DEVELOPING NEW VARIETIES OF GRAIN, OIL AND FODDER CROPS ADAPTED TO CLIMATE CHANGES FOR THE RAINFED AREAS OF UZBEKISTAN

Avazbek Rakhimov[1], Mamatkul Jurayev[2], Khamidulle Sheraliyev[1], Makhkam Shodmanov[1], Umbetali Sultanov[1], Gulxumor Turg'unova[3],Lazizjon Fozilov[4], Muxammedmurod Xudayberganov[5]

[1.]Tashkent State Agrarian University,Uzbekisan
[2.]Scientific Research Institute of Rainfed Agriculture, Uzbekisan
[3.]Andijan Institute of Agricultural and Agrotexnologies, Uzbekisan
[4].Fergana State University,Uzbekisan
[5.]Cotton Breeding, Seed Production and Agrotechnologies Research Institute, Uzbekisan

SUMMARY
Uzbekistan's rainfed agricultural regions are increasingly affected by climate variability, including reduced rainfall, higher temperatures, and frequent droughts. To ensure food security and sustainable agricultural productivity, it is crucial to develop crop varieties that are resilient to these changing conditions. This research focuses on breeding and selecting new varieties of grain, oilseed, and fodder crops with enhanced drought tolerance, heat resistance, and stable yields under rainfed conditions. Utilizing advanced breeding techniques, field trials across diverse agro-climatic zones, and collaboration with local farmers, the project aims to introduce high-performing crop varieties that can maintain productivity despite climate stress. The outcomes will support the resilience of Uzbekistan's rainfed agriculture, improve farmer livelihoods, and contribute to national food security.
Climatic conditions of Central Asia are characterized by a large amount of sunlight and heat, suddenly changes in annual and daily air temperature, low annual atmospheric precipitation, dry relative air humidity.
The rainfed lands of Uzbekistan receive less rainfall than other dryland regions of the Central Asian republic, and therefore more droughts are observed.
Scientific researches are being carried out at the Scientific Research Institute of Rainfed Agriculture on the creation of new varieties of grain, oilseed and forage crops for cultivation in the rainfed conditions of Uzbekistan. The yield and productivity of agricultural crops in rainfed lands are strongly influenced by weather conditions during the crop's vegetation.
The article presents the results of research on the effects of intense heat and drought during the growing season on the productivity indicators and productivity of varieties and samples of agricultural crops such as wheat, barley, safflower, flax and alfalfa under conditions of global climate change.
Creation of high-yielding and high-quality new varieties of grain, oilseed and fodder crops that quickly and effectively use the natural soil fertility, organic and mineral fertilizers for planting in dry areas in Uzbekistan, and are resistant to unfavourable conditions of the external environment will ensure their productivity.

Key words.rainfed lands, rainfall, bread wheat, barley, oil crops, safflower, flax, fodder, alfalfa, selection, evaluation, selection, vegetation period, spike, heat and drought tolerant, unfavourable factor, valuable traits, yield, variety, samples, green mass, dry mass, hay.

Key findings.the rainfed areas of Uzbekistan, Jizzakh-1, Moydor,new varieties of grain, oil, and fed crops,

INTRODUCTION

Today, global climate changes continue in the world, and under the influence of climate changes, strong changes are observed in the natural and climatic conditions of the rainfed regions of Uzbekistan. Due to global warming, the occurrence of heat and drought is accelerating.
In Central Asia, including the territory of Uzbekistan, in recent years, drought has been observed along with strong anomalous heat. In this case, the continuous and long duration of anomalous hot days has a negative effect on the development of agricultural crops.The total area of agricultural crops in our republic is 3998,5 thousand hectares, of which 3238,8 thousand hectares are irrigated and 759,7 thousand hectares are arable rainfed lands.
All arable lands of rainfed areas in the country are divided into 4 zones according to altitude, soil and weather conditions:
1. Plain flat region is not provided with precipitation, and the annual rainfall is 250-300 mm, strong weather and soil drought occur in the region in spring and summer.
2. The hill-step regions annual precipitation in this area is 300-350 mm.
3. Foothill region annual rainfall in this region is 400-450 mm.
4. Mountainous region annual precipitation in this region is 450-500 mm and more.

