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Ecological Trials for the High-Yielding, Stress-Tolerant and the Suitable for the Uzbekistan Conditions Rice Cultivars

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Annotation: Since rice is the staple food of more than half of the world's population, it is also the staple food of the population of our republic.

Keywords: modern, geographic, agricultural, moisture, early-ripening.

Introduction

Currently, rice is sown throughout the country on an area of about 129000 hectares with a gross yield of 611130 tons of rice. Of these, the main crop is 87.7 thousand hectares, the second crop is 41.7 thousand hectares. The main varieties of rice: UzROS 7-13, Lazurniy, Mustakillik, Tarona, mid-ripening Iskander, early-ripening Nukus-2.

Our government is carrying out comprehensive reforms to ensure the needs and security of the population in food. In particular, Decree No. PP-4973 of the President of the Republic of Uzbekistan dated February 2, 2021 “On measures for the further development of rice growing” was adopted. This decree defines the tasks of widespread use of water-saving technologies in the cultivation of rice, as well as the introduction of sowing rice seeds with modern seeders into production.

Due to its geographic location, Uzbekistan is highly vulnerable to the impacts of climate change. In recent years, we have seen increasingly severe droughts that have a negative impact on all types of water bodies, disrupting their natural functions, as well as the health and well-being of the population and economy. The agricultural sector is particularly vulnerable.

In the event of drought, crops are suppressed, crop failures and/or crop losses occur over large areas. Due to the increase in air temperature, the spring-summer vegetation of all types of vegetation on desert pastures will begin 5-10 days earlier and the total evaporation will increase, which will lead to a faster decrease in soil moisture reserves.

Based on the experience of rice cultivation in developed countries and the experience of scientists dealing with drought tolerance, it can be concluded that the development and use of drought-resistant rice varieties in agriculture will protect crops and conserve water resources in drought conditions. In addition, within the framework of the project, the use of early-ripening and drought-resistant rice varieties can help us save a lot of water in drought conditions in Uzbekistan.

Research aim

To develop and introduce improved rice varieties to obtain stable yields under abiotic stress conditions in Uzbekistan.

Objectives

To develop and test short-duration, DSR suitable drought tolerant breeding lines for suitable abiotic stress conditions of Uzbekistan.

- To develop and test elite germplasm from the RDA-GUVA project under irrigated conditions of Uzbekistan
- Conduct capacity building activities through short training in stress phenotyping and breeding techniques.

2. Methodology

The research to be carried out in Uzbekistan was planned to include 2 types of trials: drought and salinity assessment. It was planned to conduct salinity tests in hotspot conditions and drought screening in induced environments in a stress and non-stress manner. Based on the natural soil and climate conditions of the regions, stress and non-stress drought screening trails were planned to be implemented in the Namangan and Tashkent regions, while salinity stress trails in the Republic of Karakalpakistan.

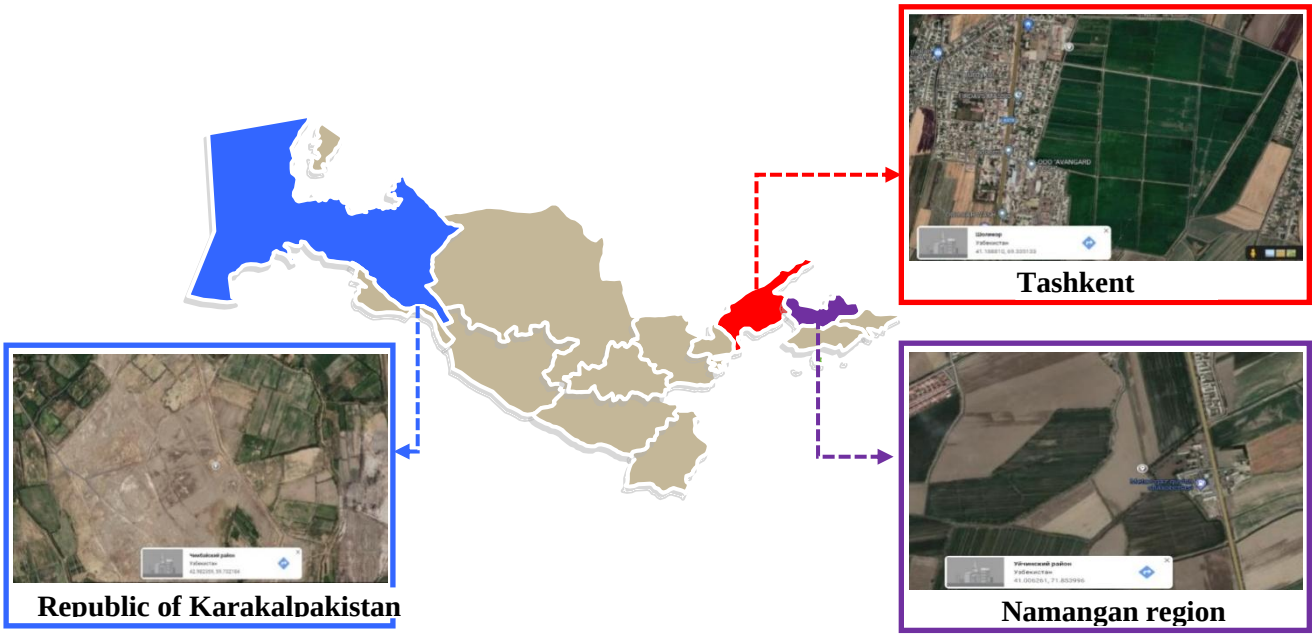

Fig.1. Field test locations.

2.1. Plant materials.

As plant materials, 100 lines, 4 global checks were expected to be received from international rice research institute (IRRI) for each trait, and the seeds did not arrive due to time lost in document preparation. Thus, for drought non-stress and stress field trails, 51 local entry lines and 5 local check lines were used. Additionally, for the salinity experimental trails, 45 local entry lines, 5 local checks, and 2 global check lines (IR50404 and OM 2517) were utilized.

2.2. *Experiment site*

2.2.1. Tashkent region.

The experiment was conducted in the farmer's paddy field of Urtachircik district Tashkent region during the rice cultivation season from May to October 2022.

Randomization plot design was used for field experiments. The plot size was 4m x 3 rows x 0.25m spacing, seed rate: 4g per row (12g per plot) (Fig.2.1.1.).

