to apply fertilizers as NPK in combination with liquid fertilizer [10]. According to data of Khayrullayev Sardor Shamsiddin o'g'li and Usmonova Shohista Usmon qizi, the location of the lower first pod in soybean varieties is 12.8-15.9 cm in Orzu variety, 3-3.1 cm in Radimax stimulator, 2.2-2.4 cm in Gummat stimulator, 2.1 cm in Tecamin stimulator and 3.1 cm in Algora stimulator was found to be high. The most effective results were observed in Radimax, Gummat and Algora bio-simulators, and the location of the lower first pod was detected 14.7-17.6 cm in the "Nafis" variety, which was 2.5-2.9 cm higher in the Radimax stimulator, 2.2-2.5 cm higher in the Gummat stimulator, 2.1 cm higher in the Tecamine stimulator, and 2.4 cm higher in the Algora stimulator than in the control variant. The most effective results were observed in Radimax, Gummat and Algora biosimulators [8]. According to Atabayeva, K. N., Umarova, N. S., Yakubov, S., & Khayrullaev, S. S, positive results were obtained from moderate levels of sulphur and manganese, and low levels of iron. Macro and micronutrients had a positive effect on soy yield. An additional 7.6 quintals (q)/ha was harvested in exchange for macro fertilizer. Compared to the background variant, the yield was 4.6-8.3 q/ha for sulphur and 4.9-9.8 q/ha for manganese. The yield of the iron element was lower than that of the background variant. Grain quality has changed in exchange for macro and micronutrients. In exchange for mineral fertilizers, this figure increased by 2.4%. In exchange for the element sulphur, the protein increased by 3.1-5.8%; an increase of 4.4-8.4% was observed in exchange for the element manganese. It was noted that the protein increased by 7.9-8.7% in exchange for the element iron [11]. Khayrullayev, S. S., & Kizi Usmonova, S. U explained that mineral fertilizers and sulfur microelements activate the symbiotic activity of soybean variety "Orzu", averaging 32.4-42.3 million nodules per hectare, the number of nodules due to the background of mineral fertilizers increased by 13.6%, and there was an increase of 19.4-23,4% due to sulfur, as well as an average weight of nodules was 6.46-9.56 c / ha, the weight of nodules increased by 5.3% due to mineral fertilizers, and 17.1-32.4% due to sulfur. During the application period, 6.46-9.56 c / ha of nodules mass was accumulated per hectare according to the studied variants, which contributes to the increase of nitrogen and organic matter in the soil and a slight increase in biological efficiency [12]. Usmonova Sh.U, Khayrullaev S.Sh, Shomuqimov N.N, & Gaynanova A.F, said that the influence of stimulants on soybeans affected the weight of 1000 grains of Vilana cultivar, under the influence of Gummat stimulator this figure was 2.2-7.4 grams higher than on basis of mineral fertilizers (Background), and under the influence of Rival stimulator-3.0-6.0 grams [13]. According to Khayrullaev S. S, In the variant, where not used mineral fertilizers and micronutrients, the leaf area in the control variant of the Orzu variety of soybean was 51.1 thousand m^2 / ha. Under the influence of microelements, the leaf area of Orzu was 59.1-64.6 thousand m^2 / ha. The highest rates of exposure to micronutrients were observed with medium use of sulfur and manganese. Under influence macro and micro fertilizers, the leaf area of Orzu variety increased from 4.0 to 13.5 thousand m^2 / ha, or from 7.3 to 20.9% [14].

It was found that when the plants were exposed to urea at different rates, they had an effect on their biometric indicators, and when the urea rate was increased to 15 grams, all biometric indicators were better than other options (Umarova Nigora Sadriddinovna, et.al. 2023) [15]. The application of stimulants to plants increases their resistance to abiotic factors. All the stimulators in the experiment showed their effect for the preservation of the plant, and the foliar feeding variant of the fulvogummat stimulator showed a better result than the other stimulators (Usmonova Shokhista Usman kizi, et.al. 2023) [16].
Usmonova Shokhista and other scientists noticed that the growth process has a great role in the formation of the plant's fruit, and the use of stimulants in the experiment showed a positive effect on the growth process of the plant. The studied stimulators have an effect on the growth process, among the stimulators Fulvogummat stimulator was 164.9 cm tall when fed from the leaf, and recorded a good indicator among the variants (Usmonova Shokhista Usman kizi and et.al. 2023) [17].

