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CONDUCTING BREEDING, SEED PRODUCTION WORK ON FORAGE CROPS RESISTANT TO SALINITY AND WATER SCARCITY IN THE ARAL SEA AREA'S

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Abstract

One of the biggest problems of the world community today is the Aral Sea problem. It is noted that over the past 80 years, the Aral Sea has lost more than 1 billion tons of water. By the 2000s, the sea had almost completely disappeared: the water level dropped, salinity increased, and the ecosystem was disrupted. The disappearance of the sea caused droughts, dust storms, and extreme temperatures. The air was filled with dust, salts, and pesticides, leading to an increase in a number of diseases. The lands became unsuitable for agriculture. In order to partially eliminate this problem, the sowing and testing of fodder crops on the dried seabed of the island and the development of technologies for growing these crops, taking into account the soil and climatic conditions of the region, the establishment of primary seed production of varieties suitable for the region, and the supply of seeds based on demand are urgent tasks today.

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This article presents data obtained as a result of work carried out in experimental nurseries where local and foreign varieties and samples of fodder crops were planted to select crop types, varieties and samples suitable for local soil and climatic conditions on the dried bottom of the island and in the Aral Sea area's.

Keywords: Dry bottom of the Aral Sea, Aral Sea region, animal husbandry, feed base, fodder crops, breeding, seed production, yield

Introduction

In paragraph 37 of the National Program approved in Appendix No. 8 to the Decree of the President of the Republic of Uzbekistan dated November 23, 2023 No. UP-199 "On Measures to Ensure Environmental Stability by Further Increasing the Level of Greening in the Republic, Consistently Implementing the National Project "Green Space," tasks are given for the correct selection of types and varieties of fodder crops suitable for livestock in this region during 2024-2026, the correct selection of primary seed production samples of crops with the best indicators, the establishment of primary seed production of samples with the best indicators, and the testing of crops such as sorghum, white sorghum, fodder beet, and rye as feed for livestock on the dried bottom of the Aral Sea. It is observed that the decrease in the water level of the Aral Sea has a negative impact not only on the ecology of Uzbekistan, but also on the ecology of the whole world.

On the dried-up lands of the Aral Sea, millions of hectares of land have turned into low-fertility lands, where it is difficult to grow agricultural crops. In recent years, global warming has had a negative impact on the environment. As a result of this situation, in summer the air temperature rises and the demand for water increases, resulting in drought and a decrease in the yield of agricultural crops. Under such conditions, many crops reduce their yield potential. For this, it is important to correctly select crop types, varieties, and samples resistant to salinity and water scarcity in natural conditions, and to conduct selection and seed production work on them.

The livestock sector also occupies a special place in the gross agricultural output of Uzbekistan, which plays an important role in providing our people with valuable food products. Therefore, the further development of livestock farming, increasing livestock productivity, and significantly increasing the volume of livestock production are among the most important tasks of today. For this purpose, it is important to create a solid fodder base in the industry, to increase the fodder unit grown per hectare of land, depending on soil and climatic conditions.

In some places in the Aral Sea region, especially on the dried seabed, the extreme difficulty of growing fodder crops negatively affects the development of livestock farming in these areas. Improving the fodder base in animal husbandry requires obtaining the highest possible yields of fodder crops on agricultural lands allocated for fodder production. In obtaining high yields of fodder crops and increasing the amount of feed units obtained from each hectare of land, the correct selection of types and varieties of fodder crops corresponding to the soil and climatic conditions of each region, as well as the sowing of high-quality seeds, is of great importance. Initial sources are of great importance in the creation of new high-yielding varieties of fodder crops. For the correct selection of starting materials for breeding processes, it is necessary to carefully study the initial sources.

On the dried bottom of the Aral Sea, at the zero point, local and foreign varieties and samples of fodder crops were planted and studied for testing in the Aral Sea region. More than 10 varieties and samples of fodder crops were planted in the Aral Sea region, including on the dried seabed.