Experimental design

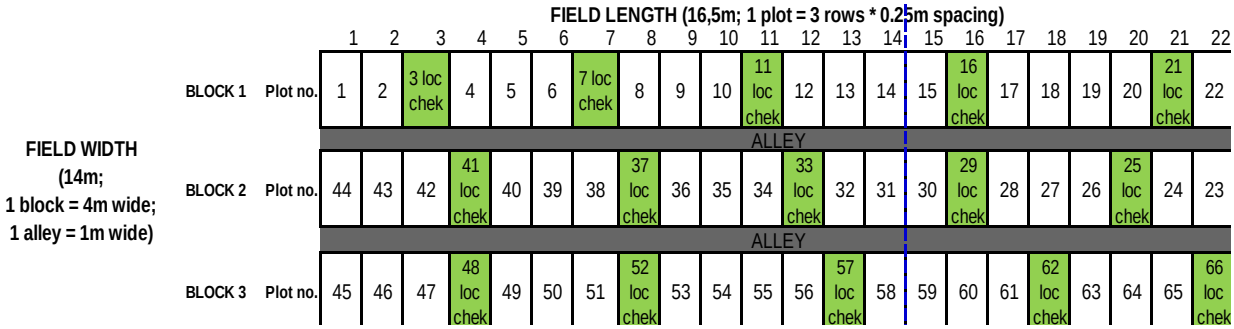

Fig.2.2.1.1. Experimental design

PlotNum	Designation
1	local entry 1 сел.п.3
2	local entry 18 сел.п.51
3	local check 1 Искандар
4	local entry 2 сел.п.5
5	local entry 34 сел.п.78
6	local entry 19 сел.п.52
7	local check 2 Лазурний
8	local entry 3 сел.п.6
9	local entry 20 сел.п.53
10	local entry 35 сел.п.82
11	local check 3 Нукус-2
12	local entry 4 сел.п.10
13	local entry 36 сел.п.86
14	local entry 21 сел.п.55
15	local entry 47 сел.п.112
16	local check 4 Гулжахон
17	local entry 5 сел.п.12
18	local entry 37 сел.п.90
19	local entry 22 сел.п.59
20	local entry 6 сел.п.16
21	local check 5 Тарона
22	local entry 44 сел.п.105
23	local entry 28 сел.п.71
24	local entry 12 сел.п.34
25	local check 3 Нукус-2
26	local entry 39 сел.п.97
27	local entry 27 сел.п.69
28	local entry 11 сел.п.27
29	local check 2 Лазурний
30	local entry 49 сел.п.117
31	local entry 26 сел.п.66
32	local entry 10 сел.п.23
33	local check 1 Искандар
34	local entry 43 сел.п.104
35	local entry 25 сел.п.65
36	local entry 9 сел.п.21
37	local check 5 Тарона
38	local entry 38 сел.п.93
39	local entry 24 сел.п.64
40	local entry 8 сел.п.19
41	local check 4 Гулжахон
42	local entry 46 сел.п.108
43	local entry 23 сел.п.63
44	local entry 7 сел.п.17
45	local entry 13 сел.п.36
46	local entry 29 сел.п.72
47	local entry 40 сел.п.100
48	local check 2 Лазурний
49	local entry 14 сел.п.37
50	local entry 30 сел.п.73
51	local entry 50 сел.п.8
52	local check 3 Нукус-2
53	local entry 15 сел.п.43
54	local entry 31 сел.п.75
55	local entry 45 сел.п.107
56	local entry 41 сел.п.101
57	local check 4 Гулжахон
58	local entry 16 сел.п.44
59	local entry 32 сел.п.76
60	local entry 51 сел.п.67
62	local check 5 Тарона
63	local entry 17 сел.п.46
64	local entry 33 сел.п.77
65	local entry 42 сел.п.102
65	local entry 48 сел.п.114
66	local check 1 Искандар

Fig.2.2.1.2. List of varieties

Fertilizer application

The basal fertilizers of nitrogen (N) 40 kg ha^{-1}as urea, phosphorus (P_2O_5) 100 kg ha^{-1}as ammophos and potassium (K_2O) 50 kg ha^{-1}as potassium chloride were applied the seeds have already been covered with soil. N 50 kg ha^{-1} of as ammonium sulfate were applied 40DAS. Also 30 kg ha^{-1} of N as ammonium sulfate and K_2O 50 kg ha^{-1} were applied 60DAS (Table 1).

Table 2.2.1. Amounts of fertilizers appliyed in the experimental a field

Nutrients	Application amounts (kg ha-1)			
	Basal	40DAS	60DAS	Total
N	40	50	30	120
P_2O5	100			100
K_2O	50		50	100

Drought imposition

i. The field was irrigated whenever necessary for seedling growth.
ii. The drought imposed in 45DAS. For this, embankments and drains around the field were opened.
iii. Drought conditions were measured in the afternoon:
   a) Using **piezometer**:
   The piezometer used was regularly checked for water table depth and re-irrigated when water table was below 100 cm.
   b) Using a **tensiometer**:
   Tensiometer readings were checked regularly. When the average readings of strain gauges dropped to -50 kPa, the embankments and water outlets were closed and re-irrigation started.
   c) Using **check varieties**:
   Tolerant check varieties were scored as '3' in the Standard Evaluation System for Rice (SES 5th Edition) rating for leaf rolling at the vegetative stage.
iv. After watering, let the water drain and let the soil dry.
v. The cycle of overlaying drought and re-watering was repeated until the plant reached maturity.

Data collected

i. Date of seeding
ii. Germination score at 10DAS
iii. Early vegetative vigor score at 10DAS
iv. Date of 50% flowering
v. Plant Height (3 plants)
vi. Plant phenotypic acceptability (PAcp)
vii. Plot yield (g)
viii. Moisture content
ix. Date of harvest
x. Daily water table readings

2.2.2. Namangan region.

Experiment site

The experiment was conducted in the farmer's paddy field of Uychi district Namangan region during the rice cultivation season from May to October 2022.

Experimental Design

Experimental used the randomization plot design. The plot size was 4m x 3rows x 0.25m spacing, seed rate: 4g per row (12g per plot) (Fig.2.2.2.1.).

