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SOYBEAN GROWING TECHNOLOGY IN THE SALTY SOILS OF THE ARAL SEA

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The monograph presents information about the experiment, which was carried out about studying influence of planting periods on the growth, development and productivity of soybean, which is the representative of legumes, in the salty soils of the Aral Sea. Students of higher educational places, agricultural farmers and people, who are interested in general information about soybean plant can be acquainted with the information and give their opinions.

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At the meeting of the department "Forestry and crop production" on 26. 02. 2022, it was looked through and discussed, then it was suggested for the allowance of KIAA methodical council to publish in many copies.

Introduction

The formation of the Republic of Uzbekistan as an independent country has brought to our nation numerous changes and development. After the independence, there were some changes in all fields of economics, including agriculture. Weather and soil conditions of our republic is suitable for growing crops.

The drying up of the Aral sea has caused natural disaster, particularly, dust, salt affected negatively to the public health. Therefore, there are some common diseases among the people like, diabetes, anemia, etc., so it is necessary to produce useful plants for them and use as food.

Food rations of people differ from each other according to age, gender and work, proteins, carbohydrate, vitamins, minerals are needed for human for everyday life. The more human is nourished with different products, the more they become healthy and live long. Particularly, in daily life we realize how stress, depression, nervous-psychological exhausting causes negative effects. Moreover, for normal life the demand for protein shouldn't be less 0.7 g for one kg. To meet this requirement, it is effective to include legumes in our diet, especially soybeans. Soybean is an oily and grainy legume that plays an important role in the agriculture of the world. According to the information of FAO in 2019, soybeans were planted on 124.0 million hectares of land of the world, with an average yield of 22.1 quintals per hectare.

Soybean is like an annual herbaceous plant (Glicina hispida L.)Belonging to the family of legumes (Fabacea L.). ***Soybean*** is a young plant in Uzbekistan. Its grains contain 30-52% protein, 17-27% fat, and 20% carbohydrates [1].

In recent years, the attention to the soybean in the Republic of Uzbekistan is growing. While soybean protein is used as a source of nutritious protein feed in livestock and poultry, an environmentally friendly product is obtained in the food industry. Soybean-planted fields improve soil microflora by providing the soil with pure nitrogen.

With the introduction of soybean cultivation, the problem of protein deficiency can be solved, the production of vegetable oil can be increased and livestock can be provided with quality, protein-rich fodder. At the same time, the fertility of the soil in which the soybean is planted can be achieved by the accumulation of biological nitrogen in the soil as a result of the activity of nitrogen-fixing bacteria in its roots.

THE ROLE OF SOYBEAN IN THE NATIONAL ECONOMY

Soybeans are used in food, machinery, canning, producing dairy and bakery products, animal husbandry, and generally used in all sectors of the economy. Its grain is used to make about 300 different foods, as fodder for livestock, silkworms and birds. Such a comprehensive use of soybean depends on the quality of its grain. Soy protein is high quality, completely

soluble in water, well absorbed. Glycine amino acids is high in the content, which can be used in fermentation to produce dairy products. Soybeans are used to make butter, margarine, cheese, milk, flour, confectionery, meat substitutes or meat flavors, and canned food. When 10-20% of soy is added to dough and flour products, its nutritional value increases.

Especially today, when protein deficiency is prevalent all over the world, the protein richness of soybeans, the presence of essential amino acids in their protein content, is of particular importance, which further enhances the nutritional value of soybeans.

Soybean-based foods are made from soy milk, soy flour, soy cottage cheese-tofu, soy cheese, soy yoghurt and skimmed soy flour - soy meat produced in the USA, China, Russia on the basis of special technology from soy isolate, fish, soy mollusks, especially meat products produced in the program type - minced meat (minced soy), soy meat cubes goulash, rounded minced meat, specially prepared types based on drying soy meat pieces (entrecotes). They are very convenient to store and transport. Because cholesterol in soybean does not contain animal fats, it is important in the prevention of cardiovascular disease in humans by clearing the blood of its users from triglycerides and lowering cholesterol levels, and is very important for human health. (2)

These meat products contain 46-70% of proteins and are well absorbed by the human body, because they contain group B PP drugs, magnesium, iron and other micro and macro minerals necessary for our bodies.