Literature review

B. Khaitov et al. conducted two-year field experiments using three repeated fully randomized block schemes to check the resistance of the Kinoa halophyte to climate change, its yield in arid and saline areas, and the adaptability of this crop to abiotic stresses, grain yield, and nutritional value in the remote areas of the Aral Sea basin. The plant cycle of the studied five lines ranged from 107 to 133 days, depending on the genotype characteristics. Lines Q5 and Q3 showed early maturity (107 and 113 days), high seed weight (2.7 and 2.35 g/1000 seeds), and good seed germination (68.3 and 56.7%). All these features were reflected in the high yield of the Q5 and Q3 genotypes, which showed an average grain yield of 2537.8 and 2361.7 kg/ha.

Agriculture plays an important role in the overall socio-economic situation of the Aral Sea region in terms of food security, employment, and the standard of living of the rural population [1]. However, there are many obstacles to sustainable agricultural management in this area, including important factors such as increased soil salinity, water scarcity, and climate variability. In addition, the drying up of the Aral Sea has exacerbated soil salinization, land degradation, and climate change, harmed agricultural systems, and led to unstable yields. The impact of this climate change was catastrophic, leading to the destruction of the entire ecosystem's life cycle [2]. As a result, many farmers and rural households are facing a decline in agricultural production, food and food shortages, and income instability.

Diversification of crops is the main potential strategy for improving domestic food security in this region. Therefore, the government of Uzbekistan pays special attention to diversifying crops that generate added value due to increased agricultural productivity, food security, and increased income. It has been found that a farmer growing three or more different crops receives significantly more income than a monoculture farmer [15]. After 1991, the area of cotton plantations was significantly reduced in favor of increasing wheat crops to increase food security. However, it should be noted that stress-resistant and expensive crops have many advantages. It cannot be denied that most farmers in the region adhere to a single crop rotation scheme rather than diversifying crops.

However, reducing this risk requires a combination of early crops, the use of modern harvesting and storage technologies to ensure uninterrupted production, and, among other ways to diversify crops, phased lending in the form of resources.

In order to improve the food supply in saline soils, M.I.Annaeva, F.N.Toreev, M.M.Yakubov, B.D.Allashov, N.Mavlonova conducted research on the development of agricultural technology for growing Melilotus albus. Studies have found that on saline lands, “Melilotus albus” produces a higher yield than alfalfa.

The article presents data obtained from testing crotalaria samples in the Aral Sea region. The experiments were conducted on moderately saline soils and yielded good results.

Experiments were conducted on the combined sowing of white sweet clover with cereal crops and their effect on cattle productivity. The article presents the data obtained as a result of these experiments.

B.D. Allashov, M.Kh. Zulfikarov, F. Toreev conducted research on the development of agricultural technology for growing fodder crops resistant to drought and salinity, studied crops for different varieties and rates of white sweet clover "Kibray" oats "Uzbek broadleaf," rye "Shalola," triticale

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"Prague silver" and corn "Uzbekistan-2018." The economic efficiency of each option was considered. An effective option for sowing white sweet clover in combination with cereals and legumes has been identified [1].

According to the Orenburg Research Institute of Agriculture (Orenburgskiy NIISX), even in areas with water scarcity, Kashgarbeda can yield up to 30 t/g of green mass with a yield of 5 tons of feed units per hectare.

According to E.I. Chekel, P.V. Yakimes, and R.A. Kishko, white clover is no less nutritious than alfalfa and clover. 1 kg of green mass of Kashgar alfalfa contains 0.23 feed units, 1 kg of hay contains 0.50 feed units, and during the budding period contains 170 g of digestible protein. Kashgar alfalfa serves to strengthen the fodder base in animal husbandry and, like other leguminous crops, is of great importance in agriculture. It has the ability to accumulate nitrogen in its roots, and when grown for 2 years, it leaves plant residues containing 0.3% nitrogen, 0.05% phosphorus, and 0.3% potassium. The roots accumulate 150-200 kg/ha of nitrogen, which is equivalent to the release of 30-40 tons of manure. In addition, another important aspect is that it improves the water permeability of the soil by 20-30%, improves moisture supply in the soil at a depth of up to 1 m, increases exchangeable calcium by 20% at a depth of up to 35 cm, and increases the biological activity of the soil by 1.2-2 times.