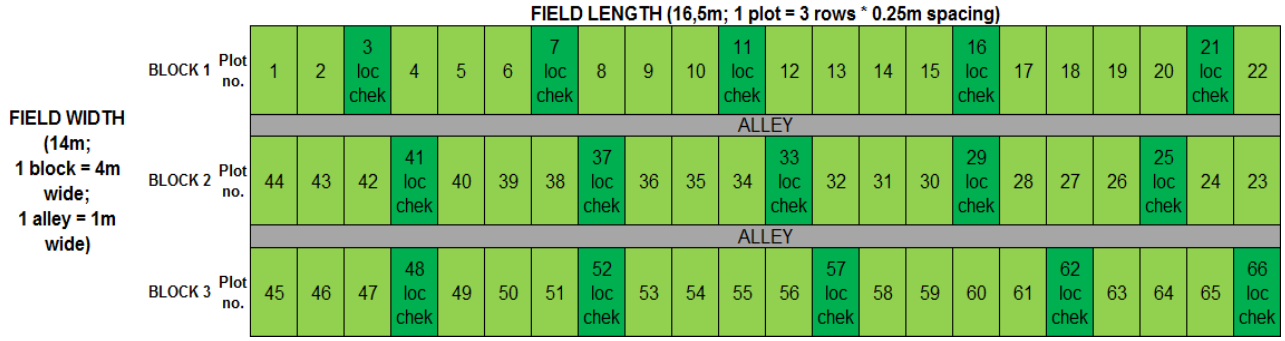

Fig.2.2.2.1. Experimental design

PlotNum	Entry no.	Designation
1	1	local entry 1 сел.п.3
2	18	local entry 18 сел.п.34
3	52	local check 1 Искандар
4	2	local entry 2 сел.п.6
5	34	local entry 34 сел.п.71
6	19	local entry 19 сел.п.36
7	55	local check 2 Лазурний
8	3	local entry 3 сел.п.7
9	20	local entry 20 сел.п.37
10	35	local entry 35 сел.п.72
11	58	local check 3 Нукус-2
12	4	local entry 4 сел.п.9
13	36	local entry 36 сел.п.74
14	21	local entry 21 сел.п.38
15	47	local entry 47 сел.п.105
16	61	local check 4 Гулжахон
17	5	local entry 5 сел.п.11
18	37	local entry 37 сел.п.76
19	22	local entry 22 сел.п.39
20	6	local entry 6 сел.п.12
21	64	local check 5 Тарона
22	44	local entry 44 сел.п.100
23	28	local entry 28 сел.п.56
24	12	local entry 12 сел.п.20
25	59	local check 3 Нукус-2
26	39	local entry 39 сел.п.78
27	27	local entry 27 сел.п.52
28	11	local entry 11 сел.п.19
29	56	local check 2 Лазурний
30	49	local entry 49 сел.п.108
31	26	local entry 26 сел.п.51
32	10	local entry 10 сел.п.17
33	53	local check 1 Искандар
34	43	local entry 43 сел.п.93
35	25	local entry 25 сел.п.46
36	9	local entry 9 сел.п.15
37	65	local check 5 Тарона
38	38	local entry 38 сел.п.77
39	24	local entry 24 сел.п.44
40	8	local entry 8 сел.п.14
40	30	local entry 30 сел.п.59
41	62	local check 4 Гулжахон
42	46	local entry 46 сел.п.104
43	23	local entry 23 сел.п.43
44	7	local entry 7 сел.п.13
45	13	local entry 13 сел.п.21
46	29	local entry 29 сел.п.58
47	40	local entry 40 сел.п.80
48	57	local check 2 Лазурний
49	14	local entry 14 сел.п.22
51	50	local entry 50 сел.п.113
52	60	local check 3 Нукус-2
53	15	local entry 15 сел.п.23
54	31	local entry 31 сел.п.60
55	45	local entry 45 сел.п.102
56	41	local entry 41 сел.п.81
57	63	local check 4 Гулжахон
58	16	local entry 16 сел.п.27
59	32	local entry 32 сел.п.65
60	51	local entry 51 сел.п.117
62	66	local check 5 Тарона
63	17	local entry 17 сел.п.28
64	33	local entry 33 сел.п.69
65	42	local entry 42 сел.п.84
65	48	local entry 48 сел.п.107
66	54	local check 1 Искандар

Fig.2.2.2.2. List of varieties

Fertilizer application

The basal fertilizers of nitrogen (N) 40 kg ha^{-1}as urea, phosphorus (P_2O_5) 100 kg ha^{-1}as ammophos and potassium (K_2O) 50 kg ha^{-1}as potassium chloride were applied the seeds have already been covered with soil. N 50 kg ha^{-1} of as ammonium sulfate were applied 40DAS. Also 30 kg ha^{-1} of N as ammonium sulfate and K_2O 50 kg ha^{-1} were applied 60DAS (Table 2.2.1.).

Table 2.2.2.1. Amounts of fertilizers applied in the experimental a field

Nutrients	Application amounts (kg ha-1)			
	Basal	40DAS	60DAS	Total
N	40	50	30	120
P_2O5	100			100
K_2O	50		50	100

Drought imposition

i. The field was irrigated whenever necessary for seedling growth.
ii. The drought imposed in 45DAS. For this, embankments and drains around the field were opened.
iii. Drought conditions were measured in the afternoon:
   d) Using **piezometer**:
   The piezometer used was regularly checked for water table depth and re-irrigated when water table was below 100 cm.
   e) Using **check varieties**:
   Tolerant check varieties were scored as '3' in the Standard Evaluation System for Rice (SES 5th Edition) rating for leaf rolling at the vegetative stage.
iv. After watering, let the water drain and let the soil dry.
v. The cycle of overlaying drought and re-watering was repeated until the plant reached maturity.

Data collected

i. Date of seeding
ii. Germination score at 10DAS
iii. Early vegetative vigor score at 10DAS
iv. Date of 50% flowering
v. Plant Height (3 plants)
vi. Plant phenotypic acceptability (PAcp)
vii. Plot yield (g)
viii. Moisture content
ix. Date of harvest
x. Daily water table readings

2.2.3. Karakalpakistan Republic

Experiment site

The experiment was conducted in the farmer's paddy field of Chimbay district Republic of Karakalpakistan during the rice cultivation season from May to October 2022.

Experimental Design

Experimental used the randomization plot design. The plot size was 4m x 3rows x 0.25m spacing, seed rate: 4g per row (12g per plot) (Fig.2.2.3.1.).