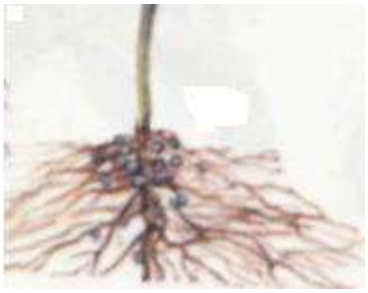
Soy protein is also important as it is well soluble in water and highly absorbed by the human body.

The use of **soy flour** from non-fat soy flour (insulation) in the production of bakery products reduces the daily consumption of bread by improving the quality of bread, soy bread does not harden for a long time, looks beautiful, increases the viscosity.

Even the use of 8-10% soy flour in our home-made bread replaces the milking of our bread, which turns out to be very nice in the oven, and does not harden for 8-10 days. Regular consumption of such bread will reduce the protein deficiency in our bodies, especially our women and children, prevents from anemia, because the most widely used product in all walks of life is bread and with soy bread people can intake some amount of protein.

As we all know, protein deficiency is the main problem of today, it causes many diseases. By increasing the share of soy products in the diet, it is possible to solve this problem or slightly reduce the intake of medicines. With this in mind, we believe that in order to improve the health of the peoples living along the Aral Sea, it is advisable to introduce the use of soy products as food. Therefore, we made recommendations for the production of soybeans by conducting experiments in the fields of the Karakalpakstan Institute of Agriculture and Agrotechnologies and the Karakalpak Grain and Legume Experimental Station for a detailed study of soybean cultivation technology.

The peculiarity of the root of the soybean and the presence in them of the bacterium Rhizobium (Pic. 1) makes this plant one of the most nitrogen-fixing plants. Soy is also of agro-technical importance. The introduction of soybean into the crop rotation system will improve the fertility of the soil, as well as ensure the accumulation of 100-120 kg of pure plant nitrogen fertilizer in the soil.



Picture 1. Bacteria Rhizobium in the soybean

In the fields where soybeans are planted for the first time, it is necessary to sow soybeans enriched with Bradirizobium. Molecular nitrogen, which is formed in the roots of the soybean plant, accumulates in our soil in the form of ecologically clean, fully assimilated by all crops in the form of biological nitrogen, enriching the soil.

As a legume, soybean is the best crop rotation crop for all agricultural crops, all types of autumn cereals, cotton, corn, and vegetables.

After soybean, the field is much cleared of weeds, so it is used in crop rotation for many crops.

It is also used as a siderate crop. Biological nitrogen accumulated in the soybean is environmentally friendly and does not harm the soil, groundwater, users, because it does not accumulate in fruits, such as artificial nitrogen fertilizers.

In Uzbekistan, soy is used for food, animal feed, butter, milk and confectionery. Soybeans contain large amounts of minerals such as potassium, calcium and phosphorus. This further enhances the importance of the soybean. It is also the only plant that produces soy artificial milk and dairy products.

Soybean oil is a highly nutritious food with a nutrient content of 9290 kcal. Soybean oil contains 80-94% of unsaturated fatty acids, 6-22% of polyunsaturated fat, and carbohydrates are almost completely soluble in tissues. In terms of amino acid composition, soy protein is rich in milk, egg and meat proteins [2, 3]

BIOLOGICAL PROPERTIES. During the growth and development of the soybean, it goes through the following developmental stages: greening, branching, budding, flowering, legume formation and maturation. The passage of the phases and the conditions required for will depend on the biology of the varieties. In particular, the technological measures taken have a significant impact on the growth of the soybean.