Biological nitrogen plays a very important role in world agriculture. Even in Western European countries, when applying 1-1.2 tons of mineral fertilizers per hectare, the plant's nitrogen requirement is met by only 25%. In the future, as the yield of agricultural crops increases, their nitrogen requirements will also increase. When solving the problem of plant protein in agriculture, it is important to solve the problem of atmospheric nitrogen using free and nodule bacteria living in the roots of leguminous crops. The introduction of atmospheric nitrogen into biological nitrogen causes an increase in protein content in plants. According to V.B.Tros and R.R.Abdullaev, cattle eat alfalfa well and can consume up to 50-60 kg per day. It was noted that the daily milk yield of dairy cows increased up to 3 liters when feeding them with sweet clover. They also write that the famous Swiss cheeses are made from cow's milk fed with sweet clover.

Methods

The research was conducted in the Aral Sea region, on the dried bottom of the Aral Sea, in the experimental field of the institute, the objects of research were varieties created at the institute, varietal samples of fodder crops from the National Genbank and foreign countries. Field experiments were conducted according to the Dospekhov (1985) method.

Analyses

In the Aral Sea region and on the dried bottom of the Ural Sea, 12 local and foreign varieties and samples of fodder crops were sown and studied (Table 1).

Table 1

Scheme for sowing fodder crops on the dried bottom of the Aral Sea

10.	9.	8.	7.	6.	5.	4.	3.	2.	1.

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1.	Esparcet-Milyutin variety	Oat-Uzbekistan broad-leaved variety
2.	Raps-	Barley-new ridge
3.	Pod (Konskiy Bob) - Tundra variety	Triticale-Silverish prag variety
4.	Grain and legume crop mixture	Grain and legume mixture of crops with biohumus
5.	Red clover	With Biogusus Oat-Uzbekistan broad-leaved variety
6.	Alfalfa	Red clover with biohumus
7.	Winter pea	Winter peas with biohumus
8.	Mustard	Esparcet with biohumus
9.	Facelia	Esparcet - a new line with biohumus
10.	Forage beet-Uzbekistan-83 variety	Esparcet-Kyrgyzstan with biohumus

On the dried bottom of the Aral Sea esparset Milyutin variety, foreign sample of rapeseed, beans (Konskiy bob) - Tundra variety, a new local line of red clover, a foreign sample of alfalfa, a foreign sample of winter chickpeas, a foreign sample of mustard, a foreign sample of facies, Uzbekistan-83 fodder beet variety, Uzbekistan broadleaf oat variety, a new line of barley, the Silvery Prag variety of triticale, as well as cereals and legumes were planted in a blend.

In addition, 9 types of desert fodder crops were planted in two replications on the dried bottom of the island.

Table 2

Scheme for sowing desert-fodder crops on the dried bottom of the Aral Sea

1.	2.	3.	4.	5.	6.	7.	8.	9.	1.	2.	3.	4.	5.	6.	7.	8.	9.
Teresken-	Circassian	Herbaceous	Camphorosma	Izen	Chenopodia	Scattered	Black saxaul	Charcoal	Teresken	Charcoal	Chenopodia	Herbaceous	Circassian	Scattered	Izen	Black saxaul	Camphorosma

In the territory of the Aral Sea region, in the Khojeyli district of the Republic of Karakalpakstan Samankul on the land of the farm "Sabir ota," the Shalola variety of rye was sown in different variants in 4 replications according to the following scheme.