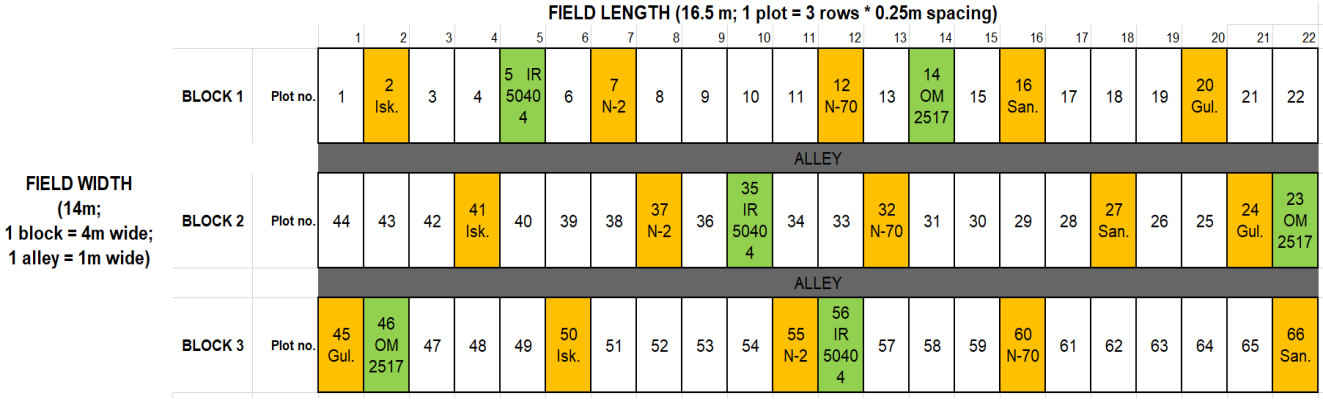

Fig.2.2.3.1. Experimental design

PlotNum	Entry no.	Designation	Rep	Block
1	32	local entry 32 кол.п. 308	1	1
2	46	local check 1 Iskandar	1	1
3	1	local entry 1 сел.п. 6	1	1
4	39	local entry 39 кол.п. 319	1	1
5	61	IR 50404	1	1
6	14	local entry 14 кол.п. 168	1	1
7	49	local check 2 Nukus-2	1	1
8	2	local entry 2 сел.п. 8	1	1
9	33	local entry 33 кол.п. 309	1	1
10	43	local entry 43 кол.п. 385	1	1
11	15	local entry 15 кол.п. 186	1	1
12	52	local check 3 Nukus-70	1	1
13	3	local entry 3 сел.п. 60	1	1
14	64	OM 2517	1	1
15	40	local entry 40 кол.п. 321	1	1
16	55	local check 4 Sanam	1	1
17	34	local entry 34 кол.п. 310	1	1
18	4	local entry 4 сел.п. 72	1	1
19	16	local entry 16 кол.п. 193	1	1
20	58	local check 5 Guliston	1	1
21	44	local entry 44 кол.п. 402	1	1
22	5	local entry 5 сел.п. 76	1	1
23	65	OM 2517	2	2
24	59	local check 5 Guliston	2	2
25	21	local entry 21 кол.п. 247	1	2
26	36	local entry 36 кол.п. 316	1	2
27	56	local check 4 Sanam	2	2
28	20	local entry 20 кол.п. 246	1	2
29	9	local entry 9 кол.п. 93	1	2
30	28	local entry 28 кол.п. 271	1	2
31	41	local entry 41 кол.п. 325	1	2
32	53	local check 3 Nukus-70	2	2
33	19	local entry 19 кол.п. 244	1	2

PlotNum	Entry no.	Designation	Rep	Block
31	41	local entry 41 кол.п. 325	1	2
32	53	local check 3 Nukus-70	2	2
33	19	local entry 19 кол.п. 244	1	2
34	8	local entry 8 кол.п. 92	1	2
35	62	IR 50404	2	2
36	27	local entry 27 кол.п. 268	1	2
37	50	local check 2 Nukus-2	2	2
38	18	local entry 18 кол.п. 243	1	2
39	7	local entry 7 кол.п. 79	1	2
40	35	local entry 35 кол.п. 311	1	2
41	47	local check 1 Iskandar	2	2
42	26	local entry 26 кол.п. 267	1	2
43	17	local entry 17 кол.п. 242	1	2
44	6	local entry 6 сел.п. 80	1	2
45	60	local check 5 Guliston	3	3
46	66	OM 2517	3	3
47	10	local entry 10 кол.п. 94	1	3
48	22	local entry 22 кол.п. 248	1	3
49	29	local entry 29 кол.п. 296	1	3
50	48	local check 1 Iskandar	3	3
51	37	local entry 37 кол.п. 317	1	3
52	11	local entry 11 кол.п. 101	1	3
53	42	local entry 42 кол.п. 380	1	3
54	23	local entry 23 кол.п. 249	1	3
55	51	local check 2 Nukus-2	3	3
56	63	IR 50404	3	3
57	12	local entry 12 кол.п. 134	1	3
58	24	local entry 24 кол.п. 257	1	3
59	30	local entry 30 кол.п. 306	1	3
60	54	local check 3 Nukus-70	3	3
61	38	local entry 38 кол.п. 318	1	3
62	45	local entry 45 кол.п. 412	1	3
63	25	local entry 25 кол.п. 266	1	3
64	13	local entry 13 кол.п. 150	1	3
65	31	local entry 31 кол.п. 307	1	3
66	57	local check 4 Sanam	3	3

Fig.2.2.3.2. List of varieties

Fertilizer application

The basal fertilizers of nitrogen (N) 40 kg ha^{-1}as urea, phosphorus (P_2O_5) 100 kg ha^{-1}as ammophos were applied the seeds have already been covered with soil. N 50 kg ha^{-1} of as ammonium sulfate

were applied 40DAS. Also 30 kg ha^{-1} of N as ammonium sulfate were applied 60DAS (Table 2.2.3.1.). Salinity stress at the reproductive and maturity stage was assessed on 5 scales based on the visual appearance of plants (Table 2.2.3.2.).