Out of a total of 760 thousand hectares of rainfed lands, including 92 thousand hectares belong to plain flat regions, 564 thousand hectares to hill-step regions, and 104 thousand hectares to foothill and mountainous regions.

In plains and hilly-step regions of rainfed lands, heat and high temperature during the wheat grain ripening period are causing a decrease in grain yield. Currently, Bread Wheat varieties are losing grain yield and quality under the influence of strong anomalous heat due to the long duration of the grain filling period. Development of early grain filling-ripening phase, Bread Wheat varieties resistant to heat and drought will ensure an increase in grain yield in rainfed lands.

In the rainfed regions of Uzbekistan, the yield of Bread Wheat varies according to the cultivated varieties. In years with favourable weather, the yield of Bread Wheat can reach 2,0-3,0 t/ha in dry farming.

In recent years, global climate change has had a negative impact on the yield and productivity of grain crops grown in rainfed regions. In the last 10 years, there is a trend of decrease in the productivity of grain crops (Juraev and Holdorov, 2023).

As a result of scientific research, it was found that Bread Wheat *(Triticum aestvium L.)* varieties with valuable traits and characteristics lose characteristics over the years under the influence of climatic changes, unfavourable conditions of the external environment and diseases(Lobell et al., 1980; Reynolds, 2009).

The increase in air temperature under the influence of global climate change requires the creation of new varieties of soft wheat suitable for the soil-climatic conditions of dry lands, resistant to biotic and abiotic stresses, high bread yield and high protein content(Challinor et al., 2014).

Barley *(Hordeum vulgare)* is one of the oldest grain crops used by humans in the world, and ranks fourth in terms of area and gross yield among cereal crops in world agriculture. In world agriculture, barley grain is mainly used for animal feed, human food and barley malt. Among grain crops, barley is more resistant to the unfavourable factors of the external environment, so it is spread over very wide areas of the globe, it is planted in the northernmost regions of the globe, in arid and semi-arid regions in the south, and at an altitude of 4000 meters above sea level.

In rainfed conditions, the effect of weather conditions on plant productivity is significant. There is a positive correlation between meteorological factors (rainfall, hydrothermal coefficient, reserve moisture in the soil) and productivity indicators of barley, and a negative correlation with high air temperature in the second half of the growing season (Ilina, 1984).

In our republic, the reduction of cotton cultivated areas has a significant effect on the decrease in the volume of vegetable oil production, and the trend of decreasing the volume of vegetable oil production is observed from year to year. Cultivation of oil crops is important to meet the demand of the population for oil products in ensuring food safety.

In Uzbekistan, it is necessary to carry out research on the creation of new varieties of oilseed crops that are quick to adapt to climate changes, have high product quality, and are resistant to abiotic and biotic factors. Oil products obtained from oilseeds such as safflower, linseed and sesame are widely used in the food industry due to their high quality dietary properties (Abdukarimov, 2010; Ortiz et al., 2008; Zang et al, 2018).

By creating new high-yielding varieties of alfalfa with higher nutritional value, protein (protein) content, leafiness and seed yield, together with the increase of the nutritional value obtained from the existing areas, the needs for feed in animal husbandry will be met(Suttie and Reynolds, 2005; Singh, 2020).

In all rainfed regions, planting alfalfa allows more nitrogen nitrate to accumulate in the soil than planting wheat. Alfalfa enriches the soil with humus substance from the third year in step-hill regions that are semi-provided with natural moisture (Isakov et al, 2023).

When sowing green manure crops (soybeans, fodder peas, triticale, triticale+fodder peas) after winter wheat, an additional yield of 0.40-0.56 t/ha^{-1} or 13.0-18.7% was obtained compared to the control. When sowing cotton after green manure crops, the green mass of intermediate crops was more effective compared to the harvested area, and an additional cotton yield of 0.41-0.56 t/ha^{-1} was obtained compared to the control variants [Tadjiyev et al., 2025].

Before sowing oilseeds, the water permeability of the soil is 520-550 m^3/ha^{-1}, in the initial state of the soil in the 0-30 cm layer the humus content was 0.669%, in the unsuitable soil layer 0.597%, total nitrogen 0.054-0.059% and total phosphorus 0.124-0.100% respectively. The general state of nutrients after repeated (oilseed) crops showed a slight increase in their content. The humus content in the cropland layer was 0.663-0.785%, the total nitrogen content in the 0-30 cm soil layer was 0.663-0.785%, the total nitrogen content in the 0-30 cm soil layer was 0.088-0.080%, in the arable soil 0.050-0.069%, and the total phosphorus was 0.130-0.139 and 0.124-0.127%, respectively (Tadjyiev and Tadjyiev, 2023).