Table 3.

Scheme of sowing the Shalola variety of rye in the Aral Sea region

1.	2.	3.	4.	5.	6.	7.	8.	9.

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Teriya-S	Hydrogel	Lucky season	ProBio Phyto	Mycoriza	Biohumus	Irradiated	Control	Phytovak
1.	2.	3.	4.	5.	6.	7.	8.	9.
Lucky season	ProBio Phyto	Biohumus	Irradiated	Teriya-S	Control	Hydrogel	Phytovak	Mycoriza
1.	2.	3.	4.	5.	6.	7.	8.	9.
Biohumus	Mycoriza	Teriya-S	Hydrogel	Control	Irradiated	Phytovak	ProBio Phyto	Lucky season
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**
Phytovak	Irradiated	ProBio Phyto	Teriya-S	Lucky season	Hydrogel	Control	Biohumus	Mycoriza

Experimental planting was carried out on October 12-13, 2025. Observation and control work was carried out in the experimental nursery under field conditions. Some differences were observed between the variants in terms of germination time. The differences in germination, identified as a result of observations, are reflected in the following Diagram 1.

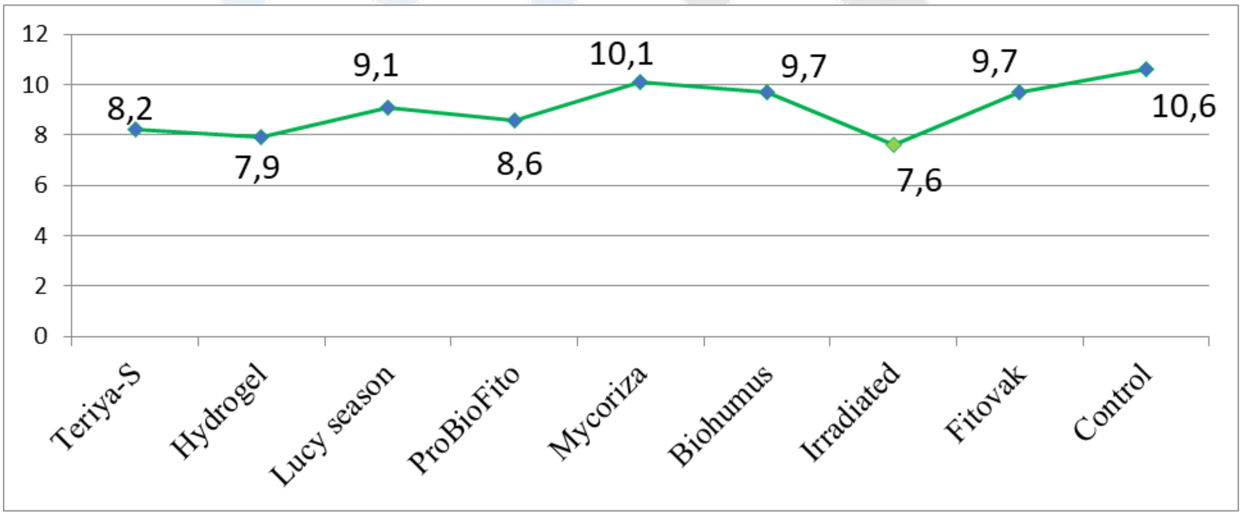

Diagram 1. Average indicators of seed germination of the Shalola rye variety under field conditions (days)

From the data of the above diagram 1, it can be seen that the average germination rate of the Shalola rye variety under field conditions for 4 replications in the variant sown with treatment with the Teriya-C preparation averaged 8.2 days, in the variant sown with the application of hydrogel in the furrow - 7.9 days, in the variant sown with the application of the Udachniy sezon fertilizer in the furrow - 9.1 days, in the variant sown with seed treatment with Probiofito - 8.6 days, in the variant sown with Mycoriza - 10.1 days, in the variant sown with vermicompost - 9.7 days, in the variant sown with

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infrared irradiation - 7.6 days, in the variant sown with treatment with phytovak - 9.7 days, and in the control variant sown by the usual method averaged 10.6 days. Thus, if the crops are treated with preparations before sowing and then sown, it has an effect on seed germination in field conditions. In this case, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3 days earlier compared to the usual method, 2.7 days earlier when sowing with hydrogel, and on average 2.4 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant.