2. Methods And Materials

Experiments are carried out in field and laboratory conditions. In the research "Methods of conducting field experiments" (T.UzPITI 2007), "Methodology of field experiment (B.Dospekhov, 1985), “Methodology of the State variety testing of agricultural crops” (1985, 1989), “Methods of agrochemical, agrophysical studies of the soil of Central Asia” (1988) methods are used.

Varieties used in the experiment
Orzu the variety is an early-ripening variety, 35-40 days pass from planting to flowering, 95-110 days to the ripening period, the stem branches. The stem grows upright, the bush is porous, the height of the stem can be up to 50-70 cm. The leaf is three-lobed, large, light green. The foliage of the plant is average, the leaves are symmetrical. The length of the leaf band is 10 cm. 75% of the leaves are shed when fully ripe. The flower is white, there are 2-7 flowers in the inflorescence. The pods are gray, small, from 2.4 cm long up to 4.0 cm. Pods do not split when ripe, on average about 40 pods are formed per bush. The grain is average, the weight of 1000 grains is 120-130 g. Grain yield in irrigated lands is 32 centners per hectare. when planted as repetitive plant 10-20 c grain yield is taken. Grain contains 25% oil and 36-38 % protein. Authors: Rakhmanov A.R, Yunusov B.K, Tulaganov N., Burigina O.V.

Nafis variety. The variety was created by the method of individual selection at the Rice Research Institute of Uzbekistan.
The growing period is 115-120 days. The height of the plant is 145-150 cm. The location of the lower pod is 14-16 cm, the number of branches is 2-4, the number of pods in one plant is 120-130, the number of grains in one pod is 2-4.
Grain quality and technological parameters: weight of 1000 seeds is 165-175 g. The protein content of grain is 40-41%, the oil content is 25-27%. Resistant to lodging, shedding, diseases and mechanized harvesting.
Yield: 30-32 c/ha grain yield and 250-300 c/ha blue mass can be obtained from the variety under favorable conditions.

Place of experiment, conditions and agrotechnical measures
The experiments were conducted in the scientific experimental fields of the Rice Research Institute in Tashkent region.
The soil layers are swamp type soils characteristic of an oasis. There are also large and small stones and sand mixtures in different depth layers. These soils derive from the typical excess moisture conditions of the left bank of the river and are ideal for rice cultivation. The soil is grassland. The soil of the experimental field is not saline, the tiller layer is 30- 40 см. The pH of the solutions in the soil is 6.8-7.3 units, and it is heavy clay according to its mechanical composition. Experiments are being conducted in 4 checks of 12 maps.
Prior to planting, the background was established in the program, in which 50 kg of nitrogen, 100 kg of phosphorus and 70 kg of potassium were applied. Planting method is wide rows, row spacing is 70 cm, bush spacing is 5 cm. Nitragin was not used because soybeans are always grown at the Rice Institute and the soil contains Rhizobium bacteria.
The experimental field was irrigated 2 times during the period of operation. Cultivation was carried out 2 times in the experimental field with the help of equipment. Soy varieties were fed in 3 different ways, suspension was used.

3. Results and Discussion

Plants go through a period when they receive a certain amount of useful temperature during each development period. In our experiment, on the basis of average 3-year data, it was found that the useful temperature in the "Orzu" variety during the full germination was 114.4^{0}C.
Among all options, the total useful temperature in the budding phase was 314.8-357.5^{0}C, in the flowering phase was 240.7- 301.3^{0}C , in the pod forming phase the total useful temperature was 271.8- 345.0^{0}C. During the ripening period, the total useful temperature in the control option was equal to 824.6^{0}C (see Table 1).
In the background option, where mineral fertilizers were applied, the total useful temperature was 817.4^{0}C. In the variants where sulfur microfertilizer was used, the total useful temperature during the ripening period was 797.7-811.7^{0}C. In the options where manganese microfertilizer was used, the total useful temperature during this period was 820.2-845.2^{0}C. The total useful temperature in the control option during the vegetative period was equal to 1855.0^{0}C. It was found that in the background variant applied mineral fertilizers was 1820.1^{0}C, which was 34.9^{0}C less than the control variant. Variants with sulfur microfertilizer applied at a temperature 55.2, 99.4, 121.2^0 C lower than the control variant, and the period received 20.3, 64.5, 86.3 ^{0} C lower than the background variant, respectively. The variants treated with manganese microfertilizer were 13.0, 57.2, 101.9^{0}C higher than the control variant and the vegetative period passed at 47.9, 92.1, 136.8 ^{0} C temperature which was higher than the background variant respectively.