MATERIALS AND METHODS

In 2023, Scientific Research Institute of Rainfed Agriculture conducted scientific researches on the creation of high-yielding grain, oilseed and forage crop varieties that are adaptable to global climate changes, resistant to heat and drought for rainfed lands.

All agrotechnical activities on grains and oilseeds were carried out on the basis of recommendations and methods developed in 1994 at Scientific Research Institute of Rainfed Agriculture. Phenological observations,

evaluations and analyzes of various indicators in field and laboratory conditions State Commission for Testing Agricultural Crops (1997) and methodical manuals developed at the former AllUnion Plant Science Institute, methods developed for Tritisum and Hordeum genera of the International SEV classification. The level of drought and heat resistance determination was carried out in the laboratory based on the method of N.Kozhushka and A.M.Volkova. Cultivation of alfalfa crops was carried out based on methodical guidelines for cultivation of forage crops (1987) of Forage Institute named after V.R.Williams. Mathematical and statistical analysis of the obtained data was carried out according to the method of B. Dospekhov and Gen Stat (ANOVA) program.

The experimental fields are located in the flat-hill region of rainfed lands, at an altitude of 580 meters above sea level. The soil is a light colored typical gray soil with weak salinity, 0.18-0.20% nitrogen, 0.16-0.18% phosphorus and 1.6-1.8% potassium in the soil depth of 0-30 cm, pH is 7.9-8.0. Groundwater is located at a depth of 8-10 meters.The annual average rainfall is 362 mm, which varies between 141.2 mm and 616.7 mm between years. Precipitation occurs mainly in winter and spring months. The average annual air temperature is +12.6°C, and the highest temperature rises to +45°C in July. Hot days last 170-250 days a year.

The average annual precipitation in the 2021-2022 agricultural year was 395.3 mm, the average air temperature in October-July was $+10.5^0$C, and in the 2022-2023 agricultural year it was 363.7 mm and $+10.2^0$C, respectively (table 1).

Table 1.
Weather conditions in the years of the experiment (October-July), Gallaaral AGMS data (2021-2023.)

Indicators	Month									Totaloraverage
	X	XI	XII	I	II	III	IV	V	VI	
Precipitation, mm										
Average multi-year	17,1	35,0	55,0	40,4	52,0	65,0	53,6	35,4	8,4	**361,9**
2021-2022	-	18,4	13,8	53,4	13,0	173,6	39,3	78,0	5,8	**395,3**
2022-2023	76,5	53,7	25,3	19,1	106,2	29,3	30,5	23,1	0	**363,7**
Airtemperature, °C										
Average multi-year	12,1	5,9	0,3	-4,0	0,4	5,6	12,7	18,4	24,6	**8,4**
2021-2022	10,0	4,3	3,8	3,4	4,7	4,9	18,2	20,0	25,4	**10,5**
2022-2023	12,5	7,5	1,4	-7,4	4,7	12,2	14,7	19,9	26,5	**10,2**
Relativeairhumidity, %										
Average multi-year	62	73	82	85	82	75	69	59	45	**70**
2021-2022	52	66	75	86	73	76	63	62	43	**66**
2022-2023	58	83	87	79	82	69	62	48	32	**67**

RESULTS AND DISCUCCIONS

Seasonal changes in precipitation are occurring under the influence of global climate change.Improper distribution of precipitation during the plant growth period, lack of moisture in the soil during the critical period of the growth period.It was observed that the weather conditions in these dry lands had a negative effect on the growth and development of crops compared to the years when they were favourable(IPCC, 2022).

Its high yield and the large number of grains in the spike and the size of the grain can evaluate the resistance to drought in wheat. The drought resistance of cereal crops is determined not only by their early maturity, but also by their ability to produce high yields in drought conditions(Dorofeev et al., 1987).

High temperature during the tillering and tubing phase of the plant causes a decrease in the total weight of the spike, which leads to a small number of grains in the spike(Lyashok, 1984).