On this farm, the Uzbek wide-leaved oat variety was also sown in various variants in 4 replications according to the following scheme.

Table 4.

Planting scheme of the Uzbek wide-leaved oat variety in the Aral Sea region

1.	2.	3.	4.	5.	6.	7.	8.	9.
Teriya-S	Hydrogel	Lucky season	ProBio Phyto	Mycoriza	Biohumus	Irradiated	Control	Phytovak
1.	2.	3.	4.	5.	6.	7.	8.	9.
ProBio Phyto	Mycoriza	Biohumus	Teriya-S	Irradiated	Hydrogel	Phytovak	Lucky season	Control
1.	2.	3.	4.	5.	6.	7.	8.	9.
Irradiated	Phytovak	Control	Mycoriza	Lucky season	Teriya-S	Biohumus	ProBio Phyto	Hydrogel
1.	2.	3.	4.	5.	6.	7.	8.	9.
Lucky season	Biohumus	ProBio Phyto	Hydrogel	Irradiated	Phytovak	Control	Mycoriza	Teriya-S

Experimental planting was carried out on October 12-13, 2025. Observation and control work was carried out in the experimental nursery under field conditions. Some differences were observed between the variants in terms of germination time. The differences in germination, identified as a result of observations, are reflected in the following Diagram 2.

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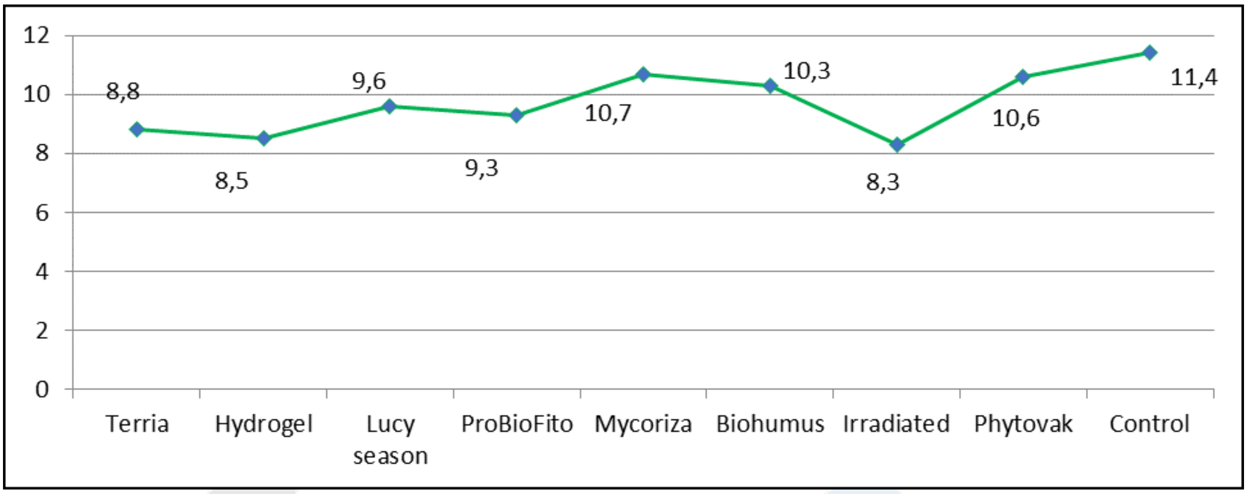

Diagram 2. Average indicators of seed germination of the Uzbek wide-leaved oat variety under field conditions (days)