In order to study growing peculiarities of soybean in saline soils along the Aral Sea research was conducted in the experimental fields of Karakalpak Scientific Experimental Station of the Uzbek Research Institute of Cereals and Legumes and the Karakalpakstan Institute of Agriculture and Agrotechnologies. The relief of the test site is flat, the mechanical composition of the soil is moderately heavy gray loam. Alfalfa is sown before crops. The field was plowed in the fall and saline washing was carried out. In the experimental layout scheme of the soybean, the varieties were placed with four repetitions. Planting depth was 5-6 cm, the method was planted in wide rows, 60 cm between rows.

The object of the experiment was "Orzu", "Selekta-302", "Tumaris", "Nafis" varieties of soybean, sowing was carried out in the I, II and III decades of April.

Prior to planting, soil samples were taken from the experimental site based on generally accepted methods for performing agrochemical tests to determine soil salinity. Soil samples were mixed with five proportions of distilled water and filtered in the laboratory of the institute to

prepare a soil solution and agrochemical analysis was carried out to determine the salinity of the soil in the field. (Picture 2) The data obtained showed that the soil salinity of our experimental site was 0.13%.

Picture 2. Works to determine soil salinity of sowing fields

In our experiment, the planting material was 1st class seeds, and when we studied the developmental stages of the growers according to the VIR methodology, it was found that there were a lot of 5-point growths, which in turn was positive for field germination. In the laboratory, we use the following indicators to determine the germination of seeds. Sand is used to determine the germination and growth energy of the seeds, it is moistened and placed in a sandy loam, then 100 seeds are sown (in four turns). It is washed before placing and heated well to avoid damaging the seeds. Seeds are placed on the rostil with a calculator or by hand using a marker. There are 4 samples in the rostil, with their numbers on the labels, the time when calculation of germination and growth energies was conducted. Seeds of field crops are often germinated at a stable temperature of 20 degrees. We checked the seeds twice for germination. In the first, growth energy was detected, and in the second, germination was detected. The growth rate of seeds is checked daily in the research.

Kuleshov I.I. [5] showed that field germination of seeds was directly related to laboratory germination, and that the lower the laboratory germination, the greater the difference between it and field germination. In our experiment, the difference between laboratory germination and field germination was average 12-13%.

In the process of individual growth and development, seed crops undergo phenological stages of organogenesis. Each of these periods and stages is characterized by the appearance of new organs and a single external morphological feature. Like all grain legumes, the soybean plant undergoes periods of germination, branching, budding, flowering, legume formation, and ripening. The conditions required for the passage of time depend on the biology of the variety. In addition, the technological measures applied to it also have a significant impact.

The soybean plant is heat demanding, the seeds germinate at 8-10^{0}C, 15-18^{0}C is required for full germination, and 20-22^{0}C is optimal. Flowering stops when the temperature drops below 17 degrees during flowering. The plant can grow up to 38-40^{0}C. Temperature is 1600-1700^{0}C for early ripening varieties, 2000-2200^{0}C for medium ripening varieties, 2800-3000^{0}C for late ripening varieties. -4-5^{0}C frost can damage [6].

When soybean seeds are sown, the lower the air and soil temperatures, the slower the germination of seeds, and the higher the temperature, the faster the germination.

The average temperature for normal development of soybean is around 18-25 degrees, and temperatures above 35 degrees causes the buds and flowers to shed.

Germination phase. Soybeans begin to swell when the water content reaches 90-150% by weight of dry matter. Two to three days after germination, the embryo ruptures the seed cortex and develops a vein. As the embryo develops, lateral veins and vascular hairs appear. The growth of the root complex depends on the physical properties of the soil, temperature, humidity and nutrients. Once the embryonic vein has formed, the hypocotyl elongates, the hypocotyl first splits the soil, and then the seed cortex sprouts. First a simple real leaf appears, then three leaves. In our experiment, this was observed after 13-14 days. Usually this period begins 8-10 days after planting. The first root buds appear 7-10 days after germination, and after two weeks they can meet the plant's need for nitrogen. When we studied the transition characteristics between varieties, we obtained the following indicators: in the germination phase there was almost no difference between varieties, all varieties germinated in 13-14 days, and in two weeks a pair of leaves appeared.