Wheat varieties of the local type grown in Central Asia are resistant to heat, and the harmful temperature that causes protein coagulation is $+55^0$C+56^0C in the early phases of the plant, and $+61^0$C in the earing-grain filling

phase, the most resistant wheat varieties belonging to other ecotypes are +56,6^{0}C withstands up to +58,2^{0}C (Amanov, 1978; Amanov et al., 2002; Ortiz et al., 2008).

When creating drought-resistant varieties in Uzbekistan, the main direction of selection of grain crops is aimed at creating early varieties, because the period of grain filling-wax ripening in early varieties passes before the onset of heat and drought.

In Central Asia, the earliripening of wheat and barley varieties is determined by the heading phase, the early heading variety is one of the indicators of earliripening. Grain yield depends on productive spikes, number of grains per spike, and 1000 kernel weight. Therefore, it is effective to select samples and lines based on the high number of grains in the spike in the selection of intensive type Bread Wheat varieties for rainfed areas of Uzbekistan (Juraev and Amanov, 2023).

More than 1,200 varieties of Bread Wheat were studied during the researches, the spike length of new varieties and lines, the number of spiklets in the spike, the number of grains in the spike, the weight of grain in the spike, and the weight of 1000 grains were determined, and samples of highly resistant variety and new lines to drought were selected.

According to the results of the research, it was found that the standard Tezpishar variety was fully spiked on April 30, while the KP-2020/43, 35/2020 (ICA), Nushkent, Kizildon, Eritrospermum-40 lines were spiked 3-4 days later. According to the growth period, lines PSI-2020/6, PSI-2020/9 were selected as middle ripening lines, as it was determined that the spike was 6 days later than the standard variety. It was observed that KSI-20/2020/-CP-2016/303 (Grekum-2023), KP-2020/26 lines are 10 days late compared to the standard, and it was found that they are late compared to other lines and that these late-ripening lines have higher productivity indicators.

Productivity indicators were also determined. In the Tezpishar variety, the plant height was 84 cm, the spike length was 10.7 cm, the number of spiklets in the spike was 17.1, the number of grains in the spike was 32.0, and the grain weight in the spike was 1.1 g.

As a result of the analysis, the height of the plant in the KP-2020/26 line is 79 cm, the length of the spike is 10.9 cm, the number of spiklets in the spike is 18.0, the number of grains in the spike is 41.2, and the grain weight in the spike is 1.4 g, KSI-20/2020/-CP-2016/303 (Grekum-2023) variety has a plant height of 96 cm, spike length of 10.6 cm, 21.2 spikletsin the spike, 40.4 grainsin the spike and grain weight of spike 1,6 g,in line PSI-26/2021-01/2020, plant height is 81 cm, spike length is 10.6 cm, the number of spiklets in a spike is 21.2, the number of grains in a spike is 40.1, and the weight of grains in a spike is 1.6 g was determined.It was found that the PSI-26/2021-01/2020 line had higher productivity than other lines.

When analyzing a Competitive variety trial nursery, it was found that samples with high productivity indicators also had high grain yield. The grain yield of the Tezpishar variety is 1.68 tons/ha, in the KP-2020/26 line 2.67 t/ha, in the PSI-2020/6 line 2.24 t/ha, in the KSI-20/2020/-CP-2016/303 (Grekum-2023) line was 2.49 t/ha, and this variety and lines were higher than the standard variety in terms of productivity. As a result of the research, the samples of the variety with high productivity and grain yield showed resistance to heat and drought, although they are late in the growing season (Table 2).

Table 2.
Evaluation of Bread Wheat variety and lines on productivity indicators (Gallaaral, 2023).

№	Variety and lines	Planthei ght, cm	Headingday (d/m)	Mainspikeindicators				Grain yield, t/ha
				length, cm	spiklets, pcs	grains, pcs	grainweig ht, g	
1	Tezpishar (st)	84	30.04.	10,7	17,1	32,0	1,1	1,68
2	Istiklol-6	86	10.05.	10,5	18,2	30,2	1,0	1,69
3	Nushkent	101	03.05.	10,3	16,1	33,5	1,2	2,03
4	Kizildon	82	03.05.	10,5	18,8	38,7	1,3	2,21
5	КSИ-2020/16-КР-2016/58	82	09.05.	9,8	17,4	34,5	1,20	2,49
6	PSI-2020/6	100	06.05.	10,0	17,3	36,1	1,2	2,24
7	KP-2020/38	84	10.05.	11,6	19,4	36,7	1,3	1,92
8	PSI-2020/9	86	06.05.	10,1	16,2	32,9	1,1	2,16
9	35/2020 (ICA)	84	02.05.	10,5	16,3	29,8	1,1	1,79
10	KP-2020/26	79	10.05.	10,9	18,0	41,2	1,4	2,67