From the data presented in the diagram above, it can be seen that the average germination rate of the Uzbek wide-leaved oat variety under field conditions for 4 replications in the variant with sowing treated with the Teriya-C preparation averaged 8.8 days, with the application of hydrogel to the furrow - 8.5 days, with the application of the "Udachniy sezon" fertilizer to the furrow - 9.6 days, with the sowing of seeds treated with Probiofito - 9.3 days, with the sowing of seeds treated with Mycoriza - 10.7 days, with the application of biohumus - 10.3 days, with infrared irradiation - 8.3 days, with the sowing of seeds treated with phytovak - 10.6 days, and in the control variant sown by the usual method - an average of 11.4 days. Therefore, treating crops with preparations before sowing and then sowing has an effect on seed germination in field conditions. In this case, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3.1 days earlier compared to the usual method, 2.9 days earlier when sowing with hydrogel, and 2.6 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant.

Also, the "Silver-like prag" variety of triticale was sown in different variants in 4 replications according to the following scheme.

Table 5.

Planting scheme of the "Silver-like prag" variety of triticale in the Aral Sea region

1.	2.	3.	4.	5.	6.	7.	8.	9.
Teriya-S	Hydrogel	Lucky season	ProBio Phyto	Mycoriza	Biohumus	Irradiated	Control	Phytovak
1.	2.	3.	4.	5.	6.	7.	8.	9.
Lucky season	ProBio Phyto	Teriya-S	Hydrogel	Irradiated	Control	Phytovak	Biohumus	Mycoriza
1.	2.	3.	4.	5.	6.	7.	8.	9.

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Inspection 8	5-Mycoriza	7-irradiated	6-Biohumus	Teriya-S 1	Season 3 Lucky	2-Hydro gel	Fitovak 9	4-ProBio Phyto
1.	2.	3.	4.	5.	6.	7.	8.	9.
4-ProBio Phyto	6-Biohumus	Fitovak 9	Inspection 8	Lucky Season 3	7-irradiated	5-Mycoriza	Teriya-S 1	2-Hydro gel
1.	2.	3.	4.	5.	6.	7.	8.	9.

Observation and control work was carried out in the experimental nursery under field conditions. Some differences were observed between the variants in terms of germination time. The differences in germination, identified as a result of observations, are reflected in the following Diagram 2.

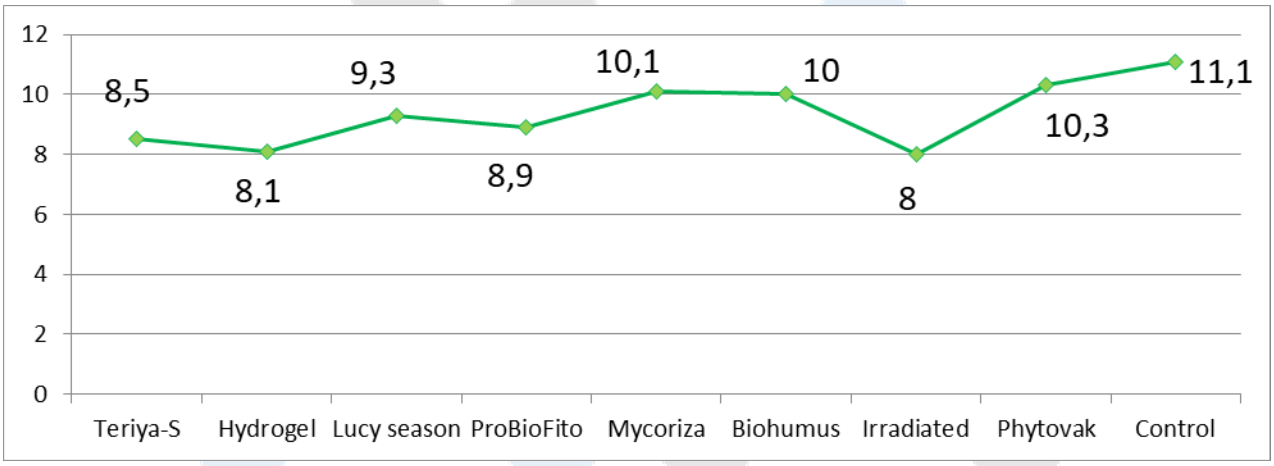

Diagram 3. Average indicators of seed germination in field conditions of the Tritikale Silver-like Prag variety (days)