In our experiment, on April 28, 2021, the seedlings sprouted in full, and the varieties "Orzu", "Selekta-302", "Tumaris" and "Nafis" germinated by an average of 90-92% (Picture 3).

Picture 3. Germination of soybeans in the field

There were almost no differences in morphological features between the varieties during the germination phase. (Picture 4)

Picture 4. Soybean varieties during pair leaf production

On May 10, soybean varieties began to branch, the vascular system of "Selekta-302" and "Nafis" varieties was more developed, and "Orzu" and "Nafis" varieties were observed to have the ability of branching. (Picture 5)

Picture 5. The complete germination pair-leaf formation phase of soybean varieties.

The planting times studied in the experiment had a direct effect on the passage of the vegetation period. The germination phase started in 14-15 days in the "Orzu" variety and 13 days in the "Nafis" variety. When planted late, this period was observed to be prolonged by 1-2 days.

The branching phase began when 3-5 complex leaves appeared in our experiment. (Pictures 6,7). During this time, the stem grows rapidly, then its growth slows down and the formation of leaves decreases. The lateral branches develop from the lower parts of the stem. Varieties with little or no branching may also occur. In our experiment, the branching phase is 23 days when planted in the "Orzu" variety on April 10; when planted on April 20, it was observed for 22 days, and this period was found to be shortened to 1 day;

Picture 6. Time when 3 complex leaves appear

Picture 7. The starting of branching phase of soybean and how to determine it

The budding phase goes at the same time with the period of branching, during which the plant is at its best leaf making period. In a bush appear 4–5 pairs of three leaves. (Pictures 8,9). Leaf making rate is 30-40%. The demand for moisture also increases during this period.

In our experiment, the budding period in the next sowing period was observed at 20 -21 days, and was reduced by 2-3 days compared to the first period.


1

2

Picture 8. The budding phase of the soybean. 1- “Orzu ” variety; 2- “Nafis” variety.


Picture 9. Budding phase of the soybean variety "Nafis" in the experimental field

Flowering phase begins with the appearance of 5-6 leaves in early ripening varieties, i.e. when the lateral leaves begin to develop, and in late ripening varieties - 30-70 days after germination. The flowering phase lasts 15-55 days, depending on the variety, agronomic and external factors.

Flowering requires intensive plant growth and a constant supply of water and nutrients. It depends on the light and temperature. Once flowering begins, the soybean grows rapidly, and the growth rate depends on the base of the seeds. Flowering begins in the lower tier and begins to slide up and sideways. The appearance and maturation of the legumes is similar.

Soybean is a self-pollinating plant. During the flowering period, soybean is more resistant to adverse conditions than other plants.

In our experiment, the flowering phase was observed in 25 days when the "Orzu" variety was planted on April 10; when planted on April 20, observed in 32 days, it was found that this period was extended to 7 days; when planted on April 30, it was observed in 47 days and was found to be 22 days longer than the first period. Observed in 29 days when sown on April 10 in "Nafis" variety; observed in 30 days when planted on April 20, it was found that this period was extended to 1 day; when planted on April 30, it was observed in 47 days and found to be 18 days longer than the first period. (Picture 10)

Picture 10. Studying the flowering phase of soybean

The flowers of "Orzu" and "Nafis" varieties were found to be white, and the flowers of "Selekta-302" and "Tumaris" varieties were found to be bright red (Pic. 11).

Picture 11. Flowers of soybean

The appearance of legumes. 10-15 days after flowering, legumes begin to appear in the lower tier. (Picture 12). The flowering and seed-filling phase is a critical period for soybean development. Water is required a lot during this period. During the period of seed filling, the growth of vegetative mass stops and the lower leaves begin to dry out.