11	KP-2020/43	79	02.05.	9,8	17,2	38,3	1,2	2,13
12	PSI-26/2021-01/2020	81	11.05.	12,7	18,9	43,5	1,5	2,0
13	Grekum-2023	96	11.05.	10,6	21,2	40,4	1,6	2,49
	CV (%)							**1,9**
	LSD_{05}							**0,8**

In the Competitive variety trial nursery 16 varieties and lines of barley were studied according to various signs and characteristics under the rainfed conditions. Two years of data on the number of grains per spike and 1000 kernel weight were studied from the main productivity indicators. These traits are characterized by low variation of genotypes under the influence of external adverse factors, and are considered to be the traits that are correctly linked to productivity. Selection of high-yielding barley genotypes in rainfed conditions is considered to be effective based on the number of grains in the spike and 1000 kernel weight (table 3).

Table 3.
Results of productivity, main productivity indicators in barley genotypes (Gallaaral 2022-2023).

№	Variety and lines	Grains on the spike, pcs		1000 kernelweight, g		Grain yield, t/ha	
		2022	2023	2022	2023	2022	2023
1	Unumliarpa (st).	21,2	22,0	56,6	48,6	1,13	2,34
2	Abu Gofur	19,6	20,2	53,4	46,3	0,96	2,22
3	Abu Gofur-20	17,2	22,0	56,4	50,7	0,91	2,53
4	Mushtarak	23,0	16,8	54,2	45,0	1,01	2,26
5	Khotira 59	22,0	20,0	54,2	44,6	1,01	2,21
6	Savruk	20,0	25,8	56,6	50,5	1,11	2,42
7	Noyob	28,2	26,0	52,6	45,7	1,03	2,02
8	Istak	20,8	19,2	48,2	42,1	1,16	2,44
9	15-13	19,6	27,2	45,6	37,8	1,03	2,67
10	NM-21-19	23,6	26,0	46,8	39,6	1,24	2,54
11	DNS-7	20,4	22,0	49,6	44,5	1,31	2,26
12	NM-2-19	19,2	20,0	53,4	45,1	1,21	2,51
13	DNS-28-20	20,4	20,4	54,2	45,2	1,09	2,56
14	DNS-1-21	22,8	24,0	54,6	44,5	1,10	2,62
15	DNS-5-21	20,4	25,2	42,8	40,7	1,01	2,23
16	DNS-10-21	22,8	20,0	46,6	42,0	1,05	2,50
	LSD_{05}					0,19	0,28

In the Competitive variety trial nursery 16 varieties and lines of barley in 2022 and 20 varieties and lines of barley in 2023 were studied in comparison with the standard variety of productive barley, all varieties and lines belong to the two-row *(Hordeumdistichon)* type of barley. In 2022, the number of grains in one spike was 21.2 grains in the standard Unumliarpa, the highest grain number was observed in the Noyob variety (28.2 grains) and the lowest grain number was observed in the NM-2-19 (19.2 grains) line.

In 2022, 6 varieties and lines with higher values than the model variety were obtained, and in 2023, 9 varieties and lines showed results higher than the standard variety Unumliarpa. According to the two-year results, it was found that the number of grains in the ear is higher in Savruk, Noyob varieties and in 15-13, NM-21-19, DNS-1-21 lines. In 2022 the 1000 kernel weight ranges from 42.8 g (DNS-5-21) to 56.6 g (Savruk and Unumliarpa), in 2023 from 37.8 g (15-13) to 50.7 g (Abu Gafur-20) was found to be in the range. Change in 1000 kernel weight was observed in the range of 4.9-18.5% and 14.1% was observed in the standard variety Unumliarpa. In the genotypes, DNS-5-21 (4.9%) and DNS-10-21 (9.9%) lines with little change in 1000 kernel weight were identified. In other varieties and lines of barley, the change in 1000 kernel weight was higher than 10%.