From the data presented in the diagram above, it can be seen that the average germination rate of the Triticale variety Silver-like Prag under field conditions for 4 replications in the variant with sowing treated with the Teriya-S preparation averaged 8.5 days, with the application of hydrogel in the furrow - 8.1 days, with the application of the Udachniy sezon fertilizer in the furrow - 9.3 days, in the variant with sowing treated with Probiofito - 8.9 days, with the application of Mycoriza - 10.1 days, with the application of biohumus - 10 days, with infrared irradiation - 8 days, with the application of phytovak - 10.3 days, and in the control variant with conventional sowing - an average of 11.1 days. Therefore, treating crops with preparations before sowing and then sowing has an effect on seed germination in field conditions. In this case, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3.1 days earlier compared to the usual method, 3 days earlier when sowing with hydrogel, and 2.6 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant.

The Kibray variety of Kashkarbeda was also sown in different variants in 4 replications according to the scheme shown below.

Table 6.

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Scheme of sowing the Kibray variety of Kashkarbeda in the Aral Sea region

1.	2.	3.	4.	5.	6.	7.	8.	9.
Teriya-S	Hydrogel	Lucky season	ProBio Phyto	Mycoriza	Biohumus	Irradiated	Control	Phytovak
1.	2.	3.	4.	5.	6.	7.	8.	9.
Lucky season	ProBio Phyto	Biohumus	Irradiated	Teriya-S	Control	Hydrogel	Phytovak	Mycoriza
1.	2.	3.	4.	5.	6.	7.	8.	9.
Biohumus	Mycoriza	Teriya-S	Hydrogel	Control	Irradiated	Phytovak	ProBio Phyto	Lucky season
1.	2.	3.	4.	5.	6.	7.	8.	9.
Fitovak 9	7-irradiated	4-ProBio Phyto	Teriya-S 1	Lucky Season 3	2-Hydro gel	Inspection 8	6-Biohumus	5-Mycoriza

Experimental planting was carried out on October 12-13, 2025. Observation and control work was carried out in the experimental nursery under field conditions. Some differences were observed between the variants in terms of germination time. The differences in germination, identified as a result of observations, are reflected in the following diagram 4.