Table 2.2.3.1. Amounts of fertilizers applied in the experimental a field

Nutrients	Application amounts (kg ha-1)			
	Basal	40DAS	60DAS	Total
N	40	50	30	120
P_2O5	100			100

Table 2.2.3.2. Scale for evaluation score for salinity stress at reproductive and maturity stage

Scale	Description	Symptom
1	Highly	Normal growth, spikelet sterility at ≤5%
3	Tolerant	Growth slightly stunted, spikelet sterility at > 5%-20%
5	Moderately tolerant	Growth moderately stunted, ¼ of all leaves brown, panicles partially exerted, spikelet sterility at 21%-40%
7	Sensitive	Growth severely stunted with about ½ of all leaves become brown, panicles poorly exerted, high sterility at 41%-70%
9	Highly sensitive	Growth severely stunted with almost all the leaves become brown, panicles not exerted, delayed heading or papery florets, chaffy panicle with very high sterility at >70%

Data collected

i. Date of seeding
ii. Germination score at 10DAS
iii. Early vegetative vigor score at 10DAS
iv. Date of 50% flowering
v. Plant Height (3 plants)
vi. Plant phenotypic acceptability (PAcp)
vii. Standard evaluation score for salinity severity at reproductive stage
viii. Standard evaluation score for salinity severity at maturity stage
ix. Plot yield (g)
x. Moisture content
xi. Date of harvest

3. Results

3.1. Tashkent region

The experimental lines in the study conducted in the Tashkent region were planted on June 4. It was found that some lines showed full germination on June 14, while others performed full germination on June 15, June 16, June 17, June 18, and even on June 19. Also, 50% flowering in local entry and local check lines was first detected on August 8 and continued until August 16. When compared to the local control varieties, it was discovered that Nukus 2 flowered earlier (on August 8) than Guliston and Iskandar rice varieties, which flowered on August 14 and 18, respectively. Also, other local entries and local check varieties achieved 50% flowering after August 20 (Table 3.1.1).
Of the studied local entries, 17 (3, 4, 5, 8, 9, 10, 11, 15, 17, 20, 32, 33, 36, 37, 44, 46, and 50) were not fully matured. That is, the wax stopped developing during the ripening phase. The remaining 34 lines were found to be of varying degrees of maturity. Plant samples were taken from the field and productivity indicators were determined based on biometric analysis. For this, local entries with (3546-4513 kg ha^{-1}) yields similar to the control types were chosen (3536-4164 kg ha^{-1}).

Table 3.1.1. Results of field trail phenological and biometric observations in the Tashkent region.

Designation	Seeding date	Germination	FLW	HT, sm	Yield, kg h^{-1}	DOH	PACP
local entry 1 sel.p.3	04.06.2022	16.06.2022	08.09.2022	114,3	1764	14.10.2022	5
local entry 2 sel.p.5	04.06.2022	18.06.2022	28.08.2022	93,0	2745	08.10.2022	
local entry 3 sel.p.6	04.06.2022	19.06.2022	13.09.2022	114,0	no maturity		
local entry 4 sel.p.10	04.06.2022	19.06.2022	12.09.2022	117,0	no maturity		
local entry 5 sel.p.12	04.06.2022	18.06.2022	12.09.2022	123,0	no maturity		
local entry 6 sel.p.16	04.06.2022	15.06.2022	20.08.2022	127,3	3975	08.10.2022	5
local entry 7 sel.p.17	04.06.2022	17.06.2022	26.08.2022	129,0	3128	08.10.2022	
local entry 8 sel.p.19	04.06.2022	18.06.2022	12.09.2022	114,0	no maturity		
local entry 9 sel.p.21	04.06.2022	19.06.2022	13.09.2022	119,0	no maturity		
local entry 10 sel.p.23	04.06.2022	18.06.2022	15.09.2022	135,3	no maturity		
local entry 11 sel.p.27	04.06.2022	18.06.2022	12.09.2022	107,3	no maturity		
local entry 12 sel.p.34	04.06.2022	16.06.2022	27.08.2022	116,0	2953	08.10.2022	5
local entry 13 sel.p.36	04.06.2022	16.06.2022	24.08.2022	117,7	2976	08.10.2022	5

local entry 14 sel.p.37	04.06.2022	16.06.2022	24.08.2022	133,0	3119	08.10.2022	
local entry 15 sel.p.43	04.06.2022	17.06.2022	14.09.2022	141,0	no maturity		
local entry 16 sel.p.44	04.06.2022	17.06.2022	26.08.2022	129,0	2383	08.10.2022	
local entry 17 sel.p.46	04.06.2022	18.06.2022	16.09.2022	128,3	no maturity		
local entry 18 sel.p.51	04.06.2022	18.06.2022	26.08.2022	110,7	2522	08.10.2022	
local entry 19 sel.p.52	04.06.2022	16.06.2022	02.09.2022	117,3	2024	12.10.2022	
local entry 20 sel.p.53	04.06.2022	17.06.2022	16.09.2022	117,7	no maturity		
local entry 21 sel.p.55	04.06.2022	16.06.2022	01.09.2022	114,3	2032	12.10.2022	
local entry 22 sel.p.59	04.06.2022	15.06.2022	06.09.2022	122,7	1658	14.10.2022	
local entry 23 sel.p.63	04.06.2022	16.06.2022	03.09.2022	123,7	2106	12.10.2022	5
local entry 24 sel.p.64	04.06.2022	18.06.2022	26.08.2022	102,3	2345	08.10.2022	
local entry 25 sel.p.65	04.06.2022	17.06.2022	01.09.2022	134,0	1942	12.10.2022	5
local entry 26 sel.p.66	04.06.2022	17.06.2022	25.08.2022	107,0	2790	08.10.2022	
local entry 27 sel.p.69	04.06.2022	17.06.2022	02.09.2022	104,7	1958	12.10.2022	5
local entry 28 sel.p.71	04.06.2022	16.06.2022	25.08.2022	111,7	2283	08.10.2022	
local entry 29 sel.p.72	04.06.2022	15.06.2022	09.09.2022	128,3	1791	14.10.2022	3
local entry 30 sel.p.73	04.06.2022	16.06.2022	21.08.2022	124,0	4164	08.10.2022	
local entry 31 sel.p.75	04.06.2022	16.06.2022	25.08.2022	144,0	3869	08.10.2022	
local entry 32 sel.p.76	04.06.2022	16.06.2022	16.09.2022	131,0	no maturity		
local entry 33 sel.p.77	04.06.2022	18.06.2022	15.09.2022	137,7	no maturity		
local entry 34 sel.p.78	04.06.2022	17.06.2022	27.08.2022	122,3	3111	08.10.2022	5
local entry 35 sel.p.82	04.06.2022	17.06.2022	27.08.2022	120,3	3180	08.10.2022	
local entry 36 sel.p.86	04.06.2022	17.06.2022	16.09.2022	130,7	no maturity		
local entry 37 sel.p.90	04.06.2022	19.06.2022	13.09.2022	115,3	no maturity		