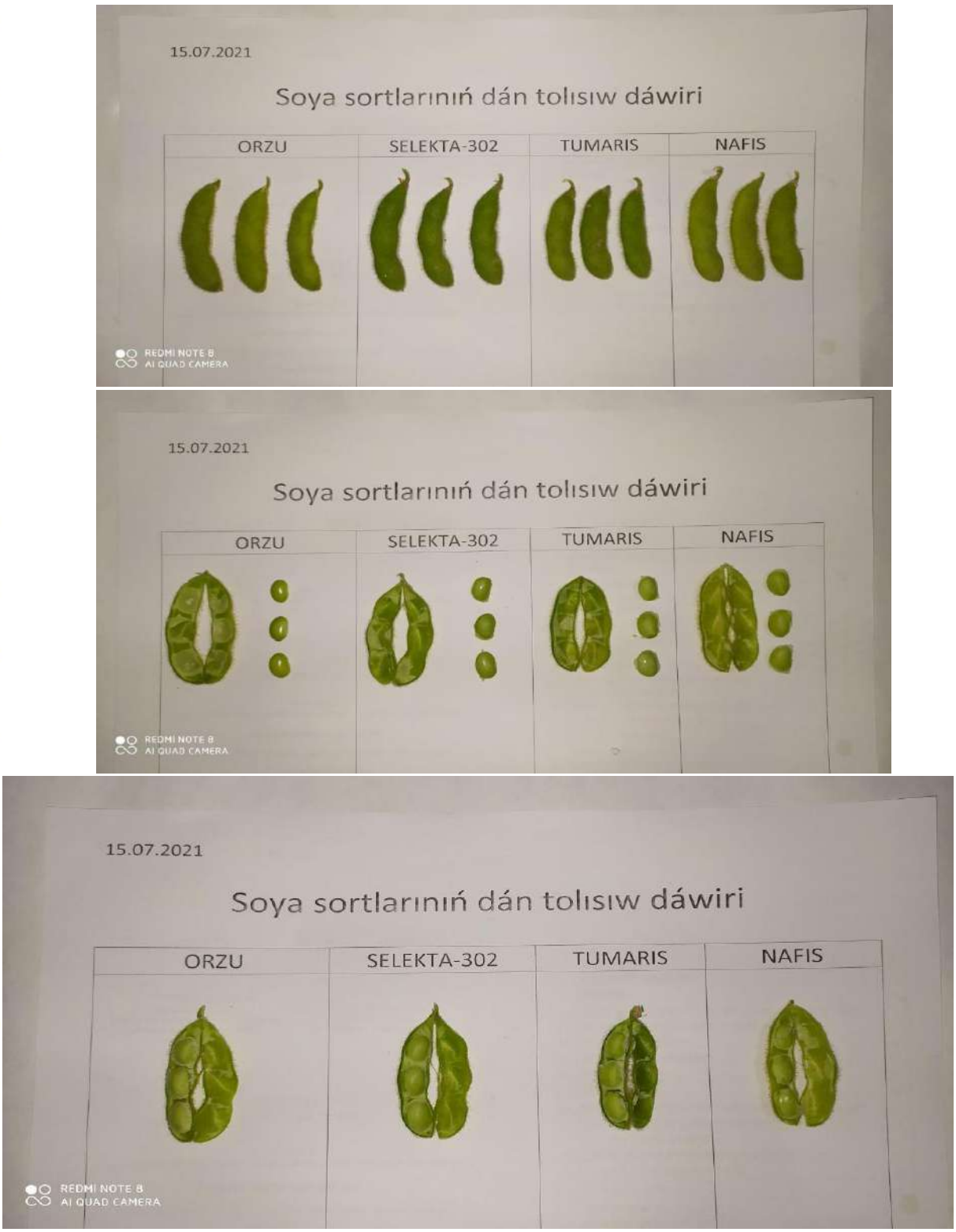
It takes 40-60 days from flowering to the ripening of the legumes, and the ripening of the seeds takes 11-20 days. The vegetation period of soybean varieties lasts 70-150 days, depending on the characteristics of the variety. In our experiment, the vegetation period of soybean lasted 108-119 days, depending on the varietal characteristics. The longest lasting phase during the vegetation period is the ripening phase. During this time, the legumes first form and then ripen

Picture 12. The number of legumes is being studied in the legume formation phase of soybean

When the "Orzu" and "Nafis" varieties were planted in the saline soil conditions along the Aral Sea, their growth periods were as follows: when planted on April 10, the "Orzu" variety ripens 7-9 days earlier than the "Nafis" variety. When planted on April 20, it ripened 1-2 days earlier, and when planted on April 30, it took 1-4 days to ripen and ripened late. The total vegetation period in 2019 was 108-112 days for "Orzu" and 117-119 days for "Nafis". Of course, these indicators vary depending on the weather. In our experience, the weather was very dry and hot.