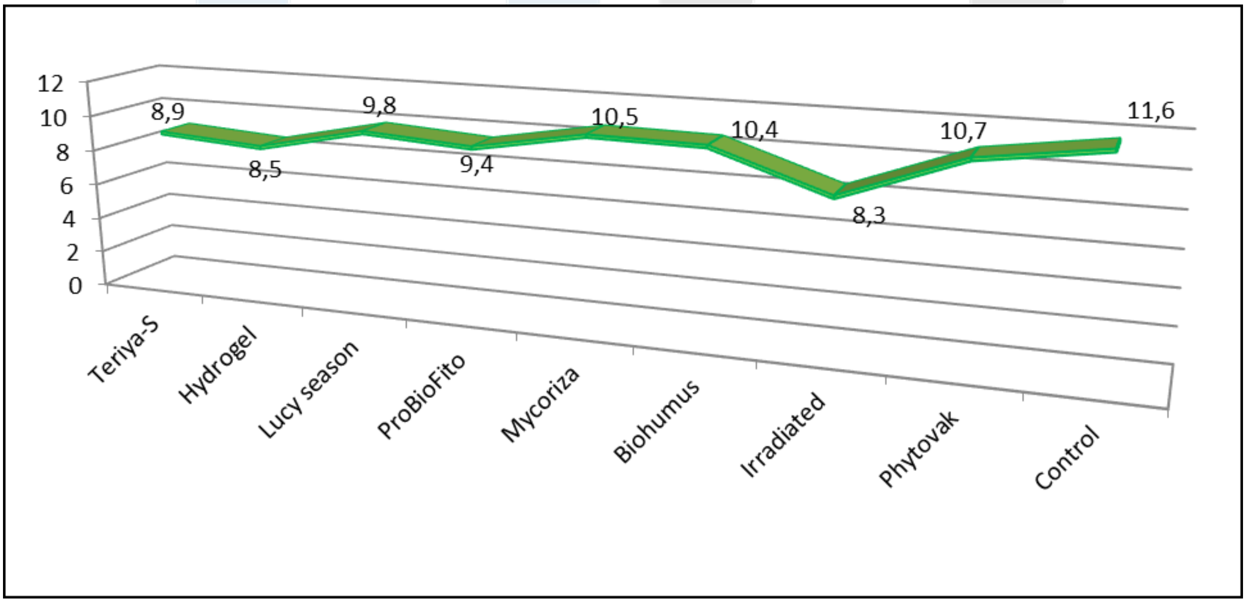

Diagram 4. Average indicators of seed germination of the Kibray variety of Kashgar alfalfa in field conditions (days)

From the data presented in the diagram above, it can be seen that the average germination rate of the Kibray variety of Kashkarbeda under field conditions for 4 replications in the variant with sowing treated with the Teriya-S preparation averaged 8.9 days, with the application of hydrogel to the furrow - 8.5 days, with the application of the Udachniy sezon fertilizer to the furrow - 9.8 days, with the sowing of seeds treated with Probiofito - 9.4 days, with the application of Mycoriza - 10.5 days, with the application of biohumus - 10.4 days, with infrared irradiation - 8.3 days, with the application of phytovak - 10.7 days, and in the control variant with conventional sowing - an average of 11.6 days. Therefore, treating crops with preparations before sowing and then sowing has an effect on seed germination in field conditions. In this case, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3.3 days earlier compared to the usual method, 3.1 days earlier when sowing with hydrogel, and on average 2.7 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant.

Conclusion

Based on the conducted research and the obtained results, the following conclusions can be drawn:

- it was established that the varieties of fodder crops created at the institute, namely the Shalola variety of rye, the Uzbekistan broad-leaved variety of oats, the Kumushsimon prag variety of triticale, and the Kibray variety of Kashgar alfalfa, germinate well even in the Aral Sea region, where the ecological conditions are difficult;
- sowing the seeds of the Shalola variety of rye before sowing with treatment with preparations yielded good results, in particular, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3 days earlier compared to the usual method, 2.7 days earlier when sowing with hydrogel, and an average of 2.4 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant;
- when sowing seeds of the Uzbekistan broadleaf oat variety before sowing with treatment with preparations, good results were obtained, in particular, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3.1 days earlier compared to the usual method, 2.9 days earlier when sowing with hydrogel, and 2.6 days earlier when sowing after treatment with the Teria-S preparation compared to the control variant;
- sowing seeds of the Silver-like prag variety of triticale before sowing with treatment with preparations yielded good results, in particular, when irradiating seeds with infrared rays before sowing and then sowing, germination was observed 3.1 days earlier compared to the usual method, 3 days earlier when sowing with hydrogel, and 2.6 days earlier compared to the control variant when sowing after treatment with the Teria-S preparation;
- when sowing seeds of the Kibray variety of alfalfa in the Aral Sea region, treatment with preparations gives good results, when sown after treatment with the Teriya-S preparation, compared to the control variant, germination is on average 2.7 days earlier, when sown with infrared irradiation - 3.3 days earlier, and when sown with hydrogel - 3.1 days earlier.

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