local entry 38 sel.p.93	04.06.2022	16.06.2022	08.09.2022	105,3	1711	14.10.2022	3
local entry 39 sel.p.97	04.06.2022	16.06.2022	22.08.2022	121,0	3536	08.10.2022	3
local entry 40 sel.p.100	04.06.2022	15.06.2022	22.08.2022	133,0	4000	08.10.2022	3
local entry 41 sel.p.101	04.06.2022	15.06.2022	21.08.2022	144,7	4008	08.10.2022	5
local entry 42 sel.p.102	04.06.2022	14.06.2022	25.08.2022	133,0	2460	08.10.2022	3
local entry 43 sel.p.104	04.06.2022	14.06.2022	21.08.2022	144,3	4004	08.10.2022	
local entry 44 sel.p.105	04.06.2022	17.06.2022	14.09.2022	117,3	no maturity		
local entry 45 sel.p.107	04.06.2022	16.06.2022	02.09.2022	135,7	1989	12.10.2022	
local entry 46 sel.p.108	04.06.2022	18.06.2022	14.09.2022	118,7	no maturity		
local entry 47 sel.p.112	04.06.2022	16.06.2022	07.09.2022	128,3	1784	14.10.2022	
local entry 48 sel.p.114	04.06.2022	16.06.2022	26.08.2022	135,0	4042	08.10.2022	3
local entry 49 sel.p.117	04.06.2022	15.06.2022	21.08.2022	131,7	4061	08.10.2022	
local entry 50 sel.p.8	04.06.2022	17.06.2022	15.09.2022	124,0	no maturity		
local entry 51 sel.p.67	04.06.2022	16.06.2022	01.09.2022	131,3	1817	12.10.2022	
local check 1 Iskandar	04.06.2022	15.06.2022	18.08.2022	117,0	4513	08.10.2022	
local check 2 Lazurniy	04.06.2022	16.06.2022	22.08.2022	94,7	4091	12.10.2022	
local check 3 Nukus-2	04.06.2022	14.06.2022	08.08.2022	86,6	3546	04.10.2022	
local check 4 Guljahon	04.06.2022	15.06.2022	14.08.2022	120,3	3867	08.10.2022	
local check 5 Tarona	04.06.2022	14.06.2022	25.08.2022	116,6	4160	12.10.2022	

A total of 7 local entries-numbers 6, 30, 39, 40, 41, 43, and 49-were selected based on the analysis. These selected local entries are planned to be planted and researched in next year's experiments of the project (Table 3.1.1).

3.2. Namangan region

Phenology and growth characters

The number of days to maturity, plant height, and yield of the tested genotypes are presented in Table. Genotypes like local entry 1, local entry 11, local entry 12, local entry 15, local entry 16,

local entry 20, local entry 27, local entry 36, local entry 39, and local entry 46 significantly matured. Whereas the best-performing genotypes local entry 46, local entry 39, local entry 20, local entry 19 and local entry 1 matured at the same time as Lazurniy, the local check variety. In drought-prone environments, a short duration accrued drought damage to the crops at the end of the season.

Table 3.1.1. Results of field trail phenological and biometric observations in the Namangan region.

Designation	Seeding date	Germination	FLW	HT, sm	Yield, kg h^{-1}	DOH	PASP
local entry 1 sel.p.3	06.06.2022	18.06.2022	22.08.2022	109,3	3818	14.10.2022	3
local entry 2 sel.p.6	06.06.2022	20.06.2022	14.09.2022	110,0	no maturity		
local entry 3 sel.p.7	06.06.2022	19.06.2022	12.09.2022	108,3	1884	14.10.2022	
local entry 4 sel.p.9	06.06.2022	17.06.2022	04.09.2022	104,0	3016	08.10.2022	5
local entry 5 sel.p.11	06.06.2022	19.06.2022	18.09.2022	112,3	2500	14.10.2022	
local entry 6 sel.p.12	06.06.2022	20.06.2022	14.09.2022	120,0	no maturity		
local entry 7 sel.p.13	06.06.2022	18.06.2022	17.09.2022	126,9	2419	12.10.2022	
local entry 8 sel.p.14	06.06.2022	19.06.2022	13.09.2022	117,4	1822	08.10.2022	
local entry 9 sel.p.15	06.06.2022	19.06.2022	14.09.2022	129,0	1750	14.10.2022	
local entry 10 sel.p.17	06.06.2022	18.06.2022	18.09.2022	127,7	2859	14.10.2022	
local entry 11 sel.p.19	06.06.2022	16.06.2022	27.08.2022	100,3	4170	14.10.2022	3
local entry 12 sel.p.20	06.06.2022	18.06.2022	26.08.2022	130,5	4343	13.10.2022	3
local entry 13 sel.p.21	06.06.2022	20.06.2022	13.09.2022	120,1	no maturity		
local entry 14 sel.p.22	06.06.2022	20.06.2022	17.09.2022	103,5	no maturity		
local entry 15 sel.p.23	06.06.2022	18.06.2022	28.08.2022	135,3	3942	14.10.2022	3
local entry 16 sel.p.27	06.06.2022	18.06.2022	29.08.2022	99,0	4058	14.10.2022	3
local entry 17 sel.p.28	06.06.2022	17.06.2022	10.08.2022	127,7	3393	08.10.2022	5
local entry 18 sel.p.34	06.06.2022	20.06.2022	18.09.2022	112,7	2953	08.10.2022	
local entry 19 sel.p.36	06.06.2022	17.06.2022	04.09.2022	115,0	2976	08.10.2022	3