The average two-year productivity of barley varieties and lines was in the range of 1.56-1.89 t/ha and it was 1.74 t/ha in the standard variety Unumliarpa.

In the two years amount of precipitation during the vegetation period was at the level of the average multi-year norm. The difference in the number of grains in the spike and the 1000 kernel weight was 10-15%, the

yield in 2022 was 0.96-1.21 t/ha, in 2023 it was range 2.02-2.67 t/ha. If we compare these two years, the harvest was 1.7-2.8 times higher in 2023 than in 2022 (table 3).

Due to unfavourable weather conditions and less than normal rainfall in spring, there were few signs of disease in Flax nurseries. Rust *(MelampsoraliniDesm)* and fusarium *(Fusarium link)* diseases of flax in samples of varieties numbered 2021/2, 2020/1 (20%), in sample 2020/2 (30%) the symptoms of the disease are the appearance of spores in reddish-yellow pads on leaves and pods during the flowering period. Also, bud drop was observed due to damage of plant points (yellowing symptoms of leaves) by flax trips. As a result of the research, pest-resistant varieties such as Bakhorikor, 2021/1, 2021/3 were selected.

Growth period, high branching, number of grains in pods, and yield indicators of flax samples were compared. Samples of varieties such as Lalmikor, 2021/1, 2021/3, 2020/3 were selected based on the higher complex valuable farm characteristics compared to the standard Bakhmal-2 variety (Table 4).

In the scientific researches in the Competitive Variety testing nursery of Safflower variety samples, blue rot disease of Safflower was detected.

Symptoms of wilting were observed in some branches of the plant, withered leaves, brown spots appeared, as well as the disease of the rust fungus *(Puccinia carthami Corda)* in lines 2018/4 (30%), 2021/1 (20%), 2021/2 (20%), Moldir (30%) and Nurlan varieties (30%) were observed. In the experiments, the symptoms of the rust disease of the plant were manifested by the appearance of dark brown pustules of 1-2 mm in size on the leaves of the plant, the appearance of small round brown spots on the two sides of the plant leaf, and then the yellowing of the leaves was observed. Also, it was observed that the damage caused by the beetle *(Psalidiummakillosum F.)* and the worm caused less damage than every year.

Table 4.
Main indicators of flax variety samples in Competitive Variety testing nursery (Gallaaral, 2022-2023).

№	Vareityandlines	Vegetationperiod, day			Yield, t/ha			Oilontheseed, %		
		2022	2023	mean	2022	2023	mean	2022	2023	mean
1	Bakhmal-2 st.	92	94	93	0,76	0,68	0,72	34,8	36,7	35,8
2	Bakhorikor	89	90	90	0,81	0,79	0,80	36,5	42,6	39,6
3	Lalmikor	90	89	90	0,89	0,85	0,87	36,8	42,1	39,5
4	KP-2020/7	93	94	94	0,79	0,72	0,76	34,4	37,7	36,1
5	2021/1	96	93	95	0,86	0,83	0,85	35,8	38,1	37,0
6	2021/2	92	88	90	0,72	0,7	0,71	34,9	39,2	37,1
7	2021/3	88	87	88	0,8	0,78	0,79	36,2	37,9	37,1
8	2020/1	93	91	92	0,78	0,82	0,80	33,3	36,4	34,9
9	2020/2	91	94	93	0,7	0,8	0,75	36,2	38	37,1
10	2020/3	90	92	91	0,84	0,82	0,83	35,8	37,7	36,8

Seed baskets, the number of seeds in them and the size of the seeds are considered to be the main and important factors that directly affect the quality. It was observed that the high productivity signs change depending on the biological characteristics of the varieties and the quality of the applied agro technical measures.

Safflower variety samples such as Jizzakh-1, Moydor, 2018/8, 2018/10 compared to the standard Milyutin-114 variety have high productivity indicators and signs of productivity, multi-branching, number of branches, number of baskets in one branch and the number of grains in baskets. The growth and full ripening period of this variety samples were observed to be shorter and 4-6 days earlier than standard varieties (Table 5).