Plant height and their growth dynamics are directly related to the biological characteristics of the plant and external factors. Plant height is also one of the main indicators of a plant. Our research found significant differences between soybean varieties and planting times. "Nafis" is 5-8 cm taller than "Orzu", which indicates its drought tolerance. As the sowing period was delayed, the height of the "Orzu" variety increased, and it was found that the option of sowing up to 60 kg per hectare was more suitable.

The longest period of vegetation - - is the ripening phase, which in our experiment lasted 60-64 days. This process begins with the formation of legumes, which then begin to ripen. (Pictures 13, 14). There seemed to be little difference in the options in 2021. "Orzu" and "Selekta-302" took 108 days to complete the growing season; "Tumaris" took 111 days and "Nafis" 114 days. It was found that there is a difference of 3-6 days between varieties in terms of total vegetation period.



Picture 13. Filling of seeds in soybean legumes.

"Selekta-302" and "Nafis" differed in height compared to other varieties.

Picture 14. Determining the stem height of soybean varieties.

The yield-forming organ of a plant is the leaf. The better the leaf develops and the healthier it is, the more active the process of photosynthesis and the more complex organic matter is formed in the leaf. To predict the yield to be obtained, it is necessary to determine the leaf surface size of the plant. Leaf surface size is determined in several ways. In a soybean plant, pieces of a certain size are cut and measured from specific plants to determine the leaf surface size (Picture 15).

Picture 15. Determining the leaf surface size of soybean varieties

In legumes, the location of the lower first legume is a very important indicator, because if the legume is located at the bottom, the combine will not be able to harvest, and the crop will fall. The location of the first lower legumes of the varieties studied in the experiment is given in Table 1. The location of the first legume was 6.2-10.8 cm among varieties, i.e. the location of the first legume in the "Orzu" variety was 6.2 cm; in "Selekta-302" variety - 8.4 cm; in "Tumaris" variety - 8.8 cm and in "Nafis" variety - 9.3 cm.

Table 1. Biometric indicators of soybean varieties

Varieties	Number of branches, piece	Location of the first legume, cm	Number of legumes on 1 plant, piece	Weight of a legume in 1 plant, gr	The length of legume, cm	Number of grains on 1 plant, piece	Weight of grains on 1 plant, gr	Weight of 1 grain, gr
"Orzu"	2,0	6,2	89,1	43,45	4,4	184,4	28,47	0,16
"Selekta-302"	2,2	8,4	89,6	44,38	4,7	184,8	29,50	0,18
"Tumaris"	2,2	8,8	87,4	42,88	4,2	184,4	27,76	0,16
"Nafis"	2,2	10,2	88,4	41,26	4,7	184,8	28,12	0,17

The number of legumes per plant ranged from 85.6 to 88.6, i.e. 85.6 in the “Orzu” variety; 88.6 in the “Selekta-302” variety; in the “Tumaris” variety it was 87.4 and in the “Nafis” variety it was 88.4, while the “Selekta-302” and “Nafis” varieties were optimal. When we determined the weight of legumes in one plant, it was in the range of 42.88-44.38 grams, and in this respect, the varieties "Selekta-302" and "Nafis" were optimal. When we determined the length of the legume, it was 4.2-4.7 cm, which means that the legume of the “Orzu” variety was 4.4 cm longer. “Selekta-302” and “Nafis” varieties were 4.7 cm, “Tumaris” varieties were 4.2 cm. The number of seeds per plant ranged from 183.4 to 189.9, and the varieties “Selekta-302” and “Nafis” were characterized by high yields. The weight of seeds per plant was 27.12-29.50 grams, which was optimal for “Selekta-302” and “Nafis”. The weight of one seed ranged from 0.16 to 0.18 grams, and the weight of one seed of the “Orzu” variety was 0.16 g; “Selekta-302” variety - 0.18; “Tumaris” weighed 0.16 grams and “Nafis” 0.17 grams, which shows that “Selekta-302” and Nafis were optimal. Thus, in terms of biometric indicators of soybean varieties, "Selekta-302" and "Nafis" have high indicators and were found to be optimal in practice.