local entry 20 sel.p.37	06.06.2022	18.06.2022	24.08.2022	80,3	3520	14.10.2022	3
local entry 21 sel.p.38	06.06.2022	17.06.2022	04.09.2022	113,3	3842	08.10.2022	5
local entry 22 sel.p.39	06.06.2022	18.06.2022	12.09.2022	114,0	2029	12.10.2022	
local entry 23 sel.p.43	06.06.2022	20.06.2022	14.09.2022	137,8	no maturity		
local entry 24 sel.p.44	06.06.2022	17.06.2022	09.08.2022	127,5	3616	08.10.2022	
local entry 25 sel.p.46	06.06.2022	20.06.2022	16.09.2022	127,7	no maturity		
local entry 26 sel.p.51	06.06.2022	18.06.2022	06.09.2022	112,3	3507	08.10.2022	5
local entry 27 sel.p.52	06.06.2022	16.06.2022	26.08.2022	101,0	3850	12.10.2022	3
local entry 28 sel.p.56	06.06.2022	19.06.2022	14.09.2022	123,3	1827	12.10.2022	
local entry 29 sel.p.58	06.06.2022	17.06.2022	10.08.2022	118,2	3888	14.10.2022	5
local entry 30 sel.p.59	06.06.2022	20.06.2022	06.09.2022	121,6	no maturity		
local entry 31 sel.p.60	06.06.2022	18.06.2022	14.09.2022	113,7	2013	08.10.2022	
local entry 32 sel.p.65	06.06.2022	20.06.2022	01.09.2022	131,0	2368	04.10.2022	
local entry 33 sel.p.69	06.06.2022	20.06.2022	02.09.2022	106,3	no maturity		
local entry 34 sel.p.71	06.06.2022	19.06.2022	17.09.2022	114,3	2283	14.10.2022	
local entry 35 sel.p.72	06.06.2022	18.06.2022	19.09.2022	125,7	no maturity		
local entry 36 sel.p.74	06.06.2022	18.06.2022	24.08.2022	94,0	3826	13.10.2022	3
local entry 37 sel.p.76	06.06.2022	20.06.2022	16.09.2022	128,0	no maturity		
local entry 38 sel.p.77	06.06.2022	20.06.2022	15.09.2022	137,9	no maturity		
local entry 39 sel.p.78	06.06.2022	16.06.2022	27.08.2022	99,3	4094	14.10.2022	3
local entry 40 sel.p.80	06.06.2022	19.06.2022	14.09.2022	106,0	1921	08.10.2022	
local entry 41 sel.p.81	06.06.2022	17.06.2022	10.08.2022	125,0	3337	12.10.2022	5
local entry 42 sel.p.84	06.06.2022	19.06.2022	13.09.2022	105,3	2026	12.10.2022	
local entry 43 sel.p.93	06.06.2022	17.06.2022	08.09.2022	106,3	3337	08.10.2022	5

local entry 44 sel.p.100	06.06.2022	17.06.2022	06.09.2022	131,7	3946	14.10.2022	5
local entry 45 sel.p.102	06.06.2022	20.06.2022	25.08.2022	131,7	no maturity		
local entry 46 sel.p.104	06.06.2022	18.06.2022	27.08.2022	143,3	4090	14.10.2022	3
local entry 47 sel.p.105	06.06.2022	20.06.2022	14.09.2022	116,0	no maturity		
local entry 48 sel.p.107	06.06.2022	20.06.2022	02.09.2022	134,3	no maturity		
local entry 49 sel.p.108	06.06.2022	20.06.2022	14.09.2022	120,0	no maturity		
local entry 50 sel.p.113	06.06.2022	18.06.2022	13.09.2022	108,3	1876	12.10.2022	5
local entry 51 sel.p.117	06.06.2022	18.06.2022	14.09.2022	128,3	2029	04.10.2022	5
local check 1 Iskandar	06.06.2022	19.06.2022	17.08.2022	112,6	4119	10.10.2022	
local check 2 Lazurniy	06.06.2022	18.06.2022	25.08.2022	98,7	4218	14.10.2022	
local check 3 Nukus-2	06.06.2022	18.06.2022	07.08.2022	88,6	3623	01.10.2022	
local check 4 Guljahon	06.06.2022	18.06.2022	12.08.2022	119,8	3819	06.10.2022	
local check 5 Tarona	06.06.2022	18.06.2022	25.08.2022	118,1	4141	14.10.2022	

The average plant height indicated highly significant differences between the lines tested in the 2022 year. The lines local entry 12, local entry 15, and local entry 46 were all relatively tall whereas the other lines were medium tall.

Tested genotypes had significantly different grain yields. Across genotypes, the mean grain yield was 3.8- and 4.3-tons ha^{-1} in 2022, respectively. The highest-yielding lines were local entry 11 and local entry 12, but only local entry 12 had a significantly higher yield than the local control Lazurniy.

The good performance of these two lines was a combination of high yields under drought stress and very high yields in 2022.

3.3. Republic of Karakalpakistan

On June 4, the experimental lines for the research project carried out in the Republic of Karakalpakistan were sown. There were no significant differences in germination times between local entries, local checks, and global checks. However big differences were indicated among them in flowering time. Correspondingly, 50% flowering in global checks IR 50404 and OM 2517 were observed earlier than other lines, on August 5 and August 2, respectively.

Furthermore, 3 local entries (2, 4, and 16) and 5 local checks showed 50% flowering between August 12 and August 18, respectively. Later on September 20, up to 50% flowering rate was seen

in the remaining local entries, it was determined that these lines were not yet mature, and the yield rate could not be calculated (Table 3.3.1).

Table 3.3.1. Results of field trail phenological and biometric observations in the Republic of Karakalpakistan.

DESIGNATION	Seeding date	Germination	EVV	FLW	HT, sm	SAL SCORE REPRO	SAL SCORE MAT	Yield, kg h^{-1}	DOH
local entry 1 сел.п. 6	18.06.2022	24.06.2022	7	22.09.2022	108,7	5	5	4960	11.10.2022
local entry 2 сел.п. 8	18.06.2022	24.06.2022	1	15.09.2022	117,7	5	5	4850	11.10.2022
local entry 3 сел.п. 60	18.06.2022	24.06.2022	9	25.09.2022	130,3	9	9	not matured	
local entry 4 сел.п. 72	18.06.2022	24.06.2022	5	17.09.2022	116,7	5	5	4850	11.10.2022
local entry 5 сел.п. 76	18.06.2022	24.06.2022	9	28.09.2022	111,0	9	9	not matured	
local entry 6 сел.п. 80	18.06.2022	24.06.2022	9	26.09.2022	129,0	5	5	4913	11.10.2022
local entry 7 кол.п. 79	18.06.2022	24.06.2022	7	23.09.2022	128,0	7	9	not matured	
local entry 8 кол.п. 92	18.06.2022	25.06.2022	7	23.09.2022	142,7	9	9	not matured	
local entry 9 кол.п. 93	18.06.2022	24.06.2022	9	25.09.2022	95,0	9	9	not matured	
local entry 10 кол.п. 94	18.06.2022	25.06.2022	9	24.09.2022	122,3	9	9	not matured	
local entry 11 кол.п. 101	18.06.2022	24.06.2022	9	24.09.2022	82,0	9	9	not matured	
local entry 12 кол.п. 134	18.06.2022	25.06.2022	9	24.09.2022	116,7	9	9	not matured	
local entry 13 кол.п. 150	18.06.2022	24.06.2022	9	24.09.2022	86,7	9	9	not matured	
local entry 14 кол.п. 168	18.06.2022	24.06.2022	7	23.09.2022	127,3	7	9	not matured	
local entry 15 кол.п. 186	18.06.2022	24.06.2022	7	23.09.2022	124,3	7	9	not matured	
local entry 16 кол.п. 193	18.06.2022	24.06.2022	5	16.09.2022	103,3	5	5	4860	11.10.2022
local entry 17 кол.п. 242	18.06.2022	26.06.2022	7	23.09.2022	115,0	7	7	not matured	
local entry 18 кол.п. 243	18.06.2022	24.06.2022	7	23.09.2022	120,7	7	9	not matured	
local entry 19 кол.п. 244	18.06.2022	25.06.2022	7	24.09.2022	113,7	9	9	not matured	