Jizzakh-1, Moydor, 2018/8, 2018/10 and Shokhzhulduz, which were studied in the Safflower's Competitive Variety testing nursery, have higher productivity indicators and signs of productivity compared to the standard Milyutin-114 variety, multi-branching, number of branches, baskets on one branch. The number of grains in the baskets were determined. In these varieties, the number of seeds in the baskets differed by 6-14 more than the model Milyutin-114 variety. In addition, although the seeds of studied cultivars belonging to Kazakh selection, such as Moldir and Nurlan, were larger than other cultivars, the number of seed baskets per plant was very small.

Table 5.
Main indicators of safflower variety samples in Competitive Variety testing nursery (Gallaaral, 2022-2023).

№	Vareityandlines	Vegetationperiod, day			Yielding, t/ha			Oil on theseed, %		
		2022	2023	mean	2022	2023	mean	2022	2023	mean
1	Milyutin-114 st.	119	124	121,5	0,75	0,71	0,73	20,8	23,4	22,1
2	Gallaral	118	121	119,5	0,7	0,68	0,69	21,6	28,2	24,9
3	Jizzak-1	117	116	116,5	0,86	0,8	0,83	22,7	23,6	23,2
4	Moydor	118	120	119	0,79	0,76	0,78	21,1	23,5	22,3
5	2018/4		124	124		0,86	0,86	22,3	21,4	21,9
6	2018/8	116	122	119	0,88	0,82	0,85	22	23,7	22,9
7	2018/10	119	126	122,5	0,8	0,75	0,78	21,3	25,4	23,4
8	2021/1	122	126	124	0,84	0,88	0,86	21,7	22,6	22,2
9	2021/2	118	128	123	0,78	0,8	0,79	22,8	23,6	23,2
10	Shokhjuldu z	-	124	124	-	0,75	0,75	-	-	
11	Moldir	-	116	116	-	0,62	0,62	-	-	
12	Nurlan	-	119	119	-	0,65	0,65	-	-	

In all rainfed regions, planting alfalfa allows more nitrogen nitrate to accumulate in the soil than planting wheat. Alfalfa enriches the soil with humus substance from the third year in plain and step hill regions that are semi-provided with natural content of alfalfa stems is 17.8% in dry land and 17.7% in irrigated land. Fiber content is 26.6% in dry land and 24.9% in irrigated land. Alfalfa doubles the fertility of the land after itself. Quick adaptation to environmental factors in different natural climate-soil conditions is important in genetic preparation of the variety.

It is known, from many years of scientific research that alfalfa is the main crop among fodder crops in dry lands. However, the climate changes observed in recent years are causing the thinning of alfalfa crops in summer months due to the effects of drought and heat. In order to solve this problem through selection, it is necessary to carry out scientific research, to create genotypes suitable for the soil and climate conditions of dry regions and resistant to the conditions of climate changes(FAO, 2020).

Research and evaluation of alfalfa crops at the selection stages, selection of new lines with 10% higher hay and seed yield, 3-5% higher in foliage and 1-2% higher protein content than the standard was carried out.

At a result of scientific research, new lines with higher foliage level and nutrient unit, higher protein content in hay than standard varieties, high hay and seed yield were selected.

The evaluation of economically valuable traits of alfalfa varieties and breeding lines was conducted in the Competitive Variety Testing nursery under the conditions of Gallaaral in 2023. Significant variability was observed among genotypes for morphological and productivity traits.

Table 6.
Description of valuable traits of alfalfa varieties and breeding lines in the Competitive Variety Testing Nursery (Gallaaral, 2023)

No	Variety / Line	Plant height (cm)	Branching (pcs)	Foliage (%)	Green mass (t/ha)	Hay (t/ha)	Seeds (t/ha)
1	Aridnaya (st.)	77.5	6.2	43.1	11.70	3.90	0.11
2	№ 504	85.0	6.8	53.7	14.88	4.98	0.12
3	№ 606	77.0	7.1	44.2	14.67	4.86	0.17
4	№ 610	87.0	6.8	54.3	12.45	4.15	0.13
5	№ 503	82.0	7.1	45.6	14.45	4.81	0.15
6	№ 2003/5	80.5	6.8	63.6	12.89	4.31	0.14
7	№ 2003/10	85.5	7.1	56.4	11.84	3.95	0.15
8	№ 63/25	85.5	6.7	57.7	12.61	4.47	0.18
9	№ 105	82.0	6.8	46.3	11.04	3.68	0.17
	Mean ± SE				12.95 ± 0.47	4.35 ± 0.16	0.147 ± 0.008
	CV, %				10.8	10.7	16.3
	$LSD_{0.05}$				1.48	0.29	0.021

Plant height varied from 77.0 cm (line No. 606) to 87.0 cm (line No. 610), with the standard cultivar *Aridnaya* measuring 77.5 cm. Lines No. 504, 610, 2003/10, and 63/25 were taller, indicating potential for higher biomass yield.