Table 1. Effect of application of micronutrients at different rates on total useful temperature of soybean varieties, ^{0} C, (2018-2020)

Application rate of micronutrients, g/l	full germination	budding	flowering	podding	ripening	total
Orzu variety						
No fertilizer (control)	114,4	333,0	268,5	320,4	824,6	1855,0
Background – $N_{50}P_{100}K_{70}$ kg/ha	114,4	324,3	261,8	308,1	817,4	1820,1
Background + S_{90}	114,4	318,7	257,0	303,8	811,7	1799,8
Background + S_{180}	114,4	315,0	245,6	285,9	800,4	1755,6
Background + S_{270}	114,4	314,8	240,7	271,8	797,7	1733,8
Background + Mn_{150}	114,4	339,5	276,6	323,3	820,2	1868,0
Background + Mn_{300}	114,4	347,9	284,9	338,3	832,9	1912,2
Background + Mn_{450}	114,4	357,5	301,3	345,0	845,2	1956,9
Nafis variety						
No fertilizer (control)	138,0	373,2	332,2	548,9	860,8	2245,7
Background – $N_{50}P_{100}K_{70}$ kg/ha	138,0	358,6	329,3	544,3	857,9	2220,7
Background + S_{90}	138,0	357,7	326,5	540,9	829,1	2184,9
Background + S_{180}	138,0	356,8	331,5	525,9	820,0	2165,0
Background + S_{270}	138,0	330,8	325,1	508,6	811,9	2107,5
Background + Mn_{150}	138,0	373,2	329,6	548,9	882,0	2264,2
Background + Mn_{300}	138,0	377,1	334,3	562,1	891,6	2295,4
Background + Mn_{450}	138,0	382,4	341,2	563,7	886,0	2303,7

In the "Nafis" variety, the total useful temperature during the full germination period was 138.0^0 C. Among all options, the sum of the useful temperature during the flowering period was 330.8-382.4^{0}C, during the flowering period was 325.1-341.2^{0}C, the sum of the useful temperature during the podding period was equal to 508.6-563.7^{0}C. During the ripening period, the total useful temperature in the control variant was 860.8^{0}C. In the background option, where mineral fertilizers were applied, the total useful temperature was 857.9^{0}C. It was observed that the useful temperature sum was around 811.9-829.1^{0}C in the options where sulfur microfertilizer was used. In the options where manganese microfertilizer was used, the total useful temperature was 882.0-891.6^{0}C in the ripening phase. The total useful temperature during the vegetative period was 2245.7^{0}C in the control option. In the background option, mineral fertilizers were applied at 2220.7^{0}C, and the temperature of was 25^{0}C lower than that of the control option. The total useful temperature sum applied sulfur micro fertilizer was 60.8, 80.7, 138.2^{0}C lower than the control variant, 36.0, 55.7, 113.2^{0}C lower than the background variant, respectively. The variants treated with manganese microfertilizer were respectively 18.5, 49.7, 58.0^{0}C higher than the control variant and 43.5, 74.7, 83.0^{0}C higher temperature than the background required to pass the

vegetative period.

4. Conclusion

Thus, vegetation period under the influence of macro and microfertilizers was observed that the duration of the period was different, under the influence of sulfur, the vegetation period was shortened up to 108-110 days in the Orzu variety, up to 132-130 days in the Nafis variety, and, on the contrary, under the influence of manganese, it was extended up to 110-113 days in the Orzu variety, and up to 132-135 days in the Nafis variety, in turn, it was determined that this is directly related to the absorption of useful temperature by the plant and that under the influence of sulfur, it absorbed relatively little useful temperature due to the shortening of the effective period, and under the influence of manganese, the sum of useful temperature was high due to the extension of the effective period.

5. Referances

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