local entry 20 кол.п. 246	18.06.2022	25.06.2022	7	28.09.2022	107,3	9	9	not matured
local entry 21 кол.п. 247	18.06.2022	25.06.2022	7	28.09.2022	83,0	7	9	not matured
local entry 22 кол.п. 248	18.06.2022	25.06.2022	7	23.09.2022	130,7	7	9	not matured
local entry 23 кол.п. 249	18.06.2022	24.06.2022	7	23.09.2022	142,3	7	9	not matured
local entry 24 кол.п. 257	18.06.2022	25.06.2022	9	26.09.2022	129,3	9	9	not matured
local entry 25 кол.п. 266	18.06.2022	24.06.2022	9	26.09.2022	104,0	9	9	not matured
local entry 26 кол.п. 267	18.06.2022	24.06.2022	9	24.09.2022	134,0	9	9	not matured
local entry 27 кол.п. 268	18.06.2022	24.06.2022	9	24.09.2022	119,0	9	9	not matured
local entry 28 кол.п. 271	18.06.2022	26.06.2022	9	24.09.2022	130,7	9	9	not matured
local entry 29 кол.п. 296	18.06.2022	25.06.2022	9	24.09.2022	101,0	9	9	not matured
local entry 30 кол.п. 306	18.06.2022	25.06.2022	9	24.09.2022	133,7	9	9	not matured
local entry 31 кол.п. 307	18.06.2022	25.06.2022	7	23.09.2022	118,7	7	9	not matured
local entry 32 кол.п. 308	18.06.2022	24.06.2022	7	23.09.2022	133,3	7	9	not matured
local entry 33 кол.п. 309	18.06.2022	25.06.2022	7	22.09.2022	121,0	7	9	not matured
local entry 34 кол.п. 310	18.06.2022	26.06.2022	9	24.09.2022	110,7	9	9	not matured
local entry 35 кол.п. 311	18.06.2022	24.06.2022	9	25.09.2022	101,0	9	9	not matured
local entry 36 кол.п. 316	18.06.2022	24.06.2022	9	24.09.2022	104,7	9	9	not matured
local entry 37 кол.п. 317	18.06.2022	25.06.2022	9	26.09.2022	124,3	9	9	not matured
local entry 38 кол.п. 318	18.06.2022	24.06.2022	7	23.09.2022	118,7	7	9	not matured
local entry 39 кол.п. 319	18.06.2022	24.06.2022	7	24.09.2022	124,7	9	9	not matured
local entry 40 кол.п. 321	18.06.2022	24.06.2022	9	24.09.2022	123,0	9	9	not matured
local entry 41 кол.п. 325	18.06.2022	24.06.2022	7	23.09.2022	123,3	9	9	not matured
local entry 42 кол.п. 380	18.06.2022	24.06.2022	7	23.09.2022	139,7	7	9	not matured
local entry 43 кол.п. 385	18.06.2022	24.06.2022	7	23.09.2022	124,0	9	9	not matured

local entry 44 кол.п. 402	18.06.2022	24.06.2022	7	23.09.2022	114,3	7	9	not matured	
local entry 45 кол.п. 412	18.06.2022	25.06.2022	7	23.09.2022	128,7	7	9	not matured	
local check 1 Iskandar	18.06.2022	24.06.2022	5	18.09.2022	110,3	3	3	5195	11.10.2022
local check 2 Nukus-2	18.06.2022	24.06.2025	1	12.09.2022	81,9	1	1	4975	07.10.2022
local check 3 Nukus-70	18.06.2022	25.06.2022	1	15.09.2022	90,3	1	1	5052	11.10.2022
local check 4 Sanam	18.06.2022	24.06.2025	3	17.09.2022	88,9	3	3	4926	11.10.2022
local check 5 Guliston	18.06.2022	24.06.2025	3	16.09.2022	79,7	3	3	4879	07.10.2022
IR 50404	18.06.2022	25.06.2022	5	05.09.022	83,7	5	5	4971	07.10.2022
OM 2517	18.06.2022	24.06.2025	5	02.09.2022	89,8	5	5	4808	07.10.2022

Lines 1, 2, 4, 6, 16 have matured in studies on salt tolerance in the Republic of Karakalpakistan and have yielded 4850-4960 kg/h. The highest rate of 4960 kg h-1 was observed in the 1st line, and the lowest - 4850 kg h-1 in the 2nd and 4th lines.

5. Conclusion

Studies were carried out in two types: assessment of drought and soil salinity. Drought resistance tests were carried out in Tashkent and Namangan regions, salt tolerance - in the Republic of Karakalpakstan.

In the Tashkent regions local entries with (3546-4513 kg ha-1) yields similar to the control types were chosen (3536-4164 kg ha-1). A total of 7 local entries-numbers 6, 30, 39, 40, 41, 43, and 49-were selected based on the analysis. These selected local entries are planned to be planted and researched in next year's experiments of the project.

In the Namangan region across genotypes, the mean grain yield was 3.8- and 4.3-tons ha^{-1} in 2022, respectively. The highest-yielding lines were local entry 11 and local entry 12, but only local entry 12 had a significantly higher yield than the local control Lazurniy.

Lines 1, 2, 4, 6, 16 have matured in studies on salt tolerance in the Republic of Karakalpakistan and have yielded 4850-4960 kg/h. The highest rate of 4960 kg h-1 was observed in the 1st line, and the lowest - 4850 kg h-1 in the 2nd and 4th lines.

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