During the experiment, caring works were carried out for the good growth of soybean varieties: feeding of leaves with potassium fertilizers during the growing season (Pic. 16) and timely watering, i.e. a total of 4 times during the growing season was carried out, the first water was given in the branching phase. (Picture 17).

Due to the daytime temperature of 36-38^{0}C, we carried out leaf feeding of the plant from 18:00 to 20:30 in the evening.

Picture 16. Leaf feeding of soybean varieties

Picture 17. 1st irrigation of soybean varieties.

Table 2. Biometric indicators of soybean varieties

Varieties	Number of branches, piece	Location of the first legume, cm	Number of legumes on 1 plant, piece	Weight of a legume in 1 plant, gr	The length of legume, cm	Number of grains on 1 plant, piece	Weight of grains on 1 plant, gr	Weight of 1 grain, gr
"Orzu"	2,0	6,2	85,6	43,45	4,4	184,4	28,07	0,16
"Selekta-302"	2,2	8,4	88,6	44,38	4,7	184,9	29,50	0,18
"Tumaris"	2,2	8,8	87,4	42,88	4,2	184,4	27,76	0,16
"Nafis"	2,2	9,3	88,4	44,26	4,7	184,9	28,22	0,17

In determining the biological yield of soybean, one stem of the plant was taken and its height, number of legumes, weight, number of seeds, weight of seeds were determined (Pic. 18). When we determined the yield characteristics of the soybean, we found that there was a difference of 2-5 c / ha between the options. The standard variety of our experience is "Orzu" 50 c / ha; "Selekta-302" type - 53 c / ha; "Tumaris" yielded 48 centners per hectare and "Nafis" yielded 52 centners per hectare, among them "Selekta-302" was more by 3 quintals comparing to

the standard variety (“Orzu”) and proved that it is possible to grow by planting in saline soils. (Table 3.) Thus, based on experimental data, we found that among the soybean varieties, “Selekta-302” and “Nafis” can be grown in saline soils.

Pisture 18. Biological yield detection

Table 3. Harvesting characteristics of soybean varieties (ts / ha)

№	Varieties	Repetitions				Average
		1	2	3	1V	
1	Orzu	53,0	50,0	48,0	50,0	50
2	Selekta-302	55,6	52,0	51,4	53,0	53
3	Tumaris	51,0	47,8	47,5	45,7	48
1	Nafis	54,2	51,8	51,0	52,2	52
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CONCLUSIONS

1. Indicators of soybean vegetation in all observations of saline soils along the Aral sea (germination, the degree of preservation of the number of bushes, the formation of leaf surface volume - leaf activity, yield, etc.) were found to be high in "Selekta-302" and “Nafis” varieties.

2. Experimental observations showed that among all the studied varieties, the stem height of “Selekta-302” and “Nafis” varieties increased. In the first and third variants (“Orzu” and “Tumaris”) the stems were lower than in the second and fourth variants.

3. The low stem height of “Orzu” and “Tumaris” varieties is probably a biological feature of the varieties, because the agro-technological measures were the same for all variants (varieties).

4. The development of soybean leaf also depends on the biological characteristics of the varieties, and it was found that the second and fourth variants of the experiment were optimal.

5. In the experiment, the number of legumes of varieties "Selekta-302" and "Nafis" was 88.4 and 89.6, the weight of one seed was 0.17 and 0.18 grams, in general, compared with other varieties, they were optimal in terms of biometric indicators.

6. The quality of seeds is high in “Selekta-302” and “Nafis” varieties, and their seeds can be used for food.

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