Branching ranged between 6.2 and 7.1 stems per plant. Lines No. 606, 503, and 2003/10 exhibited maximum branching, suggesting enhanced shoot development.Foliage percentage, influencing forage quality, ranged from 43.1% to 63.6%, with line 2003/5 showing the highest leafiness. Lines 63/25, 2003/10, and 610 also had higher foliage than the standard.Green mass yield ranged from 11.04 t/ha (No. 105) to 14.88 t/ha (No. 504).

Lines 504, 606, and 503 significantly exceeded the standard cultivar (11.70 t/ha) as the differences were greater than the LSD_{05} value (1.48 t/ha).Hay yield ranged from 3.68 to 4.98 t/ha, with lines 504, 606, and 503 outperforming the standard (3.90 t/ha, LSD_{05} = 0.29 t/ha).Seed productivity varied from 0.11 to 0.18 t/ha, with line 63/25 achieving the highest yield, indicating suitability for seed-oriented selection (LSD_{05} = 0.021 t/ha).Overall, lines 504, 606, 503, and 63/25 demonstrated superior performance in green mass, hay, and seed yield, confirming their breeding value and potential for further advancement in selection programs under rainfed conditions of Gallaaral (Gallaaral, 2023).

Consultations

It was found that the yield of agricultural crops grown in dry regions of Uzbekistan is strongly influenced by weather conditions, in addition to the genetic potential of varieties.

Despite the fact that the amount of precipitation in 2021-2023 is higher than the long-term average, the lack of temperature in March, precipitation in April is observed only in the last days of the month, and the air temperature is $+5.5^0$C higher than the average multi-year norms, which is negative for the growth and development of grain crops in the tuber-heading phases affected and resulted in less formation of productive stems.

According to the results of the research, it was found that it is effective to carry out selection work on the number of grains in the spike in BreadWheat in rainfed conditions of Uzbekistan. High grain yield was observed in varieties and lines with a large number of grains per spike. It was also proved that there is a weak relationship between the number of grains in the spike, grain yield, and 1000 kernel weight. As a result of research, it was found out that the number of grains in the spike is high and the grain yield is low even if the weight of 1000 kernel weight is high, and the grain yield is low even if the weight of 1000 kernel weight is high.It was observed that the number of grains in the spike and the 1000 kernel weight did not decrease in the varieties and lines of barley, but the productivity was low.

The oil crop Flax growth period, top branching, number of grains in pods and productivity of the varieties studied in the Competitive Variety testing nursery were compared. Samples of varieties such as Lalmikor, 2021/1, 2021/3, 2020/3 were distinguished in terms of their tolerance to external environmental conditions and higher complex valuable economic signs compared to other samples of varieties. In the experiments of Competitive Variety testing nursery, it grows very slowly at the beginning of germination, full germination in 14-17 days, arching in 15-18 days, budding in 21-26 days, flowering in 8-10 days, and ripening in 22-29 days duration was from 87 to 94 days.

It can also be concluded from the data obtained from the Competitive Variety testing nursery that the seed baskets of Safflower, the number and size of seeds in them are the main and important factors that directly affect the productivity. It was observed that the biological characteristics of the varieties and the applied agro technical measures affected the high productivity signs. It was determined that the variety samples such as Jizzakh-1, Moydor, 2018/8, 2018/10 had more branching than the standard variety, the number of branches, the number of baskets in one branch, and the number of grains in the baskets.

According to the results of scientific studies, alfalfa lines 504, 610, 63/25, 503 have a blue stalk (yield 0.5-2.7 t/ha) and hay yield (0.17-0.41 t/ha), average branching of the plant (0.6-10.8 pieces), foliage (1.1-20.5%) was high.Alfalfa lines 504, 610, 63/25, 503 were selected as varieties and lines with high leafiness, blue stem and hay yield, and resistance to drought and heat.

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